
# DRIVERS OF DIRECT COST OF INPATIENT CARE FOR HIV-INFECTED ADULTS AT AMAJUBA MEMORIAL HOSPITAL, MPUMALANGA

**BY**

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**Submitted in partial fulfilment for the degree of**

**MASTER OF SCIENCE (CLINICAL EPIDEMIOLOGY)**

**at the**

**SCHOOL OF HEALTH SYSTEMS AND PUBLIC HEALTH**

**UNIVERSITY OF PRETORIA**

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**JUNE 2013**

# DECLARATION

I, Dr Sibusiso G Nhlapo, hereby declare that the dissertation that I submit for partial fulfilment for the degree of Master of Science (Clinical Epidemiology) at the School of Health Systems and Public Health (University of Pretoria) is my own original work and has not previously been used by me for degree purposes at another university.

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**ACKNOWLEDGEMENTS**

My sincere gratitude goes to the following people:

My supervisor Professor Paul Rheeder and co-supervisor Dr Jacqui Miot, for your patient guidance and willingness to impart knowledge towards completion of this dissertation. Your constant support has helped me in acquiring skills that I believe will be useful in my career. I am truly grateful to both of you.

The staff of the school of Health Systems and Public health for their support and enthusiastic educational skills. You make a significant contribution towards empowering the students and developing the love of academia and research.

My friends for the support and encouragement during my studies, especially Mr Nkosikhona Nkosi for helping me out when my computer skills hit a snag.

My family for their love and constant prayers.

My friend Dr Zanele Nkosi for her support and encouragement.

The Mpumalanga provincial department of health for supporting this project and the administrative staff of Amajuba Memorial Hospital for assisting with the retrieving of records.

Our Heavenly Father for giving me the strength to go on even when I felt like giving up.

## ABSTRACT

**Introduction:** Sub-Saharan Africa remains the region worst affected by the HIV/AIDS pandemic in the world. South Africa (SA) is the country with the highest population of people living with HIV/AIDS in the world and Mpumalanga province is the province with the second highest prevalence of HIV/AIDS in SA.

The district of Gert Sibande has the highest prevalence in the province of Mpumalanga (38.9%) in 2006. Since many patients living with HIV/AIDS usually present to district hospitals as the first point of contact it is important to understand the implications of HIV/AIDS in a resource limited health system.

**Study setting:** The setting for this study was Amajuba Memorial Hospital (AMH) a district hospital in the Gert Sibande district of the Mpumalanga province.

**Objective:** To analyse direct costs of providing inpatient care to adult patients with HIV/AIDS-related illnesses at AMH from the perspective of the provider (hospital)

**Study methods:** The population of study comprised adult patients with HIV/AIDS-related illnesses admitted to the medical wards during the period of October 2009 and March 2010 at AMH. A detailed retrospective record review of patients admitted to the adult wards at AMH with HIV/AIDS-related illnesses over a 6-month period was conducted.

After the record review the costs were estimated using standard costs and utilisation. Demographic and clinical patient profiles were determined then descriptive statistics were calculated with total costs as an outcome variable. Subsequently univariate and multivariate regression analysis were performed.

**Results:** The demographic and clinical profiles revealed that most patients admitted with HIV/AIDS-related illnesses were: between the ages of 39 & 49 years (35.3%), male (54.9%), urban residents (82.0%), unemployed (87.2%), single (80.5%), were not on HAART (70.7%), had CD4 counts between 0 & 50 x $10^6$ /L (38.3%), had pulmonary tuberculosis (PTB) (38.4%), were admitted for the first time (60.9%) and of the total admitted to hospital 79.0% survived the index admission during the study period.

Descriptive statistics of the continuous data variables were determined. Minimums, maximums, inter-quartile ratios, means and modes were determined and tabulated.

Consultation costs followed by investigation costs were the two major contributors to total admission costs (77.7% of the median total admission cost). Univariate analysis revealed these significant associations with total admission costs: admission diagnosis, discharge diagnosis, first admission, outcome, pre-admission consults and preceding admissions.

In multivariate regression, admission diagnosis and pre-admission consults were analysed. Significant associations were found between the following categories: retroviral disease versus other diseases (p=0.001), retroviral disease versus anaemia (p=0.035), no pre-admission consults versus 1 pre-admission consult (p=0.007), no pre-admission consult versus 4 pre-admission consults (p=0.039) and no pre-admission consult versus 5 or more pre-admission consults (p=0.006).

**Conclusion:** In our study we successfully determined demographic and clinical profiles of patients admitted with HIV-related illnesses at AMH. Emerging from the results of our study were patterns of burden of HIV disease, health seeking behaviour and risky sexual behaviour that all had implications for admission costs in the hospital. Major cost drivers were consultation and investigation costs, which were increased significantly by disease categories; other diseases, anaemia and PTB. Pre-admission consults emerged as a cost reducing parameter in our study.

**Key words**

Amajuba Memorial Hospital

Cost drivers

Demographic profile

Descriptive statistics

Direct costs

HIV/AIDS

Univariate

Multivariate

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## LIST OF ABBREVIATIONS

| | |
|---|---|
| AIDS | Acquired Immune Deficiency Syndrome |
| ART | Anti Retroviral Treatment |
| ARV | Anti Retro Viral Medications |
| DALY | Disability Adjusted Life Years |
| HIV | Human Immunodeficiency Virus |
| HAART | Highly Active Anti Retroviral Treatment |
| RVD | Retroviral disease |
| TB | Tuberculosis |
| VCT | Voluntary Counselling and Testing |
| WHO | World Health Organisation |
| YLL | Years of Life Lost |

# Chapter 1

# INTRODUCTION AND STUDY SETTING

## 1.1. Introduction

The HIV/AIDS epidemic in South Africa is the largest in the world, with an estimated 5.7 million people living with HIV in 2007 [1]. Among the provinces that are worst affected is the province of Mpumalanga, which is the second highest in prevalence of HIV: estimated 32.1% in 2006. In the province of Mpumalanga, the health district of Gert Sibande has the highest prevalence of the disease, with 38.9% of its population living with HIV in 2006 [2].

The town of Volksrust is a small town in Mpumalanga with a high level of unemployment and poverty. It is in the district of Gert Sibande and in the sub district of Pixley ka-Seme. Amajuba Memorial Hospital is one of the two district hospitals in the sub-district servicing a population of 82, 874 [3]. The hospital is the bigger of the two hospitals with 105 beds and 95 usable beds. This hospital has seen a remarkable uptake of VCT and ARV rollout since 2007: with 1, 096 patients on ARV treatment by September 2009 [4].

In a study conducted by Veenstra and Oyier, it was noted that district hospitals spent the greatest proportion of direct patient care resources on treating HIV-related illness [5]. Asfaw also states: further studies that focus on patient costs are warranted to capture all patterns of service use and relevant costs [6].

## 1.2. Rationale and Motivation for the study

The burden of disease due to HIV/AIDS continues to have devastating effects globally, more so in sub-Saharan Africa and especially in South Africa. With the advent of HIV/AIDS came a burden of costs due to HIV/AIDS related illnesses on health systems. Patients were admitted with illnesses related to advanced HIV disease costing health systems heavily in terms of budget expenditure and inpatient care. Unfortunately sub-Saharan Africa continues to be burdened with HIV/AIDS and there is a need to find cost-effective ways to provide health care for people living with the disease.

Although provision of HAART for people living with HIV/AIDS has significant financial implications for health systems, it proves to be more cost-effective in the long run by

reducing morbidity and mortality due to the disease. Hospital admissions due to HIV/AIDS-related illnesses cost health systems heavily due to many factors among which are: long periods of stay in hospital, medication prices and laboratory investigations.

In South Africa the government has launched campaigns to expand HIV counselling and testing and plans have been put into place to expand rollout of HAART to people who need it. Mpumalanga province is a province with the second highest prevalence of HIV in South Africa and Gert Sibande district has the highest prevalence in this province. Conducting the study in a district hospital setting will help inform plans to expand the HIV/AIDS program at primary care level and having an indication of the costs of inpatient care related to HIV/AIDS will help in resource allocation for HIV care. As a medical officer in the district hospital which is a first point of contact for patient with AIDS related illnesses the researcher developed interest in establishing the extent of expenditure associated with these illnesses in this under resourced institution. Analysis of inpatient costs will inform resource allocation for patient care in the hospital.

### 1.3. Study question

What are the direct drivers of costs for inpatient care for HIV-infected adults at AMH, Mpumalanga Province?

### 1.4. Aim of the study

To analyse direct costs of providing inpatient care to adult patients with HIV/AIDS-related illnesses at Amajuba Memorial Hospital from the perspective of the provider (hospital)

### 1.5. Objectives of the study

- To determine the variables associated with admission to hospital of adult patients with HIV/AIDS-related illnesses at Amajuba Memorial Hospital
- To determine the direct costs of HIV-related inpatient care in the adult wards during the period of October 2009 to March 2010
- To identify major variables that drive direct costs of inpatient care for patients with HIV/AIDS-related illnesses

# Chapter 2

# LITERATURE STUDY

## 2.1. The HIV/AIDS burden of disease

HIV/AIDS remains one of the world's biggest problems to date. Sub-Saharan Africa remains the region worst affected by HIV in the world, accounting for 67% of people living with HIV and 75% of AIDS deaths in 2007 [1]. Southern Africa bears a disproportionately high burden of global HIV, with 35% of HIV infections and 38% of AIDS deaths in 2007 having occurred in this sub region [1]. Women account for approximately 60% of HIV- infections in sub-Saharan Africa. Although the number of women living with HIV has stabilised globally in the past 10 years, in some regions there has been an increase in the number of women living with HIV since 1990 [1]. According to the South African Ministry of Health, HIV prevalence among women attending antenatal clinics was 29.1% in 2006 [2].

The prevalence of HIV among people of ages 15 years and older in rural areas of South Africa has not really been studied extensively and this necessitates acquisition of greater knowledge of the burden of HIV in these areas. Gomez-Olive, *et al* conducted a study of HIV prevalence in the rural areas of South Africa in these age groups and they found the prevalence to be high (19.4%) and they described a large gender gap among those diagnosed with HIV (10.6% for men and 23.9% for women) with rates peaking at 45.3% among men and 46.1% among women, both peaks were at ages 35-39 years of age. They compared their study to a similar study conducted in rural Kwa-Zulu Natal Province where peak prevalence was among older adults. Rates were above 15% for men and 10% for women through to the age of 70, in the comparative study. It was their conclusion that high prevalence among older adults suggests likely infection at older ages [7]. This necessitates expansion of prevention activities to older age groups to curb new infections among these age groups.

The burden of HIV continues to be compounded by risky sexual behaviour and poor health seeking behaviour especially among the youth in South Africa. According to Mhlongo, *et al* in a survey they conducted found low rates of condom use as well as HIV testing in Soweto, South Africa. Their study with 1539 men aged 18-32 years revealed that 71% of the men had not taken an HIV test and 55% were young ages 18-23 years. Of those who were not testing there was poor condom use at the rate of 44%. Among those that reported condom use

(n=1036, 67%) only 43% (n=451) used condoms consistently. Men with primary and high school education were more likely not to test and to have more than one sexual partner. In their study HIV testing did not correlate with condom use [8]. This risky sexual behaviour in a setting with high prevalence of HIV is concerning and strategies to modify behaviour in this population need to be developed urgently.

Risky sexual behaviour is not limited to men, a survey among 845 women who reported 2 or more sexual partners in the previous 3 months, revealed a prevalence of 28.8% with the mean age of 23.9 years. The majority of these women were from low socio-economic settings with 49.6% living in informal settlements, 31.8% reported not having money for food and only 6.4% were married. Women of ages 20-29 years had a significant relation with HIV infection. Those who had never attended a public health facility (10.1%) compared to those who had, were more likely to be 16-19 years (p=0.008), reported sexual debut at 10-14 years (p=0.044), were more likely to have experiences a symptom of sexually transmitted infection (p=0.031) and had taken illegal drugs (p=0.007). This survey showed that there is high prevalence of HIV infection and HIV-risk related behaviour among women who have concurrent multiple partners [9].

The burden of disease due to HIV brings with it a host of other diseases that compound the situation. Opportunistic infections complicate HIV-infection and they add more burden of disease to the health systems. Tuberculosis is one of the opportunistic infections that are commonly and highly associated with HIV-infection. Claassens, *et al* quoted the national estimated prevalence of all forms of TB to be 960/100 000 by 2008 and in their study in 2 communities in the Western Cape they found prevalence in community A (32/1000-culture positive TB and 8/1000-smear positive TB) and community B (24/1000-culture positive TB and 9/1000-smear positive TB). They concluded that both communities had higher prevalence of TB than national estimates and lower diagnostic rates. They further suggested that cases are not detected at a sufficient rate to interrupt transmission and that this may contribute to the rising incidence of TB in South Africa (as suggested by the WHO report in 2011) [10].

Provinces such as the Western Cape have always had high prevalence of tuberculosis but the advent of HIV has worsened the burden of tuberculosis. In the study by Wood, et al found that in a population of 29 478 newly notified TB cases, 56% were laboratory confirmed. Eighty seven percent of the population had their HIV-status recorded and of those with a

recorded HIV status, 49% were HIV-negative and 51% were HIV-positive. Retreatment cases comprised 30% of the HIV-associated TB burden and 88% of these had no history of prior treatment failure or default. They concluded that the annual burden of TB is huge and that TB in the HIV-negative population contributed almost half of the overall burden of TB with the cumulative lifetime risks similar to those reported in the pre-chemotherapy era. Retreatment TB contributed significantly to both HIV-associated and non-HIV-associated TB, but infrequently pre-ceded by inadequate treatment [11].

Complicating the high prevalence and the rising incidence of TB in South Africa is the emerging problem of drug resistant TB. This is posing a threat to TB control and comprises multi-drug resistant (MDR-TB) and extreme-drug resistant (XDR-TB) TB. These two types of resistant TB are now reaching epidemic levels. In a survey conducted by Cox, et al in 2008 at Khayelitsha they diagnosed culture positive pulmonary TB in 271 new cases and 264 previously treated cases in TB suspects. Among those with known HIV-status 55% (new) and 71% (retreatment) were HIV infected. MDR-TB was diagnosed in 3.3% (new) and 7.7% (previously treated) cases. These figures equated to an estimated rate for MDR-TB of 51/100 000/year. Fifty five percent of the MDR-TB burden being contributed by new cases. There was an extremely high MDR-TB burden in that setting most likely indicating ongoing transmission [12].

There are other diseases that are emerging and are associated with HIV-infection contributing to an increased burden of disease e.g. human papilloma virus (HPV) infection, which is associated with cervical oncogenesis, hepatitis B virus (HBV), hepatitis C virus (HCV) malignancies like Hodgkins lymphoma and mental illnesses like depression[13] [14] [15] [16] [17]. All these contribute significantly to HIV-related burden of disease.

HIV-infection is also linked by some evidence to premature frailty, a syndrome typically viewed as related to aging. Pathai, *et al* conducted a case-control study to determine the prevalence and predictors of this syndrome in a population of HIV-infected adults in South Africa. There were 504 adults older than 30 years, 248 – HIV-infected and 256 – age and gender matched HIV-negative individuals. The mean ages were: 41.1 ± 7.9 years HIV-infected and 42.6 ± 9.6 years HIV-negative adults. Eighty seven point one percent of the HIV-infected adults were on anti retroviral medications and 84.3% had undetectable plasma viral loads. HIV-infected individuals were more likely to be frail than HIV-negative individuals (19.4% vs. 13.3%; p=0.07), even after adjustment for confounding variables the

association persisted [adjusted OR=2.14; 95% CI (1.16-3.92); p=0.01]. Older age was a strong predictor of frailty, especially among women. Lower current CD4 count (<500 cells/µL) had an independent association with frailty. In conclusion they found that HIV-infection is associated with premature development of frailty, especially in older women. Since higher CD 4 counts were associated with lower risk of frailty, they suggested that earlier initiation of anti retroviral treatment may be protective [18]

The steady increase in the prevalence of HIV is attributed in part to the increase in the uptake of HAART. Using data from a large, longitudinal population-based HIV surveillance in rural KZN, Zaidi, *et al* investigated HIV prevalence trends after scale up of antiretroviral treatment (ART) in 2004 though to 2011. They found that coverage of all HIV-infected people in that community increased from 0% in 2004 to 31% in 2011. Adult HIV prevalence also increased steadily from 21% to 29% over the same period. This increase was largely driven by men and women over the age of 24 years (the age group in which the largest proportions of HIV-infected people received ART). They concluded that the dramatic increase in adult HIV prevalence can be explained by increased survival of infected people due to ART and they suggested that this interpretation was supported by the fact that the overall prevalence trend is mostly due to increases in prevalence in older adults ( age groups that currently benefit most from the local ART scale up [19].

The HIV/AIDS pandemic has caused a remarkable rise in the burden of disease globally. Despite the rise in the burden of disease due to HIV, the global burden of disease has continued to shift from communicable to non communicable diseases and from premature death to, years lived with disabilities (YLD). In sub-Saharan Africa, however, many communicable, maternal, neonatal and nutritional disorders remain the dominant causes of disease burden [20].

Marsh, *et al* conducted a multi-centre prospective cross sectional survey of consultations in primary care in 4 provinces of South Africa to assess the burden of disease. They came to a conclusion that in ambulatory primary care dominates non-communicable chronic diseases. HIV/AIDS and TB are common, but not to the extent predicted by burden of disease [21].

Efforts to try and reduce HIV-related costs have to be made. Reducing hospital admissions is one of the ways that can be used to try and reduce HIV-related and this can be done among other ways by having outreach visits instead of having patients consulting or being admitted to hospital all the time, especially for patients that need palliative care. In a cost analysis

study of palliative care in low- and middle-income countries it was shown that having outreach programmes can reduce the costs of HIV care. The study showed that costs per hospital outreach visit and in-hospital visit were US$ 71 and US$ 80, respectively. The cost per outreach visit was 50% less than the average cost of a patient day equivalent per district hospitals of US$ 142. In conclusion hospital outreach visits were shown to have potential to avert hospital admissions in generally overcrowded services in low resource settings and may improve the quality of life of patients in their home environments [22].

HIV/AIDS has a major contribution in the burden of disease and its impact cannot be ignored, therefore efforts have to be made to try and curb the spread of the disease and in managing those that are already infected in order to preserve or restore the good quality of health in these populations. Together with managing HIV/AIDS efforts have to be made to acquire knowledge on all other diseases that are associated with it and to manage them appropriately for the good of all society.

### 2.2. Cost burden due to HIV/AIDS

With the increase in the burden of disease due to HIV/AIDS, is bound to be an increase in the financial burden on health systems [23]. A study conducted by Badri, *et al* revealed that there is more cost burden associated with advanced HIV disease in South Africa, compared with earlier stages of HIV disease i.e. WHO stage 1-3. It also revealed that it is more cost effective and cost saving to have patients on HAART [24].

The study conducted by Cleary, McIntyre and Boulle at Khayelitsha, found costs to be higher for patients on HAART in the initial stages of treatment due to the higher frequency of utilization rates (3.4 clinic visits for No-ART patients at US$20 per visit versus 9.7 clinic visits for ART patients at US$19 per visit). In the long term having patients on ART is more cost effective because patients spend less time in hospital despite the fact that the costs of ART are high. Inpatient days were found to be 0.7 for the No-ART group of patients and 0.1 for the ART group of patients. They also noted that there is a higher prevalence of tuberculosis in the No-ART group when compared with the ART group (0.1 tuberculosis cases per patient quarter for No-ART and 0.02 tuberculosis cases per patient quarter for ART) [25].

Patients with HIV related illnesses have been found to have a significant contribution in the burden of inpatient costs. In a study conducted by Andrulis, et al the hospitals studied treated 30% of all AIDS patients estimated to have been alive during 1988. These patients represented 35% of HIV-related admissions, 29% of all inpatient costs and 35% of all inpatient losses due to death [26]. The financial burden on health systems will not only be due to direct patient care costs, but also to indirect costs associated with staff absenteeism, early retirement due to illness and death in the health sector [27]. The costs of providing medical care to HIV positive patients continue to increase, although the burden of cost is distributed differently from before the introduction of HAART [28].

In a cross sectional review of medical by Gebo, *et al* they provided estimates of expenditures for HIV management. They assessed inpatient days, outpatient visits and prescribed medications for 14 691 adult HIV-infected patients in primary care. They estimated expenditures stratified by median CD4 cell count obtained in 2006 (≤50, 51-200, 351-500, >500 cells/μL). Averaging over all CD4 strata, the mean annual total expenditure per person for HIV care was US$ 19 912 with the inter-quartile range from US$ 11 045 to 22 626. Average expenditures were greatest for patients with CD4 cell counts ≥50 cells/μL (US$ 40 678) and lowest for those with CD4 cell counts <500 cells/μL (US$ 16 614). Majority of the costs were attributable to medications except in those with low CD4 counts where inpatient costs contributed most. In conclusion they suggested that with increased survival, costs may increase and need to be monitored [29].

### 2.3. Cost implications of using HAART

In a comparative study of inpatient costs of HIV-infected and uninfected children and adults in Soweto, Thomas, et al found inpatient costs of HIV-infected adults to be high and even higher for those patients on ARVs. They further concluded that budget allocations should incorporate case mix by HIV and ARV status as a key determinant of hospital expenditure [30].

The cost of not using ART to treat people with AIDS is significantly greater as patients with AIDS require more expensive time in hospital and other medical care. The advent of ART has converted HIV/AIDS from a terminal disease to a chronic manageable disease. In the process it has also helped in reducing the number of HIV/AIDS related hospital admissions

and the costs associated with such admissions [23] [24] [27] [31]. As stated by Ojo in 1997, research focused on the economic implications of AIDS prevalence and control is minimal in the Southern African region, which suggests that an urgent response is needed if substantial progress is to be made in understanding the long term economic-demographic impacts of AIDS [32]. HIV/AIDS is a dynamic disease that needs to have its economic impacts continuously evaluated in order to inform public policy in terms of cost of delivering care, assessment of the impact of loss of skilled professionals in key economic sectors and planning for resource allocation and collaboration between different sectors of the economy in trying to combat the spread of the disease.

In an analysis by Farnham of the costs of treating patients with HIV in the US the rate of hospital admissions decreased speedily with the advent of HAART. Initially the declines in hospital admissions and its associated costs were greater than the increases in drug therapy costs, so the annual total costs of treating patients with HIV decreased. However, subsequent studies failed to show decreases in overall annual treatment costs, given rising drug costs and increasing hospital admissions due to complications from, or resistance to, HAART and due to other diseases impacting HIV-infected patients. Although the lifetime costs of treating a person with HIV have increased, this treatment has resulted in substantial gains in the length and quality of life for those living with HIV [33].

Hecht, *et al*, suggested that countries will move in increasingly divergent directions in the next 20 years with regard to financing HIV/AIDS. Middle income countries with a lower burden of HIV/AIDS will gradually be able to take on the modest costs of their HIV/AIDS response, whereas low-income countries with a high burden of disease will remain reliant upon external support for their rapidly expanding costs. A small but important group of middle-income countries with a high prevalence of HIV/AIDS (e.g. South Africa) form a third category, in which rapid scale-up in the short term, matched by outside funds, could be phased down within 10 years assuming strategic investments are made for prevention and efficiency gains are made in treatment [34].

# Chapter 3

# RESEARCH METHODOLOGY

## 3.1. Introduction

This chapter deals with the setting of the study and methods used during the study. The actual methodology of the study addresses the following subjects:

- Selection of participants;
- Collection of data through a record review and in-depth interviews;
- Analysis of data; and
- A consideration of ethical issues.

## 3.2. Study setting

Amajuba Memorial is set in the South African public health sector, and is situated in the province of Mpumalanga, which is the province with the second highest incidence of HIV/AIDS in the country. This is a district hospital in a town that is in the border with the province of KwaZulu-Natal, which has the highest prevalence of HIV/AIDS in the country. Coupled with the fact that the hospital drainage population is from a district with the highest prevalence of HIV/AIDS in the province of Mpumalanga, is the fact that the neighbouring district has the highest prevalence of HIV/AIDS in the province of KwaZulu-Natal. The burden of HIV/AIDS related illnesses in this hospital then comes from two districts that both have highest prevalence in their respective provinces.

The hospital has approximately 4 clinics and 3 mobile clinics that refer to it and it still has to provide some primary health care services to the immediate surrounding community. Although there has been a remarkable uptake of HIV counselling and testing leading to an increase in the numbers of patients on anti retroviral medications, there is still a significant number of patients that present with AIDS related illnesses and get admitted to the hospital. This is despite the fact that all the clinics, except the mobiles, are now accredited for the rollout of ARVs.

Other than shortages of staff there are also shortages of basic working equipment and medical consumables for proper patient care. Dedicated efforts are still, however, being made by health workers in the unit to ensure the best possible outcomes for patients that they attend to.

## 3.3. Methods

### 3.3.1 Study Population

The population of study comprised adult patients with HIV/AIDS-related illnesses admitted to the medical wards during the period of October 2009 and March 2010 at AMH.

### 3.3.2 Study Design

The study employed a detailed retrospective record review of patients admitted to the adult wards at AMH with HIV/AIDS-related illnesses over a 6-month period. The period of the record review was from October 2009 to March 2010.

### 3.3.3 Record review

Ward admission registers were used to identify all records of patients with AIDS-related illnesses to be reviewed for the study.

All records of adult patients admitted with clinical diagnoses associated with advanced HIV disease: Pulmonary Tuberculosis (PTB), Pneumocystis Carinii Pneumonia (PCP), Bronchopneumonia (BPN), Lower Respiratory Tract Infection (LRTI), Meningitis, Retroviral disease (RVD), Oral and Oesophageal Candidiasis (OC), Chronic Diarrhoea (CD), Gastroenteritis (GE), Dehydration, TB Abdomen (TBA), Kaposi Sarcoma (KS), Lactic Acidosis (LA) and other less common diagnoses related to HIV/AIDS. Records of patients with positive HIV test results, but admitted with non HIV/AIDS-related illnesses or conditions e.g. trauma or chronic hypertension were not reviewed.

A detailed record review of patients admitted to the female and male wards with HIV/AIDS related illnesses during the study period was carried out. Records that were included in the review were those with patients' demographic information, admission, inpatient or discharge; doctor's notes, including details of investigations conducted, drugs prescribed and administered, transfusions received and procedures performed.

For each record, HIV status was designated as HIV-infected if the clinician's diagnosis included an illness associated with advanced HIV disease or if the results of positive HIV tests were recorded with the HIV/AIDS-related illness in association with a clinical condition that falls within Stages 3 and 4 of the WHO classification of HIV; see Appendix B below [35]. All complete records in which an HIV status was recorded as positive or was suspected as positive were reviewed. All records with a diagnosis of an HIV/AIDS-related illness, but with a confirmed negative HIV test were excluded from the analysis.

Study population size was dictated by difficulties in retrieving complete patient records from patient admissions department. For each record, information on patient demographics, HIV status on admission, HAART status on admission and CD4+ cell count during that episode of admission, clinical diagnoses, outcome of admission, investigations conducted, medication administered, intravenous fluids, blood transfusions, length of stay in hospital, indication of whether the index admission was a primary admission or a readmission, number of preadmission outpatient consults, number of admissions in the preceding 12 months, clinical diagnoses and outcomes of admissions were extracted by the researcher from clinical records onto the case report forms and entered into the database. Patients that were readmitted were included in the study because during each admission new costs were incurred and they contributed in the escalation of costs.

### 3.3.4 Variables to determine profile of admissions

Variables used to determine the demographic and clinical profiles of patients admitted to the medical wards during the period of study were:

- Age of patients admitted who were 18years old and older
- Sex
- Place of residence whether urban or rural. Urban areas were described as formalised residential areas with basic infrastructure such as tap water, electricity, sanitation facilities for each household and easy access to health service facilities. Rural areas were described as farms or places that have no basic infrastructure and no easy access to health service facilities.
- Employment status at the time of admission, whether employed (formally or informally), unemployed or on pension (old age pension or social grants).

- Marital status as married if still married or separated and single if never married or divorced at the time of admission.
- The CD4 cell count values to determine the severity of immune-suppression. Those who had counts above $200x10^6$/L as mild immune-suppression, counts of 50 – $200x10^6$/L as moderate immune-suppression and counts less than $50x10^6$ as severe immune-suppression.
- The HAART status at time of admission, whether the patient had already been commenced on HAART or not
- Diagnosis was described as diagnosis 1 and diagnosis 2. Diagnosis 1was the diagnosis at admission if it was HIV-related and left as such if it was not changed at discharge. Diagnosis 2 was recorded if diagnosis 1 was not HIV-related or changed at discharge after confirmation of a positive HIV status. Both diagnoses were recorded if HIV-related and a positive HIV status confirmed.
- First admission to describe if the patient was admitted for the first time during the study period or not
- Pre admission consults were recorded as a way of determining the frequency of contact with the health system
- The number of preceding admissions
- Outcomes of admission: death, discharge or transfer to another level of care.

### 3.3.5 Variables for cost estimation

Estimation of costs was derived from the following variables:

- All the laboratory investigations conducted from admission to discharge
- Radiology costs for all x-ray investigations during the period of admission
- Consultation costs as determined in the government gazette inpatient and doctors' consults from admission to discharge.
- Intravenous fluid costs for IV fluids administered
- Blood transfusion costs included service costs, blood and blood product costs
- Anti infective medication costs included antibiotic medications, anti viral medications, anti fungal medications and anti tuberculosis medications administered from admission to discharge. Medications dispensed for patients to take at home were not included in the cost estimations.

- Other medication costs included medications like analgesics, topical non anti infective substances, anti psychotic medications, vitamins and minerals administered to inpatients from admission to discharge.
- Total costs were estimated as sum totals of individual costs.

### 3.3.6 Cost Estimations

Costs that were calculated were categorised into utilisation and price components. Direct Inpatient Costs included laboratory investigation costs, pharmaceutical costs (divided into anti-infective medications i.e. antibiotic medications, antifungal medications, antiviral medications, and anti TB medications and other medications), consultation costs, radiology costs, intravenous fluids costs and blood transfusion costs, which were determined for each patient. Costs are defined in Appendix A; see below for definition of costs. Costs were calculated using the two components viz. utilisation and price: costs = utilisation × price.

For each cost variable a price per item was obtained from a standard cost source for service provider's e.g. pharmaceutical price list and multiplied with the number of units administered to the patient.

Standard costs were obtained from the following sources:

- The Mpumalanga Province Gazette Extraordinary Volume 16, Nr 1733 dated 23 October 2009 (based on the Uniform Patient Fee Schedule [UPFS] of 01 July 2009) - (radiography costs, and consultation costs)
- Provincial Pharmaceutical Price list - (pharmaceutical costs and intravenous fluids costs)
- National Health Laboratory Service (NHLS) tariff list - (laboratory investigation costs)
- South African National Blood Service (SANBS) state patients price list 2009 - (blood transfusion costs including service costs).

Costs for doctor consultations were calculated from the Gazette Extraordinary and specialist consultations were not estimated because patients needed to be referred to a Secondary Level Hospital (Witbank Hospital) for specialist consultations. Bed occupation costs were not included in the study because they are included in the facility fees, which include some indirect costs as well.

### 3.3.7 Analysis of data

Data analysis was done using Microsoft Excel Data Analysis and STATA version 10 [36] [37], and results presented in the form of graphs, tables and free text. Analysis of data was two-fold beginning with determining the clinical and demographic profile of patients admitted to the medical wards during the study period. The variables were: Age, Gender, residential area (urban or rural), CD4+ cell count (categorised less than $50 \times 10^6$/L, 50 to 200 $\times 10^6$/L and greater than $200 \times 10^6$/L – to determine the severity of disease), status of HAART (started on HAART or not), admission as well as discharge disease category (diagnosis as recorded in the discharge summary),whether the index admission was the first or not, number of preadmission clinic or outpatient visits, preceding admissions and the outcome of the admission.

The second part of the analysis dealt with the costs. Total costs were the outcome variable and independent variables were costs estimated for: laboratory investigations, radiological investigations, blood transfusions, pharmaceuticals, intravenous fluids and doctors' consultations. Costs corresponding with different individual variables were expressed as percentages of total costs and presented in a form of graphs, pie charts or bar charts. Total Costs for each individual variable with associated standard deviations were calculated for each group of patient categorised by HIV/AIDS-related illness admission. Individual costs were then totalled up for each variable to get total costs per variable for all admitted patients. Total costs for all variables were then calculated and summary statistics were computed based on the total costs to determine variable costs (cost drivers) that drive inpatient costs for patients admitted with HIV/AIDS related illnesses.

Univariable and multivariable regression analysis was done to determine the associations with total and specific costs.

#### 3.3.7.1 Descriptive statistics

Summary statistics were calculated for the continuous variables (age, CD4 cell counts, pre admission consults and preceding admissions) and all costs (investigations, radiology, consults, intravenous fluids, blood transfusions, anti infective medications, other medications and total costs), while percentages were calculated for the discrete variables (sex, residence,

marital status, employment, HAART medication commenced or not, first admission or not and outcome of admission)

Continuous variables were then converted to categories (using clinically significant categories and for ease of analysis) and tabulation of percentages performed. Age and CD4 counts were categorised and the descriptive parameters of the continuous variable (median and inter-quartile ratio p25, p75) were entered into the table on top of the categorical parameters. Descriptive parameters tabulated for pre admission consults and preceding admissions were the mode and inter-quartile ratio. For all costs the median and inter-quartile ratio were tabulated.

#### 3.3.7.2 Association of variables with individual costs

Prior to examining the association of variables with individual costs, pre admission consults and preceding admissions were categorised into categories of 0 to 5 or more and 0 to 2 or more, respectively. Pre admission visits were categorized for analysis as an indicator of health seeking behaviour, while preceding admissions were categorised for analysis as an indicator of health status i.e. patients with recurrent admissions indicating a poor health status. The tabulation of variable by median, p25 and p75 of each cost was performed. To determine significant association of each variable with individual cost a Mann-Whitney test was used for variables with 2 categories and a Kruskal-Wallis 2 test (Kruskal Wallis test in STATA allowing for adjustment for multiple comparisons) was used for variables with more than 2 categories.

Groups that showed significance in the multiple comparisons were then tabulated with their respective p-values and adjusted p-values for significance for the comparison.

#### 3.3.7.3 Regression analysis

The purpose of regression modelling was not to build a prediction model but to determine which variables were independently associated with the total costs (main outcome). Total costs were log transformed for analysis in the linear regression model.

A regression model was built using all variables that had a p-value <0.3 (probability of clinical significance in this study) in association with total costs during examination of variable association with individual costs. According to an article by Hopkins, statistical significance does not do justice to some clinically useful effects. He advocates that we should

rather be reporting on probabilities of clinical significance not the probability that defines statistical significance [38]. The variables included in the initial model were then tested with the Wald test (test parameter in STATA) to determine their suitability for inclusion in the model. Those parameters that showed a non significant p-value>0.05 were then dropped from the model and R2 observed for any changes when variables were dropped from the initial model.

All variables that showed co linearity with other variables (admincategory with number of pre admissions) were not included in the model. Two models were built using the diagnoses variables to avoid overlapping of the effects in the model. The final models with admission diagnosis and discharge diagnosis had 2 significant variables, diagnosis and pre admission consults.

#### 3.3.7.4 Diagnostics and final models

The tests used for diagnostics were: residual plots, marginal plots, added-variable plots, and density plots of residuals, diagnostic tests (hat-values, Bonferroni p-value, studentized residuals and Cook's distance). Diagnostic tests were used for both models and identified outliers were dropped to see their effect on the models.

### 3.4. Missing data

Missing data can be a source of bias in research. To try and minimise the amount of missing data in this study, efforts were made to retrieve all the records of patients that were eligible to form part of the study. It is acknowledged that there were some records that were not accessed due to misfiling or loss and some were retrieved with lost inpatient records due to improper filing. These were a source of missing data.

Missing data in this study was handled by complete case analysis [39]. Missing data were however quantified and reported in the write up of the study. All possible means were made to ensure that missing data in terms of records were less than 10% of all records reviewed for the study. Although this method of handling missing data is subject to bias, it had been

chosen for this study because methods of imputation of data might be subject to even more bias with records that were missing completely.

### 3.5. Ethical considerations

- The protocol was submitted to the Chief Executive Officer of Amajuba Memorial Hospital for permission to conduct the study to be obtained and permission was granted.
- After approval was obtained from the hospital, the protocol was then be submitted to the Ethics Committee of the University of Pretoria for approval.
- The protocol was also submitted to the Mpumalanga Provincial Research Planning committee for approval and Provincial support for the project was granted.

- No patient identifying data were used for the purposes of the study to ensure preservation of patient information confidentiality. Study record numbers were allocated to each record reviewed and included in the study. Original record numbers that correlate with study record numbers were kept in a password protected file accessible only to the principal investigator.

# Chapter 4

# RESULTS

## 4.1. Introduction

This chapter presents the results of the study. The results are presented in tabular form as patient demographics and descriptive statistics. We reviewed 145 patient records admitted over a 12 month period. Eleven of the 145 records reviewed were incomplete and therefore discarded and not used for the study. One of the files with complete data could not be used for the study because it belonged to a child of 14years although she had been admitted in an adult medical ward she did not qualify for inclusion in the study population. That left a total of 133 records that could be used for the study.

## 4.2. Demographic data

Table 1 outlines the demographic data of the patients admitted to AMH over the duration of the study period. The total number of patients admitted with HIV/AIDS-related illnesses whose records qualified for review was 133.

Age distribution was categorised into 4 categories that have clinical and public heath significance as it is normally done in HIV/AIDS literature: 27(20.3%) patients were younger than 29years of age; patients aged 29 – <39years were 47(35.3%); patients from the ages 39 - <49years were 32(24.1%) and 27(20.3%) patients were 49years of age and older. Sixty patients (45.1%) were female while 73(54.9%) were male. Most patients admitted were from urban areas 109(82.0%) compared with 24(18.0%) from rural areas.

One hundred and sixteen (87.2%) patients were unemployed, 13(9.8%) employed and 4(3.0%) were on pension or disability grants. The majority of admitted patients were single 107(80.5%) compared with 26(19.5%) married patients.

**Table 1: Patient demographics**

| **Age (years)** | **35 (30, 45)*** | |
|---|---|---|
| | | **Number (%) of patients** |
| **Age categories (years)** | <29 | 27 (20.3) |
| | 29– <39 | 47 (35.3) |
| | 39– <49 | 32 (24.1) |
| | ≥49 | 27 (20.3) |
| **Sex** | Female | 60 (45.1) |
| | Male | 73 (54.9) |
| **Residence** | Rural | 24 (18.0) |
| | Urban | 109 (82.0) |
| **Employment** | No | 116 (87.2) |
| | Yes | 13 (9.8) |
| | Pension | 4 (3.0) |
| **Marital status** | Single | 107 (80.5) |
| | Married | 26 (19.5) |
| **HAART** | No | 94 (70.7) |
| | Yes | 39 (29.3) |
| **CD4 count (x$10^6$/L)** | **62.5 (23.5, 151.0)*** | |
| **CD4 count categories (x$10^6$/L)** | Missing | 13 (9.8) |
| | 0 - 50 | 51 (38.3) |
| | 51 - 200 | 48 (36.1) |
| | >200 | 21 (15.8) |
| **Admission Diagnosis** | Retroviral disease | 12 (9.0) |
| | Pulmonary TB | 51 (38.4) |
| | Anaemia | 8 (6.0) |
| | Diarrhoeal diseases | 24 (18.1) |
| | Respiratory diseases | 17 (12.8) |
| | Meningitis | 11 (8.3) |
| | Other diseases | 10 (7.5) |
| **Discharge Diagnosis** | Retroviral disease | 61 (53.0) |
| | Pulmonary TB | 18 (15.7) |
| | Anaemia | 3 (2.6) |
| | Diarrhoeal diseases | 4 (3.5) |
| | Respiratory diseases | 16 (13.9) |
| | Other diseases | 13 (11.3) |
| **First admission** | No | 52 (39.1) |
| | Yes | 81 (60.9) |
| **Outcome** | Death | 27 (20.3) |
| | Discharge | 106 (79.0) |
| | Transfer | 1 (0.8) |

*median (p25, p75)

### 4.3. Clinical demographic data

Clinical demographic data includes: patients being on HAART during index admission, CD4 cell count during index admission, diagnosis, whether index admission was a first admission or not and the outcome of admission.

The majority of patients admitted were not on HAART 94(70.7%) while 39(29.3%) were on HAART. Of the 133 reviewed records; 13(9.8%) had missing CD4 counts because the bloods for counts were drawn either at clinics or at centres other than AMH and could therefore not be traced; 51(38.3%) patients had CD4 counts of 0 – $50x10^6$/L, 48(36.1%) of patients with CD4 counts of 51 – $200x10^6$/L and 21(15.8%) with CD4 counts greater than $200x10^6$/L.

Diagnoses were recorded as diagnosis 1 (admission diagnosis) and diagnosis 2 (discharge diagnosis) depending on whether it was recorded on admission and changed on discharge, so both admission and discharge diagnoses were recorded. If the admission diagnosis remained the same on discharge then only diagnosis 1 was recorded. Diagnoses were then grouped into major groups of: Retroviral disease, Pulmonary TB, Diarrhoeal diseases, Respiratory diseases, Meningitis and Other diseases.

Proportions for diagnosis 1 were as follows: retroviral disease 12(9.0%), pulmonary TB 51(38.4%), anaemia 8(6.0%), diarrhoeal diseases 24(18.1%), respiratory diseases 17(12.8%), meningitis 11(8.3%) and other diseases 10(7.5%). For diagnosis 2: retroviral disease 61 (53.0%), pulmonary TB 18(15.7%), anaemia 3 (2.6%), diarrhoeal diseases 4(3.5%), respiratory diseases 16(13.9%) and other diseases 13(11.3%). Meningitis was not recorded as part of diagnosis 2.

Patients whose index admission was the first admission were 52(39.1%) and the other 81(60.9%) patients were not first admission on index admission. Outcome of admission was as follows: 27(20.3%) patients died, 105(79.0%) patients were discharged home from the hospital and 1(0.8%) patient was transferred to a secondary level of care.

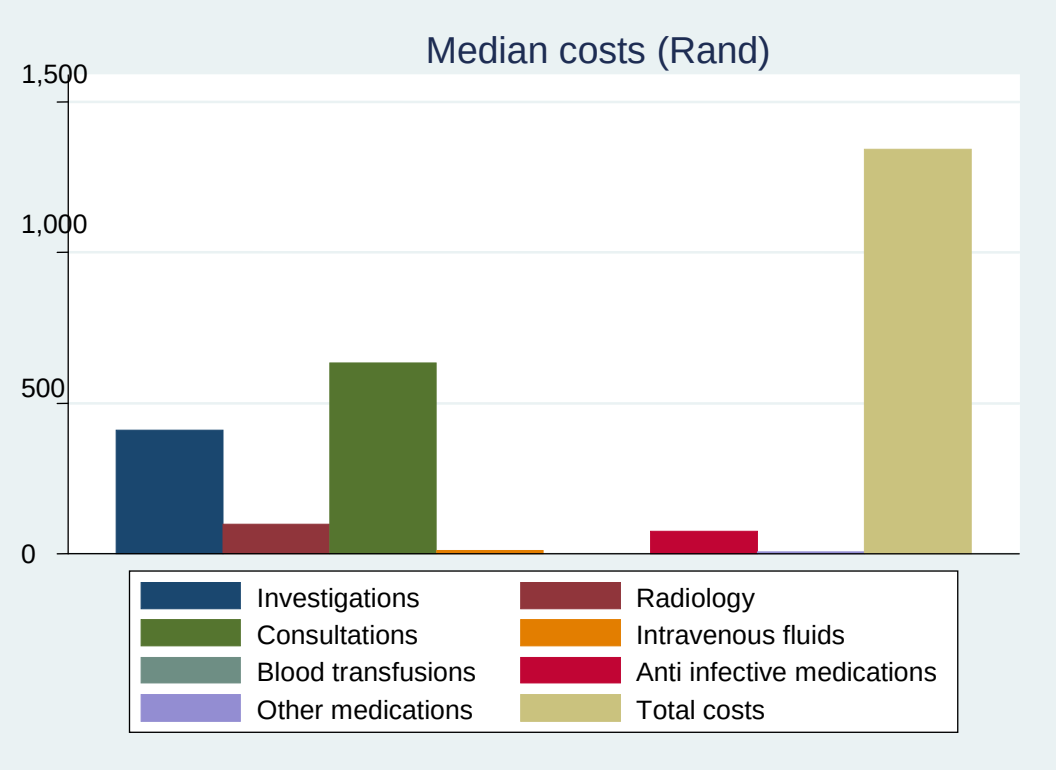
### 4.4. Descriptive statistics of costs and consultations

**Table 2: Descriptive statistics of costs and consultations**

| | N | Minimum / maximum | p25 / p75 | Median | Mode |
|---|---|---|---|---|---|
| **Pre admission consults** | 133 | 0 / 5 | 0 / 4 | | 0 |
| **Preceding admissions** | 133 | 0 / 2 | 0 / 1 | | 0 |
| **Investigation costs (Rand)** | 133 | 0.00 / 1431.44 | 121.21 / 736.98 | 409.93 | |
| **Radiology costs (Rand)** | 133 | 0.00 / 198.00 | 0.00 / 99.00 | 99.00 | |
| **Consultation costs (Rand)** | 133 | 158.00 / 4623.00 | 348.00 / 918.00 | 633.00 | |
| **IV fluid costs (Rand)** | 133 | 0.00 / 136.89 | 0.00 / 21.93 | 10.53 | |
| **Blood transfusion costs (Rand)** | 133 | 0.00 / 5017.35 | 0.00 / 0.00 | 0.00 | |
| **Anti infective medication costs (Rand)** | 133 | 0.00 / 869.76 | 25.65 / 151.93 | 74.63 | |
| **Other medication costs (Rand)** | 133 | 0.00 / 3061.84 | 1.68 / 27.52 | 8.09 | |
| **Total costs (Rand)** | 133 | 175.20 / 6709.36 | 883.13 / 2108.75 | 1342.37 | |

Table 2 outlines descriptive statistics of costs (investigations, radiology, consults; IV fluids, blood, anti infective medications, other medications and total costs). Other components of count data are age, CD4 count, pre admission consults and preceding admissions.

**Figure 1: Bar graph of median costs in Rand**




The bar graph shows median costs in the study that contributed to the total costs. Consultation costs formed major contribution to the total costs followed by investigation costs, radiology costs and anti infective medication costs. Costs from other medications, radiology, intravenous fluids and blood transfusions contributed the least to total costs.

### 4.5. Univariate associations

Associations between single variables and total costs were investigated and the outcomes are shown in appendix D. Highlighted in table 3 are all the univariate associations with p-values less than 0.3 that were used subsequently in multivariate analysis.

**Table 3: Significant univariate comparisons p-values and medians**

| Variable | P-value | Medians in Rand |
|---|---|---|
| Admission diagnosis | <0.01 | RVD 1195.74<br>Pulmonary TB 1484.96<br>Anaemia 3404.61<br>Diarrhoeal Ds 967.02<br>Respiratory Ds 1208.19<br>Meningitis 1088.19<br>Other Ds 4002.27 |
| Discharge diagnosis | 0.01 | RVD 1346.59<br>Pulmonary TB 1278.43<br>Anaemia 4349.26<br>Diarrhoeal Ds 596.63<br>Respiratory Ds 1587.42<br>Other Ds 1256.16 |
| First admission | 0.01 | No 1101.54<br>Yes 1429.06 |
| Outcome | 0.12 | Death 1147.30<br>Discharge 1351.17<br>Transfer 424.53 |
| Pre-admission consults | 0.12 | 0 consult 1484.96<br>1 consult 1150.70<br>2 consults 1329.68<br>3 consults 1360.16<br>4 consults 1175.08<br>>4 consults 937.08 |
| Preceding admissions | 0.01 | 0 admission 1429.06<br>1admission 913.89<br>>1 admission 1231.39 |

The variable discharge diagnosis was not used in the multivariate analysis because of the overlap of some diagnoses with admission diagnoses. The admission diagnoses were completely recorded with no missing records. The 1st admission category was also not used in multivariate analysis because of its perfect correlation with the preceding admissions category. The significant univariate categories used in multivariate analysis models were: admission diagnosis (p-value < 0.01), outcome (p-value = 0.12), pre-admission consults (p-value = 0.12) and preceding admissions (p-value = 0.01).

**Table 4: Multiple comparisons between groups**

| | **P-value** | **Medians** |
|---|---|---|
| **Admission diagnosis** | | |
| *Adjusted p-value needed for significance* | 0.001 | |
| Pulmonary TB versus Diarrhoeal diseases - (group 2 compared to group 4) | <0.001 | 1484.96 versus 967.02 |
| Anaemia versus Diarrhoeal diseases - (group 3 compared to group 4) | <0.001 | 3404.61 versus 967.02 |
| Diarrhoeal diseases versus Other diseases – (group 4 compared to group 7) | <0.001 | 967.02 versus 4002.27 |
| **Discharge diagnosis** | | |
| *Adjusted p-value needed for significance* | 0.001 | |
| Anaemia versus Diarrhoeal diseases – (group 3 compared to group 4) | <0.001 | 4349.26 versus 596.63 |
| **Preceding admissions** | | |
| *Adjusted p-value needed for significance* | 0.008 | |
| One admission versus more than 1 admission – (group 1 compared to group 2) | 0.002 | 913.89 Versus 1231.39 |

Multiple comparisons between groups showed some significant associations and some non significant associations. Significant associations are shown in table 3 above.

Comparison of medians between groups showed significance between some groups in the admission diagnosis category, discharge diagnosis category and preceding admissions category.

In the admission diagnosis category: pulmonary TB versus diarrhoeal diseases showed a significant p-value less than 0.001, anaemia versus diarrhoeal diseases a p-value less than 0.001 and diarrhoeal diseases versus other diseases a p-value less than 0.001.

In the discharge diagnosis category, anaemia versus diarrhoeal diseases showed a significant p-value less than 0.001. In the preceding admissions category, one admission versus more than one admission showed a significant p-value of 0.002.

### 4.6. Multivariate associations

Variables included for initial multivariate regression analysis were: admission diagnosis, pre admission consults, preceding admissions and outcome.

Model 1 was found to have an adjusted R-squared of 0.25, P-value less than 0.001 and AIC of 295.6. After model 1 parameter testing showed the following p-values: admission diagnosis p-value was less than 0.001, pre-admission consults p-value was 0.059, preceding admission categories p-value was 0.284 and outcome p-value was 0.775. The outcome variable had the highest p-value and was therefore dropped from the subsequent model.

For model 2 the adjusted R-squared was 0.25, P-value less than 0.001 and AIC was 291.7. Parameter testing showed the p-values: admission diagnosis p-value was less than 0.001, pre-admission categories p-value was 0.056 and preceding admission categories p-value was 0.275. The preceding admissions found to have the largest p-value was then dropped from the final model, the results of which are shown below.

### 4.7. Final model

The parameters included in the final model were admission diagnosis and pre-admission consults.

**Table 5: Significant multivariate associations**

| Log total costs | Coefficient | Cost change | 95% confidence interval | P-value | Model results |
|---|---|---|---|---|---|
| Compared with retroviral disease only as diagnosis | | | | | |
| Pulmonary TB | 0.434 | R43.00 | -0.006 - 0.874 | 0.053 | Adjusted R-squared = 0.25 |
| Anaemia | 0.682 | R68.00 | 0.051 - 1.313 | 0.035 | Model P-Value < 0.001 |
| Diarrhoeal diseases | -0.179 | -R18.00 | -0.667 - 0.308 | 0.468 | AIC = 288.6 |
| Respiratory diseases | -0.028 | -R3.00 | -0.547 - 0.492 | 0.917 | |
| Meningitis | -0.222 | -R22.00 | -0.810 - 0.366 | 0.456 | |
| Other diseases | 1.011 | R101.00 | 0.424 - 1.598 | 0.001 | |
| Compared with no pre admission consults | | | | | |
| One pre admission consult | -0.610 | -R61.00 | -1.050 - -0.170 | 0.007 | |
| Two pre admission consults | 0.055 | R6.00 | -0.375 - 0.485 | 0.800 | |
| Three pre admission consults | -0.290 | -R29.00 | -0.685 - 0.105 | 0.149 | |
| Four pre admission consults | -0.431 | -R43.00 | -0.839 - -0.023 | 0.039 | |
| Five or more pre admission consults | -0.491 | -R49.00 | -0.838 - -0.144 | 0.006 | |

The final model had the smallest AIC of 288.6, but the adjusted R-squared did not differ from the full model. Data diagnostics were performed and revealed case 72 as an outlier, however excluding the case from the model did not result in a significant change of coefficients [Appendix C].

A linear relationship was hypothesized between log transformed total costs as an outcome variable and predictor variables [40]. The regression beta coefficients were interpreted as the expected change in the log of total costs with respect to one-unit increase in a predictor variable holding all other variables at fixed value, assuming that a predictor variable enters the model only as a main effect [20].

Interpretation of changes in costs using a change in beta coefficient: Y changes by 100*beta coefficient for 1 unit increase in X while all other variables are held constant e.g. for pulmonary TB; beta equals 0.434 and this means that the total cost for pulmonary TB compared to retroviral disease increases by 100 x 0.43 = R43 (moving from retroviral disease only to pulmonary TB). The expected change in costs according to beta coefficients is included in the table above.

### 4.8. Summary of findings

So what did we find in this study?

- The demographic and clinical profiles of adult patients admitted in this hospital with HIV-related illnesses were identified. The majority of patients admitted during the study period were males with the median age of 35years. Of the total number of patients admitted, the greatest proportion was between the ages of 29years and 39years. Single unemployed patients living in urban areas were more likely to be admitted to hospital with HIV-related illnesses. Clinically most patients were admitted for the first time during the study period, with no prior contact with health care services as shown by lack of pre-admission consults and they presented in advanced stages of the disease process with CD4 counts of 200 $x10^6$ or less (74.4%) and median CD4 count of 62.5 $x10^6$. The greatest proportion of patients were admitted with PTB, were not on HAART and they survived the index admission.
- Direct costs of inpatient care during the period of study were determined. Total admission costs ranged from R175.20 to R6709.36 with a median cost of R1342.37. Major contributors to total costs were consultation and investigation costs, together comprising 77.7% of the total median cost.
- We determined drivers of direct costs in this group of patients, which were clinically and statistically significant. Clinically significant costs were: admission diagnosis, outcome, pre-admission diagnosis and preceding admissions. From these we

determined that admission diagnosis and pre-admission consults were statistically significant in driving the costs of admission. The diagnoses of other diseases, anaemia and pulmonary TB were the major diagnostic drivers of costs. Pre-admission consults showed potential to reduce admission costs.

# Chapter 5

# DISCUSSION

## 5.1. Introduction

The HIV/AIDS pandemic has a major impact on health and health systems for almost three decades now. Major strides have been taken in attempts to understand the pandemic in terms of its demographic impact and health systems impact including its financial implications. It is important to have an understanding of the demographics of people with HIV/AIDS with their bearing on the burden of disease and of the financial impact of the HIV pandemic. Understanding patient profiles helps in channelling public health interventions to relevant target populations, while understanding cost implications allows proper planning and channelling of funds to ensure cost effectiveness in the public health sector, which is all too often plagued by a scarcity of resources. Proper financial planning also helps in ensuring adequate provision of health care services to those who need it most.

## 5.2. Burden of disease

Our study shows who was mostly affected by the disease in this hospital. In the results we found that men were more affected by the disease compared to women, urban patients more affected than rural patients, older patients more than younger patients and elderly patients, single patients more than married patients and unemployed patients more than employed patients.

All these groups have different patterns of health seeking behaviour, engagement in risky sexual behaviour and their contribution in health care costs. Most disconcerting is the fact that the burden of disease affected worst are the unemployed, which may be a common thread among those found to be worst affected by HIV/AIDS and interfere with health seeking behaviour of the patients. As confirmed by other studies it is unfortunate that the burden of disease globally tends to affect the poor and this may limit health seeking behaviour among the poor sick. The heavy burden of disease among the world's poorest increases the percentages of years of life lost (YLLs) and disability adjusted life years (DALYs) up to 64%, and communicable diseases contribute most to the disease burden [41] [42]. Even though the burden of disease in our study is significantly high looking at the proportion of patients with advanced HIV disease (CD4 counts $\leq 200$ x$10^6$), our patient mortality rate was not as high compared with other studies (20.3% v. 38%) [41].

### 5.3. Health seeking behaviour

Generally the patients admitted to hospital demonstrated poor health seeking behaviour as shown by the proportion of patients admitted for the first time (60.9%), with no pre-admission consults (mode = 0), not on HAART (70.7%) and with CD4 counts of 200 $x10^6$ or less (74.4%)

In the results of this study the different categories of patients that showed differences in affectation by advanced HIV-related illnesses also have different patterns of health seeking behaviour. Women generally have better health seeking behaviour than men; Norcross found that women are more likely to seek and use health care, possess greater knowledge about health, are compliant with a therapeutic regimen and monitor the health of others as well as their own health [43]. Men on the other hand do not use health care for various reasons unless they are severely ill and even then some do not. According to Letsela and Ratele the majority of men (63%) reported to never go for health care check-ups, while 37% indicated that they do. Seventy six percent of those that indicated that they don't go for health check-ups reported that they eventually do access health services when they are feeling severely ill, while 24% never go at all. They mentioned a number of reasons for not accessing health care services among others were; lack of medical aid, distrust of public health services, the view that visiting health care services was a waste of their time, the fear of finding out that one is unwell and the idea that health check-ups are for those that are weaker, which confirmed that men saw visits to health care services as an unmasculine activity as described in previous studies [44]. Our study is in agreement with the findings by Letsela and Ratele, with more patients being male in the study and presenting with advanced HIV disease (CD4 counts of 200 x106 or less).

Patients younger than 29years had a lower prevalence of disease in our study, which is not in agreement with some of the studies of prevalence and HAART uptake in adults that showed this group to have a higher prevalence of disease. Women between the ages of 20-29 years were more likely to be infected with HIV, especially if they engage in high risk sexual behaviour while male and female adults older than the age of 24 years were found to have a high prevalence of HIV and were the highest age group that was on ART [19] [25]. This low prevalence rate could still be attributable to poor health seeking behaviour in young adults as demonstrated by Mhlongo, *et al* in their study where most young men in a high HIV-prevalence setting were likely not to have tested for HIV 602 of 1539 (55%) of males ages

18-23 years of age or to the fact that this study was conducted during a period when the trend of HIV was on the decline in this age group (from about 25% in 2004-2005 to 21.7% in 2008) [8] [45].

Less rural patients were admitted to hospital during the period of the study compared to urban patients. Their health seeking behaviour patterns have been studied before comparing them to urban patients. Some of the factors contributing to these differences in health seeking behaviour were demonstrated in the study by van der Hoeven, Kruger and Greef exploring differences in health care seeking behaviour among rural and urban populations. Rural participants showed a propensity to have earlier health seeking behaviour than urban participants did with significantly more rural participants expressing the opinion that people need medical help when they experience pain ($p = 0.002$). More urban participants indicated that someone who seeks medical treatment must be very sick/ill ($p = 0.053$). Living in a rural community was associated with a high number of visits to a health clinic ($p = 0.002$). Other differences that were found were due to socio-economic circumstances, health beliefs and access to health care that could have an impact on health seeking behaviour of the participants [46].

### 5.4. Risky sexual behaviour

In other studies there has been an association between marital status and HIV prevalence with prevalence being higher in single people than in married people. Risky sexual behaviour is also found to be more prevalent in single than in married people. Prevalence of HIV-infection was found to be significantly associated with marital status by Shisana, *et al* with unmarried people (15.70%) having a higher prevalence than married people (10.48%). The odds of HIV infection were 1.59, (95% CI: 1.58-1.60). The risk of HIV infection was not different between unmarried men and married men (11.59% v. 11.41%). However, unmarried women (18.53%) were more at risk of HIV infection compared to married women (9.82%). They also found that the odds of married men were significantly higher than the odds of married women to be infected with HIV, while the odds of unmarried men were lower than the odds of married men to be infected [47].

In this study a similar pattern of HIV-prevalence emerged with single people comprising a greater proportion of patients admitted to hospital.

### 5.5. Cost implications

Risky sexual behaviour, health seeking behaviour and burden of disease as emerged from the profiles in our study all have cost implications. They lead to patients being infected with HIV, allow the disease to progress unchecked and eventually patients being admitted to hospital. When patients get admitted to hospital costs are incurred by the health services. In our study variables such as not being on HAART or CD4 counts may not have shown any statistical or clinical significance with relation to costs, but they without doubt have a contribution to admission costs judging by the difference in proportions. Other studies have shown that parameters such as CD4 counts contribute to admission costs of patients with HIV. Besides being markers of advanced disease, these CD 4 count categories have a significant association with increased costs in management of HIV-infected patients because they increase the incidence of hospital admissions. This was confirmed in the study in the US by Farnham [33].

Direct costs of patient care were made up mainly of consultation costs and investigation costs (77.7%). Comparing our study, which showed consultation costs and investigation costs as cost drivers in hospital admissions with that done by Olukoga in 2007; we found that he found personnel costs to be the major contributor to unit hospital costs in South African district hospitals (77.7% v. 73-82%) [48].

Of the clinically significant parameters, only admission diagnosis and pre-admission consults were the only two that showed statistical significance. So in our studies drivers of admission costs were consultation and investigation costs significantly increased by the following diagnoses: other diseases, anaemia and pulmonary TB which is the most common opportunistic disease associated with HIV infection. Tuberculosis (TB) is the leading HIV-associated opportunistic disease in developing countries [46]. An increase in the number of pre-admission consults emerged as a significant parameter that would reduce admission costs, which is an encouraging finding that can be used as a measure of cost reduction.

### 5.6. Conclusion

In our study we managed to successfully map the patient profiles both demographic and clinical for adult patients admitted with HIV-related illnesses at AMH. From these profiles patterns of disease burden, health seeking behaviour and risky sexual behaviour were derived and these lead to cost implications related to hospital admissions. Parameters that were not

clinically or statistically significant in association with costs, but that had an important contribution to costs were identified.

Drivers of direct costs were identified as consultation costs and investigation costs increased by diagnosis categories of other diseases, anaemia and pulmonary TB. The increase in the number of pre-admission consults emerged as a potential parameter that could help in reduction of admission costs and it can be used as one of the measures to curtail an increase in admission costs for HIV-related diseases.

### 5.7. Strengths of the study

The study evaluated cost implications at a district hospital, which is a primary point of contact with the health system for patients with HIV/AIDS-related illnesses. Major direct cost contributors were determined and their drivers identified.

The study has a potential to add knowledge about potential areas to target in trying to contain costs related to inpatient admissions for HIV-related illnesses. Since the study was conducted in a hospital bordering two districts with the highest prevalence of HIV in their respective provinces, it is representative of the general population living with HIV at the time and may be generalizable in similar settings.

The study helps in understanding of patient demographic and clinical profiles relating to HIV/AIDS at primary health care level and this can be used as a guide to resource allocation and in strengthening of primary prevention measures in communities. The study has a potential to prompt further research in this subject or in related subjects.

### 5.8. Limitations of the study

The sample size of the study was small therefore not highly powered to make conclusive deductions. Collection of retrospective data had a limitation of not having research oriented data and therefore not standardised. The study sample was not all inclusive because the records that were missing or incomplete could not be used in the study. A total of 12 of 145 records could not be used due to incomplete or missing data and one excluded because it did not fulfil the age criterion of adulthood

The analysis was limited to direct inpatient costs of HIV-related illnesses with no comparison e.g. outpatient costs or with non HIV-related illnesses , which narrowed the scope of the study. The impact would be stronger if the study was comparative.

### 5.9. Suggestions for further research

This study could possibly be expanded to include direct and indirect costs of inpatient admissions for HIV-related illnesses.

There could be a comparison of direct costs of HIV/AIDS-related admissions with non HIV/AIDS-related admissions.

Comparison of inpatient costs to outpatient costs for patients infected with HIV is another possible area of research.

A cost comparison between inpatient and/or outpatient care for HIV-infected patients on HAART and those that are not on HAART, could be investigated.

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# Appendix A

## List of definitions / terms of costs

**Anti infective medications:** All anti infective medications administered during admission i.e. antibiotics, anti viral, anti tuberculosis and anti fungal medications. Costs of administration, which include syringes, needles, drip sets, sterile water, etc, will not be included in these costs because they are included in the facility fee according to the patient administration and billing (PAAB) system. These costs will be done according to the PAAB system as used by the hospital.

**Blood transfusions:** Blood transfusion costs including all blood and blood products and cross match plus service costs as charged by the SANBS.

**Consultation costs:** Doctors' consultation fees as per UPFS guide starting from the initial consultation that leads to admission and subsequent inpatient consultations

**Intravenous fluids:** Intravenous fluids infused during admission viz. Dextrose Saline, Maintelyte, Modified Ringers Lactate, Normal Saline and Voluven. Costs of administration will be excluded from these costs as they are part of the facility fee.

**Laboratory investigations:** Investigations conducted on blood and other body fluids like cerebrospinal fluid, pleural fluid, lymph node aspirates, stool and urine. Laboratory cost will be calculated using the tariff system that is used by National Health Laboratory Services (NHLS) to bill the hospital and will be obtained from the hospital finance department.

**Length of stay:** The number of days that a particular patient spends admitted in hospital as determined by the PAAB. A full day is determined by overnight stay in hospital.

**Other medications:** All medications other than anti infective medications i.e. anti inflammatory, analgesics, anti psychotics, vitamins and supplements, etc.

**Radiology:** All radiological examinations conducted during admission; x-rays, ultrasound and CT scans. All radiological investigations will be costed from the PAAB system as based on the UPFS guide.

# Appendix B

## Revised WHO Clinical Staging of HIV/AIDS

### For Adults and Adolescents

(Interim African Region version for persons aged 15 years or more with positive HIV antibody test or other laboratory evidence of HIV infection.)

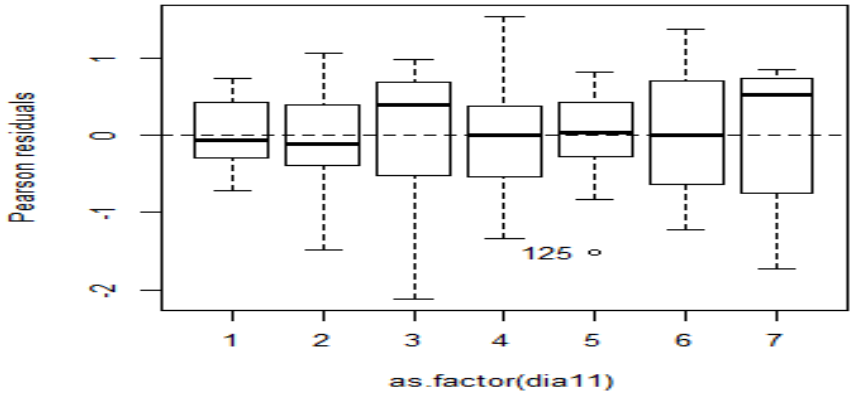
| **Primary HIV infection** |
|---|
| Asymptomatic<br>Acute retroviral syndrome |
| **Clinical stage 1** |
| Asymptomatic<br>Persistent generalized lymphadenopathy (PGL) |
| **Clinical stage 2** |
| Moderate unexplained weight loss (<10% of presumed or measured body weight)<br>Recurrent respiratory tract infections (RTIs, sinusitis, bronchitis, otitis media, pharyngitis)<br>Herpes zoster<br>Angular chelitis<br>Recurrent oral ulcerations<br>Popular pruritic eruptions<br>Seborrheaic dermatitis<br>Fungal nail infections of fingers |
| **Clinical stage 3** |
| Conditions where a presumptive diagnosis can be made on the basis of clinical signs or simple investigation<br>Severe weight loss (>10% of presumed or measured body weight)<br>Unexplained chronic diarrhoea for longer than one month<br>Unexplained persistent fever (Intermittent or constant for longer than one month)<br>Oral Candidiasis<br>Oral hair leukoplakia<br>Pulmonary tuberculosis (TB) diagnosed in last two years<br>Severe presumed bacterial infections (e.g. pneumonia, empyema, pyomyositis, bone or joint infection, meningitis, bacteraemia)<br>Acute necrotising ulcerative stomatitis, gingivitis, periodontitis<br>Conditions where confirmatory diagnostic testing is necessary<br>Unexplained anaemia (<8g/dl), and or neutropenia (<500mm3) and or thrombocytopenia (<50 000mm3) for more than one month |
| **Clinical stage 4** |
| Conditions where a presumptive diagnosis can be made on the basis of clinical signs or simple investigation, HIV wasting syndrome, Pneumocystis pneumonia<br>Recurrent severe or radiological pneumonia<br>Chronic herpes simplex infection (orolabial, genital, anorectal of more than one month duration)<br>Oesophageal Candidiasis, Extrapulmonary TB, Kaposi's sarcoma<br>Central nervous system (CNS) toxoplasmosis<br>HIV encephalopathy<br>Conditions where confirmatory diagnostic testing is necessary<br>Extra-pulmonary cryptococosis including meningitis<br>Disseminated non-tuberculous mycobacteria infection<br>Progressive multifocal leukoencephalopathy (PML) |

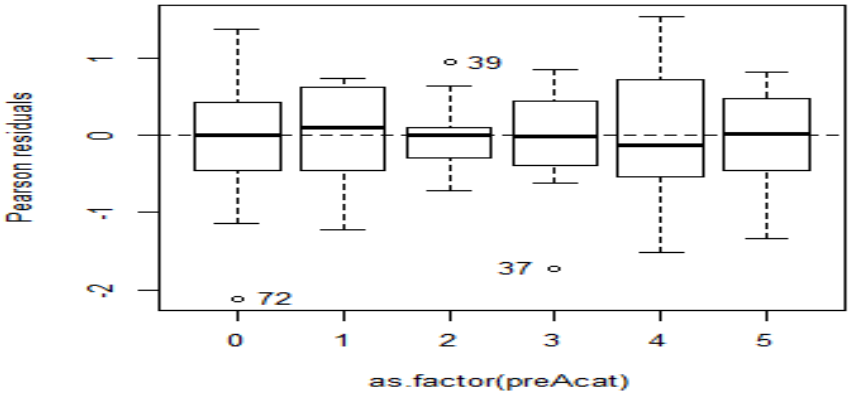
| |
|---|
| Candida of trachea, bronchi or lungs |
| Cryptosporidiosis |
| Isosporiasis |
| Visceral herpes simplex infection |
| Cytomegalovirus (CMV) infection (retinitis or of an organ other than liver, spleen or lymph nodes) |
| Any disseminated mycosis (e.g. histoplasmosis, coccidiomycosis, peniciliosis) |
| Recurrent non-typhoidal salmonella septicaemia |
| Lymphoma (cerebral or B-cell non-Hodgkin's) |
| Invasive cervical carcinoma |
| Visceral leishmaniasis |

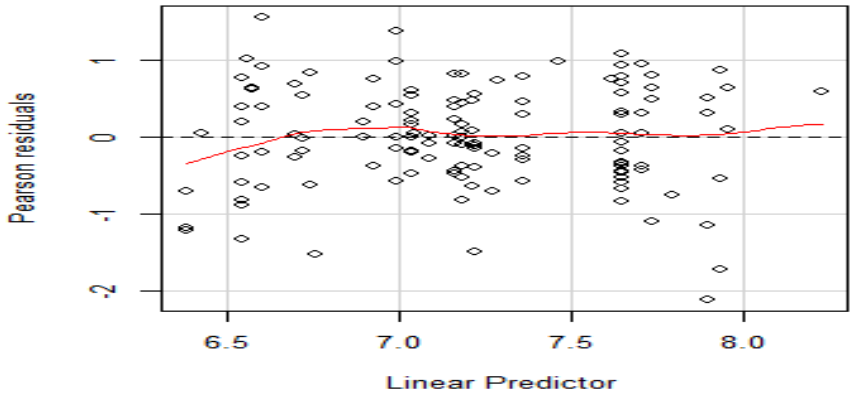
## Appendix C

## Data diagnostics

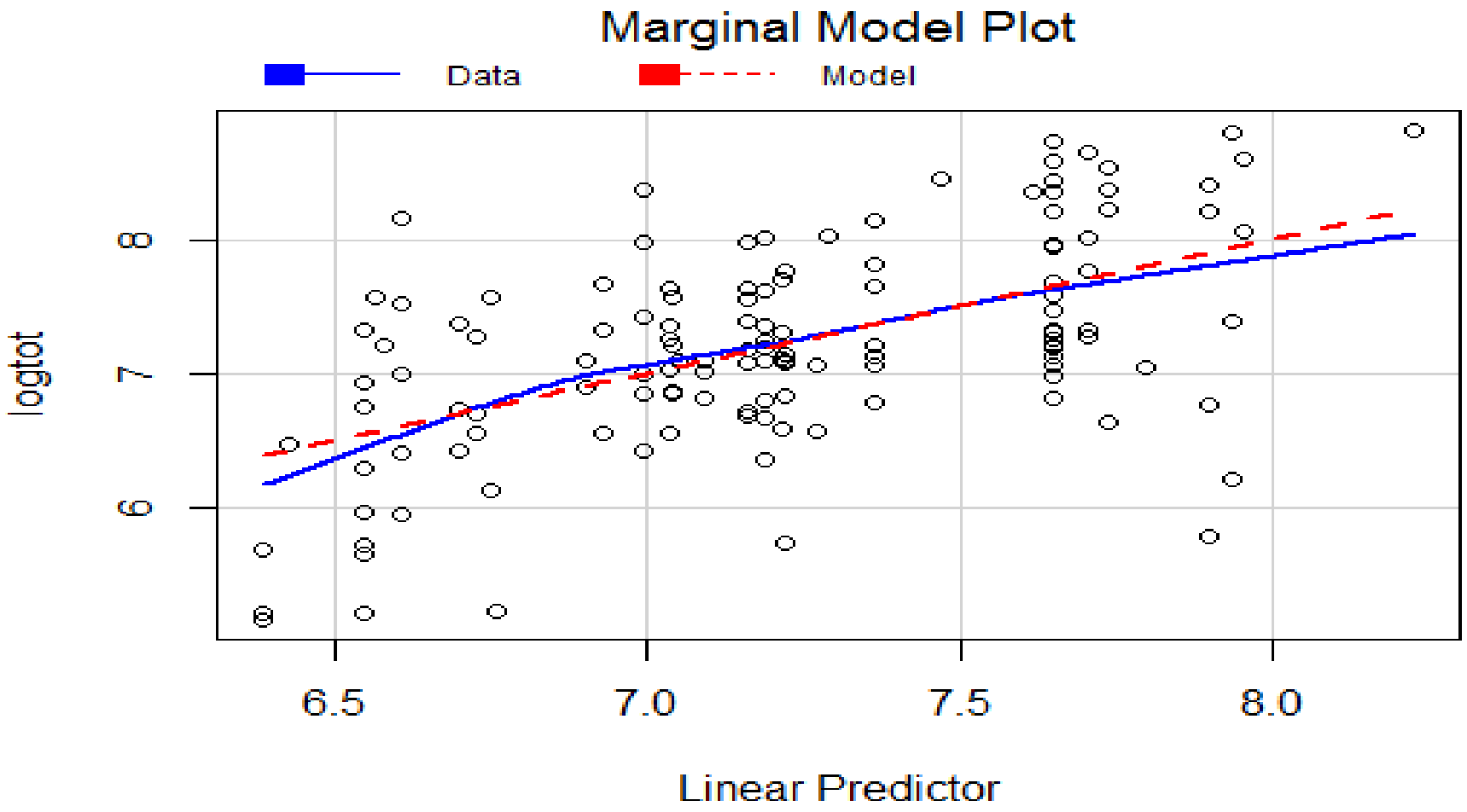
### Residual plots



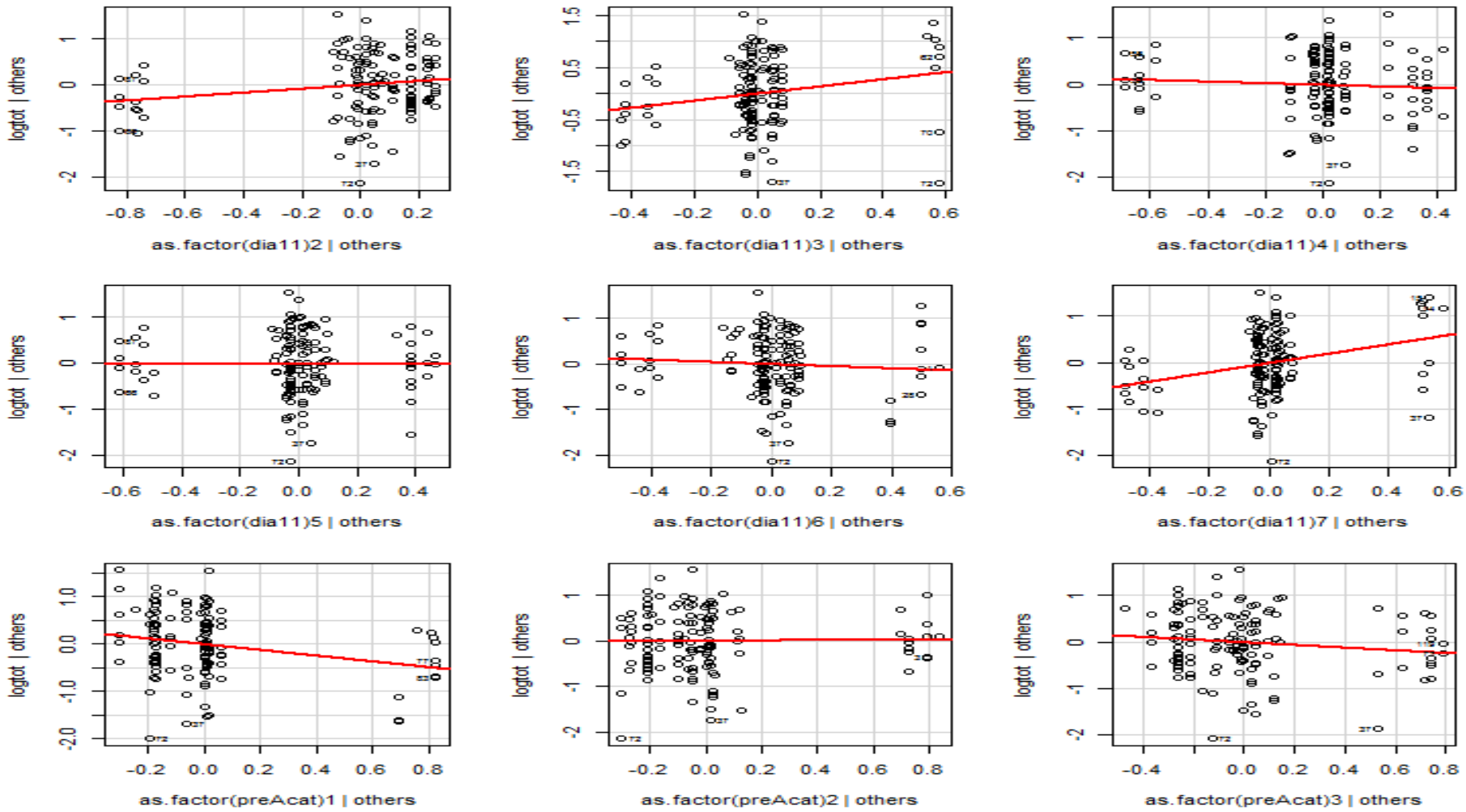



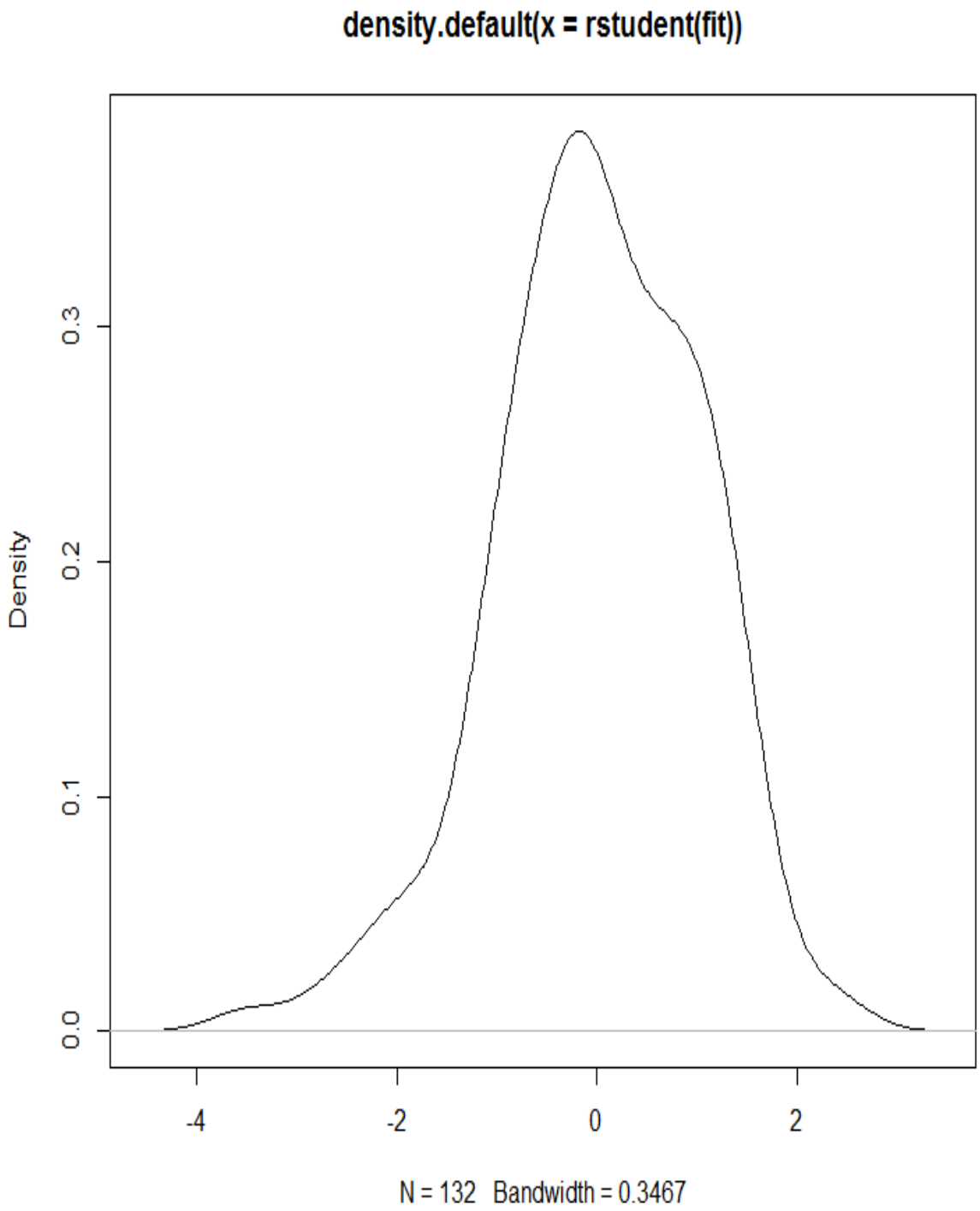
**Marginal plots**



## AV-plots

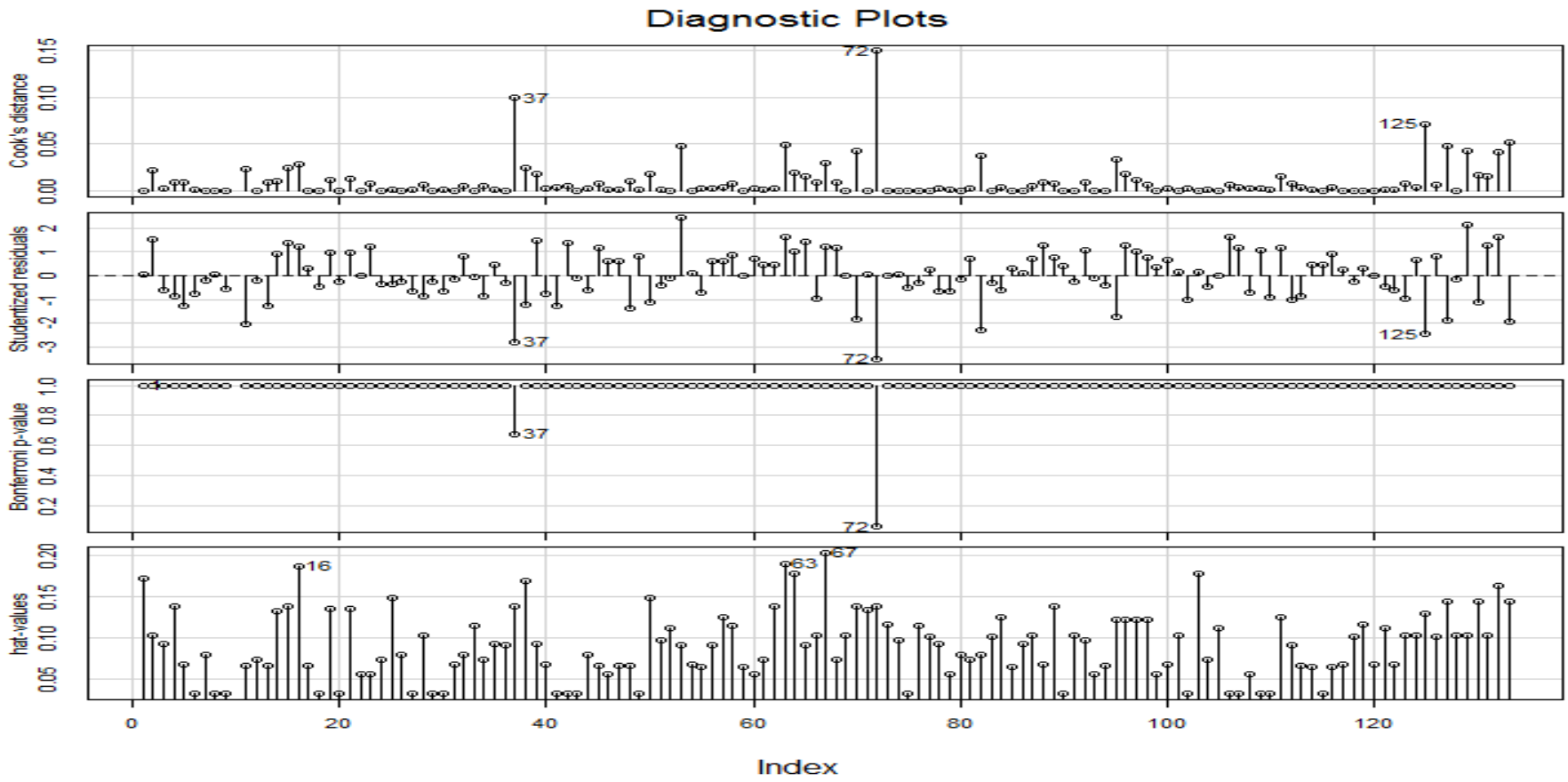


**Density plot of Residuals**



## Influence plot

**For model with admission diagnosis**




For model with admission diagnosis, patient 72 was identified an outlier

Outlier Test (fit)

No Studentized residuals with Bonferonni p < 0.05

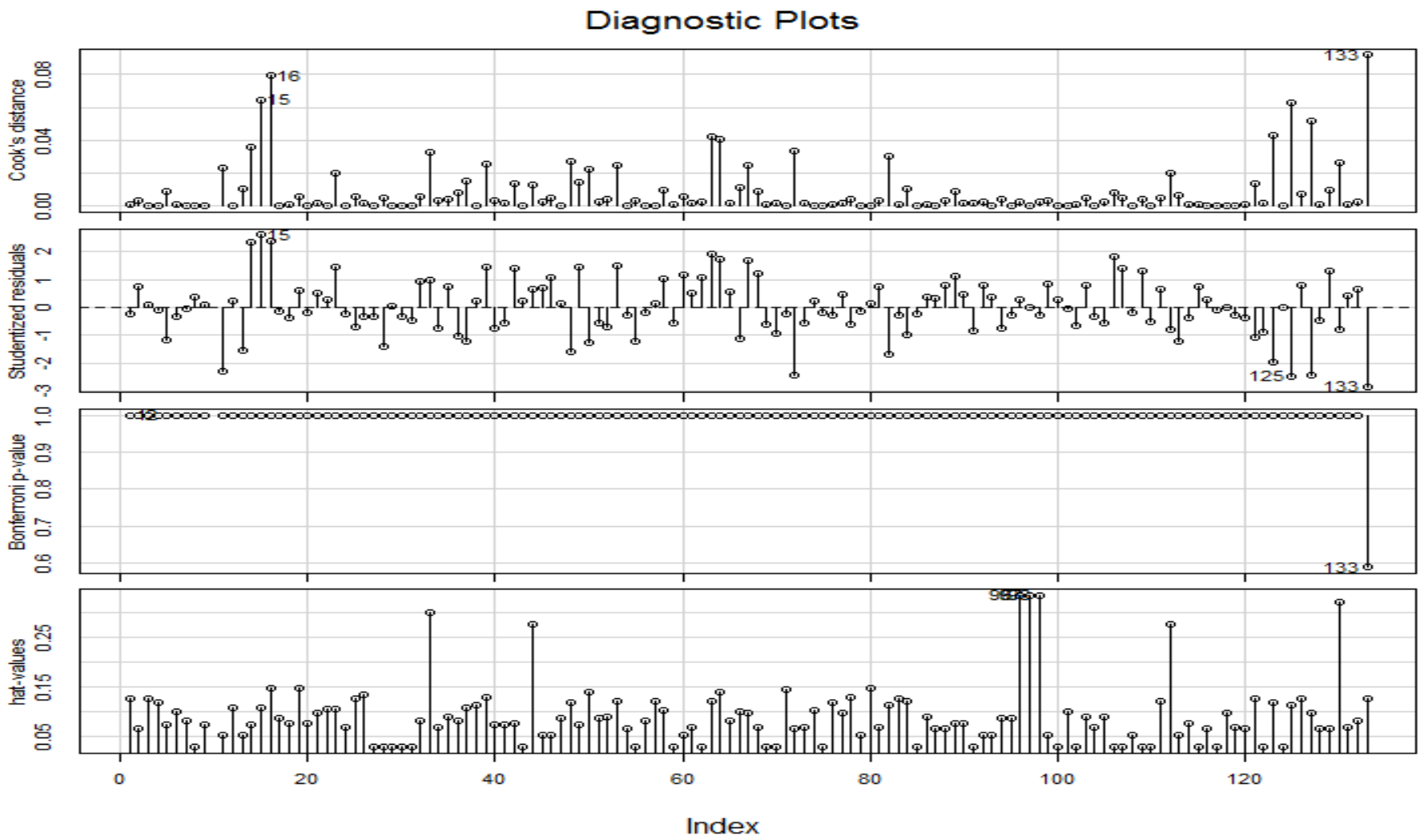
Largest |rstudent|:

| Record | rstudent | Unadjusted p-value | Bonferonni p-value |
|---|---|---|---|
| 72 | -3.501615 | 0.00046245 | 0.061043 |

If we drop this record nothing changes significantly in the model (model 2 id where 72 is dropped)

| | Estimate 1 | Standard Error 1 | Estimate 2 | Standard Error2 |
|---|---|---|---|---|
| (Intercept) | 7.2167 | 0.2181 | 7.2165 | 0.2195 |
| as.factor(dia11)2 | 0.4343 | 0.2223 | 0.4344 | 0.2233 |
| as.factor(dia11)3 | 0.6819 | 0.3189 | 0.6821 | 0.3204 |
| as.factor(dia11)4 | -0.1792 | 0.2461 | -0.1791 | 0.2473 |
| as.factor(dia11)5 | -0.0275 | 0.2622 | -0.0267 | 0.2681 |
| as.factor(dia11)6 | -0.2221 | 0.2972 | -0.2219 | 0.2988 |
| as.factor(dia11)7 | 1.0109 | 0.2964 | 1.0109 | 0.2977 |
| as.factor(preAcat)1 | -0.6096 | 0.2222 | -0.6096 | 0.2231 |
| as.factor(preAcat)2 | 0.0552 | 0.2170 | 0.0553 | 0.2181 |
| as.factor(preAcat)3 | -0.2898 | 0.1995 | -0.2891 | 0.2062 |
| as.factor(preAcat)4 | -0.4308 | 0.2061 | -0.4308 | 0.2070 |
| as.factor(preAcat)5 | -0.4908 | 0.1753 | -0.4907 | 0.1762 |

**For model with discharge diagnosis**




For model with discharge diagnosis, patient 133 was identified an outlier.

Outlier test

```
No Studentized residuals with Bonferonni p < 0.05
Largest |rstudent|:
```

| Record | rstudent | Unadjusted p-value | Bonferonni p-value |
|---|---|---|---|
| 133 | -2.842882 | 0.0044708 | 0.59014 |

```
If we remove this outlier
```

| | Estimate 1 | Standard Error 1 | Estimate 2 | Standard Error2 |
|---|---|---|---|---|
| (Intercept) | 7.1896 | 0.1974 | 7.1764 | 0.1918 |
| as.factor(dia2)1 | 0.2392 | 0.2003 | 0.2359 | 0.1946 |
| as.factor(dia2)2 | 0.2592 | 0.2500 | 0.2699 | 0.2430 |
| as.factor(dia2)3 | 1.8078 | 0.4786 | 1.8155 | 0.4651 |
| as.factor(dia2)4 | -0.4567 | 0.4147 | -0.4933 | 0.4032 |
| as.factor(dia2)5 | 0.4146 | 0.2555 | 0.5283 | 0.2515 |
| as.factor(dia2)7 | 0.1587 | 0.2696 | 0.1433 | 0.2621 |
| as.factor(preAcat)1 | -0.5634 | 0.2407 | -0.3927 | 0.2415 |
| as.factor(preAcat)2 | 0.0758 | 0.2278 | 0.0735 | 0.2214 |
| as.factor(preAcat)3 | -0.1332 | 0.2086 | -0.1289 | 0.2027 |
| as.factor(preAcat)4 | -0.3011 | 0.2212 | -0.2896 | 0.2150 |
| as.factor(preAcat)5 | -0.6190 | 0.1847 | -0.6134 | 0.1795 |

In choosing the best model we used the strategy of removing the highest p-value. Other strategies that can be used are: using a model with the largest adjusted R-squared statistic or the smallest AIC statistic.

## Appendix D: Table 3: Relationship of variables to individual costs

| | Inv:* p50, p25, p75 | P | Rad:* p50, p25, p75 | p | Con:* p50, p25, p75 | p | IVF:* p50, p25, p75 | p | Bld:* p50, p25, p75 | P | An inf:* p50, p25, p75 | p | Other:* p50, p25, p75 | p | Tot:* p50, p25, p75 | p |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Age cat**** | | | | | | | | | | | | | | | | |
| <29 | 408.86, 62.54, 682.74 | **0.85** | 0.00, 0.00, 99.00 | **0.31** | 633.00, 443.00, 918.00 | **0.89** | 10.53, 0.00, 32.50 | **0.04** | 0.00, 0.00, 0.00 | **0.98** | 85.75, 58.03, 165.55 | **0.15** | 6.67, 2.80, 19.63 | **0.01** | 1256.16, 906.01, 2108.75 | **0.63** |
| 29-<39 | 401.17, 75.26, 775.31 | | 0.00, 0.00, 99.00 | | 538.00, 348.00, 918.00 | | 10.53, 0.00, 21.06 | | 0.00, 0.00, 0.00 | | 82.37, 39.80, 156.18 | | 3.66, 1.16, 21.56 | | 1305.62, 696.00, 1977.19 | |
| 39-<49 | 480.81, 172.33, 750.40 | | 99.00, 0.00, 99.00 | | 538.00, 348.00, 823.00 | | 0.00, 0.00, 10.53 | | 0.00, 0.00, 0.00 | | 61.42, 20.59, 92.01 | | 7.21, 1.50, 35.52 | | 1291.40, 1024.38, 2170.84 | |
| ≥4 | 409.23, 96.28, 769.48 | | 0.00, 0.00, 99.00 | | 633.00, 348.00, 918.00 | | 10.53, 0.00, 42.12 | | 0.00, 0.00, 0.00 | | 42.50, 11.04, 151.93 | | 21.24, 10.53, 82.06 | | 1517.19, 861.64, 3695.79 | |
| **Sex **** | | | | | | | | | | | | | | | | |
| Female | 364.72, 149.13, 654.76 | **0.48** | 99.00, 0.00, 99.00 | **0.82** | 633.00, 348.00, 870.50 | **0.69** | 10.53, 0.00, 27.20 | **1.00** | 0.00, 0.00, 0.00 | **0.13** | 74.86, 22.35, 156.79 | **0.83** | 7.38, 1.35, 23.88 | **0.48** | 1242.74, 1024.38, 2128.29 | **0.66** |
| Male | 441.14, 80.00, 780.03 | | 99.00, 0.00, 99.00 | | 538.00, 348.00, 918.00 | | 10.53, 0.00, 21.06 | | 0.00, 0.00, 0.00 | | 70.23, 31.01, 149.60 | | 9.13, 1.82, 30.22 | | 1351.17, 847.53, 2084.10 | |
| **Res**** | | | | | | | | | | | | | | | | |
| Rural | 442.09, 69.64, 720.63 | **0.74** | 99.00, 0.00, 99.00 | **0.84** | 585.50, 300.50, 918.00 | **0.81** | 10.53, 5.26, 21.06 | **0.26** | 0.00, 0.00, 0.00 | **0.12** | 82.75, 10.57, 189.94 | **0.81** | 3.00, 1.60, 9.71 | **0.05** | 1491.35, 560.46, 2574.61 | **0.63** |
| Urban | 393.48, 122.90, 746.80 | | 99.00, 0.00, 99.00 | | 633.00, 348.00, 918.00 | | 10.53, 0.00, 22.88 | | 0.00, 0.00, 0.00 | | 74.08, 39.23, 151.25 | | 10.73, 1.82, 35.41 | | 1305.62, 906.01, 2041.30 | |

| | **Inv:*** p50, p25, p75 | **p** | **Rad:*** p50, p25, p75 | **p** | **Con:*** p50, p25, p75 | **p** | **IVF:*** p50, p25, p75 | **p** | **Bld:*** p50, p25, p75 | **p** | **An inf:*** p50, p25, p75 | **p** | **Other:*** p50, p25, p75 | **p** | **Tot:*** p50, p25, p75 | **p** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Emp**** | | | | | | | | | | | | | | | | |
| No | 405.55, 122.06, 741.89 | **1.00** | 99.00, 0.00, 99.00 | **0.51** | 633.00, 348.00, 918.00 | **0.97** | 10.53, 0.00, 27.20 | **0.29** | 0.00, 0.00, 0.00 | **0.70** | 81.19, 39.52, 157.04 | **0.04** | 7.92, 1.65, 25.41 | **0.48** | 1336.70, 872.38, 2067.92 | **0.79** |
| Yes | 408.86, 119.31, 754.01 | | 0.00, 0.00, 99.00 | | 538.00, 443.00, 823.00 | | 0.00, 0.00, 10.53 | | 0.00, 0.00, 0.00 | | 25.65, 12.75, 63.29 | | 15.20, 4.50, 40.48 | | 1523.56, 837.81, 3722.98 | |
| Pension | 520.69, 228.87, 608.23 | | 99.00, 49.50, 99.00 | | 680.50, 300.50, 1108.00 | | 5.26, 0.00, 47.37 | | 0.00, 0.00, 0.00 | | 59.50, 19.85, 97.17 | | 6.66, 0.83, 50.50 | | 1358.93, 1053.47, 1556.34 | |
| **Mar**** | | | | | | | | | | | | | | | | |
| Single | 416.30, 126.31, 754.01 | **0.21** | 99.00, 0.00, 99.00 | **0.08** | 633.00, 348.00, 918.00 | **0.37** | 10.53, 0.00, 22.88 | **0.69** | 0.00, 0.00, 0.00 | **0.49** | 79.30, 43.82, 158.72 | **0.01** | 6.79, 1.66, 23.48 | **0.07** | 1346.59, 906.06, 2187.39 | **0.32** |
| Married | 388.97, 0.00, 567.22 | | 0.00, 0.00, 99.00 | | 585.50, 253.00, 823.00 | | 10.53, 0.00, 21.06 | | 0.00, 0.00, 0.00 | | 35.36, 10.00, 106.24 | | 14.76, 2.45, 73.34 | | 1193.04, 765.69, 1912.73 | |
| **HAART**** | | | | | | | | | | | | | | | | |
| No | 536.74, 281.86, 775.88 | **0.00** | 99.00, 0.00, 99.00 | **0.03** | 538.00, 348.00, 918.00 | **0.17** | 10.53, 0.00, 21.06 | **0.24** | 0.00, 0.00, 0.00 | **0.34** | 68.99, 29.30, 149.60 | **0.55** | 6.44, 1.25, 21.56 | **0.01** | 1343.52, 934.24, 2193.84 | **0.38** |
| Yes | 144.53, 0.00, 441.14 | | 0.00, 0.00, 99.00 | | 728.00, 443.00, 918.00 | | 10.53, 0.00, 42.12 | | 0.00, 0.00, 0.00 | | 83.80, 13.90, 158.72 | | 15.20, 4.34, 38.33 | | 1256.16, 765.69, 1950.77 | |
| **CD4 cat**** | | | | | | | | | | | | | | | | |
| 0-50 | 304.17, 122.90, 834.15 | **0.96** | 0.00, 0.00, 99.00 | **0.79** | 443.00, 348.00, 823.00 | **0.63** | 0.00, 0.00, 10.53 | **0.22** | 0.00, 0.00, 2759.81 | **0.66** | 58.03, 20.88, 109.57 | **0.67** | 2.08, 0.48, 38.33 | **0.17** | 1188.80, 906.06, 2108.75 | **0.75** |
| >50-200 | 409.93, 119.31, 736.98 | | 0.00, 0.00, 99.00 | | 633.00, 348.00, 1013.00 | | 10.53, 0.00, 21.06 | | 0.00, 0.00, 0.00 | | 80.01, 39.23, 151.25 | | 7.76, 1.38, 23.48 | | 1484.96, 906.01, 2108.75 | |

| | **Inv:*** p50, p25, p75 | **p** | **Rad:*** p50, p25, p75 | **p** | **Con:*** p50, p25, p75 | **p** | **IVF:*** p50, p25, p75 | **p** | **Bld:*** p50, p25, p75 | **p** | **An inf:*** p50, p25, p75 | **p** | **Other:*** p50, p25, p75 | **p** | **Tot:*** p50, p25, p75 | **p** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| >200-350 | 437.74, 125.53, 716.76 | | 99.00, 0.00, 99.00 | | 585.50, 395.50, 918.00 | | 10.53, 0.00, 37.31 | | 0.00, 0.00, 0.00 | | 76.69, 32.67, 180.38 | | 6.51, 2.35, 20.02 | | 1280.89, 949.97, 2046.52 | |
| >350 | 416.30, 160.65, 746.80 | | 99.00, 0.00, 99.00 | | 443.00, 348.00, 823.00 | | 10.53, 0.00, 21.06 | | 0.00, 0.00, 0.00 | | 65.80, 19.34, 106.78 | | 18.88, 8.09, 56.88 | | 1175.08, 708.14, 1621.20 | |
| **Ad dia**** | | | | | | | | | | | | | | | | |
| Retroviral disease | 447.59, 48.14, 667.95 | **0.20** | 99.00, 0.00, 99.00 | **0.00** | 633.00, 443.00, 775.50 | **0.01** | 15.79, 0.00, 32.05 | **0.37** | 0.00, 0.00, 0.00 | **0.03** | 68.90, 24.73, 149.36 | **0.25** | 10.99, 2.14, 34.37 | **0.01** | 1195.74, 714.64, 1499.73 | **<0.01** |
| Pulmonary TB | 416.30, 190.98, 786.97 | | 99.00, 0.00, 99.00 | | 728.00, 443.00, 1108.00 | | 10.53, 0.00, 31.59 | | 0.00, 0.00, 0.00 | | 105.28, 54.72, 165.55 | | 7.11, 1.76, 23.48 | | 1484.96, 1175.08, 2365.99 | |
| Anaemia | 328.15, 123.76, 438.24 | | 0.00, 0.00, 0.00 | | 395.50, 253.00, 1108.00 | | 10.53, 0.00, 26.29 | | 2759.81, 815.52, 2759.81 | | 23.19, 2.84, 152.64 | | 2.78, 0.57, 44.36 | | 3404.61, 1950.76, 4549.98 | |
| Diarrhoeal diseases | 178.56, 0.00, 420.07 | | 0.00, 0.00, 0.00 | | 443.00, 300.50, 823.00 | | 10.53, 0.00, 43.01 | | 0.00, 0.00, 0.00 | | 56.07, 30.16, 97.56 | | 9.25, 2.28, 21.39 | | 967.02, 499.98, 1462.95 | |
| Respiratory diseases | 583.56, 205.45, 641.04 | | 99.00, 99.00, 99.00 | | 538.00, 253.00, 728.00 | | 0.00, 0.00, 10.53 | | 0.00, 0.00, 0.00 | | 65.80, 15.07, 115.05 | | 2.80, 0.91, 8.09 | | 1208.19, 837.81, 1400.89 | |
| Meningitis | 568.93, 0.00, 1043.39 | | 0.00, 0.00, 0.00 | | 253.00, 158.00, 728.00 | | 0.00, 0.00, 10.53 | | 0.00, 0.00, 0.00 | | 61.88, 17.20, 264.64 | | 17.98, 1.16, 116.15 | | 1088.19, 292.39, 1937.93 | |
| Other diseases | 456.64, 119.31, 685.42 | | 0.00, 0.00, 99.00 | | 680.50, 443.00, 1013.00 | | 5.26, 0.00, 10.53 | | 0.00, 0.00, 2759.81 | | 55.55, 0.00, 407.69 | | 35.66, 18.88, 82.06 | | 4002.27, 1147.30, 5090.33 | |
| **Dis dia**** | | | | | | | | | | | | | | | | |
| Retroviral disease | 416.30, 190.98, 718.94 | **0.06** | 99.00, 0.00, 99.00 | **0.07** | 633.00, 348.00, 918.00 | **0.74** | 10.53, 0.00, 21.93 | **0.13** | 0.00, 0.00, 0.00 | **0.62** | 83.80, 39.80, 158.38 | **0.12** | 6.67, 1.25, 27.52 | **0.22** | 1346.59, 1066.96, 2041.30 | **0.01** |

| | **Inv: *** p50, p25, p75 | **p** | **Rad:*** p50, p25, p75 | **p** | **Con:*** p50, p25, p75 | **p** | **IVF:*** p50, p25, p75 | **p** | **Bld:*** p50, p25, p75 | **p** | **An inf:*** p50, p25, p75 | **p** | **Other:*** p50, p25, p75 | **p** | **Tot:*** p50, p25, p75 | **p** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pulmonary TB | 556.03, 119.31, 754.01 | | 99.00, 0.00, 99.00 | | 680.50, 348.00, 1013.00 | | 10.53, 0.00, 21.06 | | 0.00, 0.00, 0.00 | | 55.61, 25.65, 155.69 | | 8.64, 2.80, 24.30 | | 1278.43, 847.53, 2913.83 | |
| Anaemia | 203.31, 119.31, 441.14 | | 0.00, 0.00, 0.00 | | 728.00, 538.00, 823.00 | | 0.00, 0.00, 10.53 | | 2759.81, 0.00, 3888.58 | | 0.00, 0.00, 12.75 | | 544.44, 31.86, 3061.84 | | 4349.26, 3722.98, 5090.33 | |
| Diarrhoeal diseases | 0.00, 0.00, 79.66 | | 0.00, 0.00, 0.00 | | 443.00, 253.00, 633.00 | | 46.02, 26.78, 61.36 | | 0.00, 0.00, 0.00 | | 52.50, 26.54, 100.75 | | 14.82, 7.26, 15.37 | | 596.63, 336.64, 867.07 | |
| Respiratory diseases | 657.01, 203.29, 932.49 | | 99.00, 49.50, 99.00 | | 585.50, 443.00, 1155.50 | | 0.00, 0.00, 10.53 | | 0.00, 0.00, 0.00 | | 81.95, 41.74, 157.57 | | 7.43, 2.31, 38.05 | | 1587.42, 1204.35, 2859.60 | |
| Other diseases | 351.08, 80.00, 589.14 | | 0.00, 0.00, 99.00 | | 633.00, 348.00, 823.00 | | 10.53, 0.00, 2288 | | 0.00, 0.00, 0.00 | | 105.28, 63.17, 198.54 | | 10.53, 4.34, 21.24 | | 1256.16, 708.14, 1517.19 | |
| **1st ad**** | | | | | | | | | | | | | | | | |
| No | 122.06, 0.00, 386.76 | **0.00** | 0.00, 0.00, 99.00 | **0.00** | 633.00, 395.50, 870.50 | **0.96** | 10.53, 0.00, 31.59 | **0.21** | 0.00, 0.00, 0.00 | **0.52** | 63.23, 10.52, 130.91 | **0.03** | 15.07, 2.92, 37.02 | **0.02** | 1101.54, 702.26, 1769.56 | **0.01** |
| Yes | 579.16, 351.08, 802.88 | | 99.00, 0.00, 99.00 | | 538.00, 348.00, 918.00 | | 10.53, 0.00, 18.66 | | 0.00, 0.00, 0.00 | | 85.50, 44.26, 164.53 | | 6.37, 1.25, 19.63 | | 1429.06, 1127.06, 2365.99 | |
| **Out**** | | | | | | | | | | | | | | | | |
| Death | 457.73, 0.00, 834.15 | **0.35** | 0.00, 0.00, 99.00 | **0.20** | 538.00, 348.00, 918.00 | **0.57** | 10.53, 0.00, 21.06 | **0.52** | 0.00, 0.00, 0.00 | **0.66** | 69.60, 25.50, 156.18 | **0.78** | 17.98, 1.82, 57.23 | **0.15** | 1147.30, 837.81, 1937.93 | **0.12** |
| Discharge | 409.93, 144.53, 736.98 | | 99.00, 0.00, 99.00 | | 633.00, 348.00, 918.00 | | 10.53, 0.00, 21.93 | | 0.00, 0.00, 0.00 | | 75.10, 25.65, 151.93 | | 6.79, 1.68, 24.30 | | 1351.17, 940.92, 2193.84 | |
| Transfer | 0.00, 0.00, 0.00 | | 0.00, 0.00, 0.00 | | 348.00, 348.00, 348.00 | | 33.41, 33.41, 33.41 | | 0.00, 0.00, 0.00 | | 43.04, 43.04, 43.04 | | 0.08, 0.08, 0.08 | | 424.53, 424.53, 424.53 | |

| | Inv: * p50, p25, p75 | p | Rad:* p50, p25, p75 | p | Con:* p50, p25, p75 | p | IVF:* p50, p25, p75 | p | Bld:* p50, p25, p75 | p | An inf:* p50, p25, p75 | p | Other:* p50, p25, p75 | p | Tot:* p50, p25, p75 | p |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Pre ad**** | | | | | | | | | | | | | | | | |
| 0 | 754.01, 501.70, 871.42 | **0.00** | 99.00, 0.00, 99.00 | **0.02** | 538.00, 348.00, 918.00 | **0.39** | 10.53, 0.00, 10.53 | **0.08** | 0.00, 0.00, 0.00 | **0.95** | 74.80, 42.50, 151.25 | **0.26** | 3.08, 1.15, 21.56 | **0.04** | 1484.96, 1127.06, 2803.99 | **0.12** |
| 1 | 187.06, 0.00, 428.94 | | 49.50, 0.00, 99.00 | | 348.00, 205.50, 728.00 | | 0.00, 0.00, 15.79 | | 0.00, 0.00, 0.00 | | 61.97, 17.29, 98.65 | | 6.83, 0.34, 25.46 | | 1150.70, 471.29, 1646.13 | |
| 2 | 347.74, 0.00, 579.16 | | 0.00, 0.00, 99.00 | | 633.00, 348.00, 918.00 | | 10.53, 0.00, 31.51 | | 0.00, 0.00, 0.00 | | 66.80, 23.82, 165.55 | | 3.73, 1.76, 10.79 | | 1329.68, 1111.90, 3025.28 | |
| 3 | 258.26, 190.98, 704.27 | | 99.00, 0.00, 99.00 | | 633.00, 538.00, 918.00 | | 22.88, 0.00, 45.76 | | 0.00, 0.00, 0.00 | | 88.82, 68.38, 189.91 | | 35.62, 5.40, 46.36 | | 1360.16, 981.80, 2108.75 | |
| 4 | 281.86, 0.00, 583.66 | | 0.00, 0.00, 99.00 | | 633.00, 443.00, 918.00 | | 21.06, 0.00, 59.54 | | 0.00, 0.00, 0.00 | | 79.30, 46.29, 155.69 | | 13.86, 3.47, 18.88 | | 1175.08, 607.52, 1937.93 | |
| >4 | 119.31, 0.00, 258.58 | | 0.00, 0.00, 99.00 | | 633.00, 348.00, 918.00 | | 10.53, 0.00, 21.06 | | 0.00, 0.00, 0.00 | | 48.14, 8.80, 115.05 | | 15.07, 7.76, 38.33 | | 937.78, 696.00, 1626.39 | |
| **Prc ad**** | | | | | | | | | | | | | | | | |
| 0 | 579.16, 351.08, 802.88 | **0.00** | 99.00, 0.00, 99.00 | **0.00** | 538.00, 348.00, 918.00 | **0.40** | 10.53, 0.00, 18.66 | **0.24** | 0.00, 0.00, 0.00 | **0.89** | 85.50, 44.26, 164.53 | **0.09** | 6.37, 1.25, 19.63 | **0.04** | 1429.06, 1127.06, 2365.99 | **0.01** |
| 1 | 85.77, 0.00, 358.00 | | 0.00, 0.00, 99.00 | | 585.50, 348.00, 775.50 | | 21.06, 0.00, 32.95 | | 0.00, 0.00, 0.00 | | 63.64, 12.47, 130.91 | | 13.23, 2.92, 24.38 | | 913.89, 651.95, 1559.31 | |
| >1 | 144.56, 0.00, 386.76 | | 0.00, 0.00, 49.50 | | 728.00, 443.00, 918.00 | | 10.53, 0.00, 21.06 | | 0.00, 0.00, 0.00 | | 46.13, 8.75, 132.88 | | 21.59, 2.98, 65.22 | | 1231.39, 842.67, 2001.25 | |

*Inv = laboratory investigation costs, Rad = radiology costs, Con = consultation costs, IVF = intravenous fluid costs, Bld = blood transfusion costs, An inf = anti infective medications costs, Other = other medications costs, Tot = total costs. **Age cat = age categories, Sex = sex , Res = residence, Emp = employment, Mar = marital status, HAART = highly active anti retroviral medication, CD4 cat = CD4 count categories, Ad dia = admission diagnosisDis dia = discharge diagnosis, Out = outcome, Pre ad = pre admission consults, Prc ad = preceding admissions.

# MPUMALANGA PROVINCIAL GOVERNMENT

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## Department of Health

Litiko Letemphilo | Umnyango WezaMaphilo | Departement van Gesondheid

**Enquiries: Molefe Machaba (013) 766 3009/3172**

**17 February 2011**

**Dr Sibusiso G Nhlapo**
**P.O. Box 2115**
**VOLKRUST**
**2470**

MPUMALANGA PROVINCE
DEPARTMENT OF HEALTH
PLANNING & INFORMATION
2011 -02- 17
PRIVATE BAG X 11285
NELSPRUIT 1200

**Dear Dr Sibusiso G Nhlapo**

**DRIVERS OF DIRECT COST OF INPATIENT CARE FOR HIV-INFECTED ADULTS AT AMAJUBA MEMORIAL HOSPITAL**

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1. The request for provincial support [not financially] in relation to the above-mentioned research is hereby approved in principle, provided that you supply the Department of Health with your research proposal and ethical clearance from University of Pretoria.
2. The onus lies with researcher to seek approval from the above-mentioned institution.

Please do not hesitate to call should require additional assistance.

Kind regards,

Molefe Machaba
Research and Epidemiology

17-02-2011
Date

We care Do you?
Siyanakekela

MPUMALANGA

## *155/2010 Nhlapo*

| | |
|---|---|
| **PROTOCOL NO.** | **155/2010** |
| **PROTOCOL TITLE** | Divers of direct cost of impatient care for HIV-infected adults at Amajuba Memorial Hospital, Mpumalanga |
| **INVESTIGATOR** | **Principal Investigator:** Dr S G Nhlapo |
| **SUBINVESTIGATOR** | None |
| **SUPERVISOR** | Prof P Rheeder paul.rheeder@up.ac.za |
| **DEPARTMENT** | **Dept:** Clinical Epidemiology **E-Mail:** drsbu@medis.co.za **Cell:** 0827835675 |
| **STUDY DEGREE** | MSc (Clinical Epidemiology) |
| **SPONSOR** | None |
| **MEETING DATE** | **25/08/2010** |

**Comments received back**

| Ethics Committee Member | Comments that need to be addressed | Comments to be noted only |
|---|---|---|
| 1. | | No comments at this stage. |
| 2. | | No comments at this stage. |
| 3. | | No comments at this stage. |
| 4. | Very sensitive data – confidentiality? | No comments at this stage. |
| 5. | | No comments at this stage. |
| 6. | | No comments at this stage. |
| 7. | Is there a standard inpatient cost ('benchmark') that the results of this study can be compared with? | |
| 8. | | No comments at this stage. |
| 9. | | No comments at this stage. |
| 10. | ? Mpumalanga Ethics Committee Approval | |
| 11. | | No comments at this stage. |

**24/08/2010 Feedback from Principal Investigator:**
When I enquired about ethics application in Mpumalanga before submitting the protocol, I was given an impression that there was no provincial research ethics committee. I will however re investigate and apply for provincial permission.

**Meeting Minutes of 25/08/2010**
No researcher was present.

- Provisionally approved until December 2011 pending the answers to the comments.

Votes 10/10