A RETROSPECTIVE REVIEW OF THE CLINICAL OUTCOMES IN PATIENTS ADMITTED TO A NEWLY ESTABLISHED MEDICAL HIGH CARE UNIT AT KING EDWARD VIII HOSPITAL.

By

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Declaration

I.....declare that

(i) The research reported in this dissertation, except where otherwise indicated, is my original work.

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Overview

A High Care Unit (HCU) provides intensive monitoring and care to critically ill patients. The norm is a nurse to patient ratio of 1:2. There is currently a lack of HCUs in South Africa due to South Africa's emphasis on primary health care. However, with the increasing burden of diseases like Human Immunodeficiency Virus (HIV) and Tuberculosis (TB) these units could prove beneficial to critically ill patients. It is hoped that this project will provide relevant information to establish the importance of such units in South Africa.

The purpose of this study was to describe the clinical outcomes in patients admitted to the newly established HCU at King Edward VIII Hospital. The median length of stay, the mortality rate, the clinical disease spectrum in the unit, the impact of HIV disease on the clinical outcomes and the number of patients either stepped up to a higher level of care or stepped down to the general medical wards was reviewed from 1 August 2015 to 31 January 2016.

This was done by conducting a retrospective chart review of patients admitted into the unit for the stipulated period. Admission into the High Care Unit was dependent on the physician in charge of the patient.

The population consisted of 171 patients divided into general medical cases and peritoneal dialysis cases. A large proportion of the study population was HIV positive. The median length of stay for patients in the unit was 5 (2-8) days. A third of the population demised with a greater percentage among the general medical cases. Almost 60% of the cases were renal, followed by respiratory and cardiac.

Length of stay differed significantly between the HIV positive and negative groups with HIV negative groups tending to stay longer ($p=0.029$). This statistic was limited by having almost 3 times more HIV positive patients than HIV negative patients. Mortality was higher in the HIV positive group ($p<0.0001$) but again, this result is limited by not knowing the HIV status in 62 patients.

A large proportion (62%) of the critically ill patients were stepped down to a lower level of care. The role of HCUs in our health care system needs to be reviewed. They could potentially assist in the management and control of critically ill medical patients with positive outcomes. HIV related disease still poses a significant health burden despite antiretroviral therapy. A large proportion of HIV positive patients are still unaware of their viral loads. Non infectious diseases including cardiovascular disease has increased in the HIV positive population.

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Chapter 1: A Review of the Literature

Definition and origins

The United Kingdom Intensive Care Society defines intensive care as, "a service for patients who have potentially recoverable conditions, who can benefit from more detailed observation and invasive treatment than can be provided safely in an ordinary ward or high dependency area."[1] An Intensive Care Unit provides intensive monitoring and support to critically ill patients requiring, or likely to require, advanced respiratory support alone or patients who require support of two or more organ systems.[1] The unit is able to provide mechanical ventilation, haemodialysis and circulatory support. There is a nurse to patient ratio of 1:1.

When compared to an Intensive Care Unit, a High Care Unit provides less intensive nursing care, with generally a nurse to patient ratio of 1:2. The HCU is suitable for patients requiring support for a single failing organ system, but excluding those needing advanced respiratory support.[1] A High Care Unit, however, provides intensive monitoring and more comprehensive care than a general medical ward.

The concept of an intensive care monitoring facility was first pioneered in 1952 by Dr. Bjorn Ibsen, a Danish anaesthetist, to treat critically ill polio patients.[2] At that time many Danish patients were dying from respiratory failure secondary to respiratory muscle paralysis. Ibsen assembled a team of medical doctors and students to mechanically ventilate these patients. With intensive care and monitoring of these patients the mortality rate was reduced from 80% to 25%. This positive outcome resulted in Ibsen establishing the first Intensive Care Unit in 1953.[2] The concept of an intensive care monitoring facility was then replicated across the world.

Critical care medicine in South Africa began in the late 1960s and 1970s. In the 1980s the Critical Care Society of South Africa was established.[3]

Global Perspectives

Globally, there is a significant difference in the availability of ICU beds in developed and underdeveloped countries. The importance of establishing critical care units is emphasized by Adhikari et al[4] in their article *Critical care and the global burden of critical illness in adults.* They state that the problem of critical illness is higher than generally accepted, and will increase as the population ages, especially in underdeveloped countries. Therefore, with the growing demand, specialised critical care units would be required to treat patients in urgent need of such facilities. Unfortunately, there is very little epidemiological data of critical illness syndromes such as acute lung injury, sepsis or multiple organ dysfunction as compared to other general medical conditions.[4] This has led to very little emphasis being placed on the establishment of critical care units in low income countries.

A systematic review done by Srinivas Murthy *et al*[5] in 2015, looking at Intensive Care Unit Capacity in low income countries, showed that most low income countries lack ICU beds. Most ICUs are also situated in large referral hospitals.[5] People in rural areas therefore have poor access to these facilities. In more developed countries, the availability of ICU beds per 100 000 people ranges from 3 ICU beds per 100 000 for the United Kingdom (UK) as opposed to 25 ICU beds per 100 000 for Germany.[6]

This disparity in the number of ICU beds has a definite impact on the patient profile and clinical disease spectrum of the patients admitted. Countries with more resources tend to admit older patients with less severe disease.[7] The United States of America (USA) has a seven- fold higher number of ICU beds per capita than the United Kingdom (UK). Twenty per cent of admissions in the US received intensive care as opposed to 2 % in the UK. A direct comparison of medical ICU admissions in the USA with the UK showed that patients in the USA were not as sick, and fewer patients required mechanical ventilation as compared to those in the UK. The severity of illness was assessed using the Acute Physiology and Chronic Health Risks (APACHE) II Score.[7] With regard to the clinical disease spectrum more patients in the USA were admitted for monitoring purposes, as opposed to the UK, where patients were admitted for active management of their respective diseases. This could be explained by the lack of critical care resources in the UK and the need to prioritise the sickest patients for admission. [7]

The current situation in African countries with regard to the lack of critical care facilities is a matter of concern. A study done by Sawe *et* al,[8] for example, on disease patterns of patients in Intensive Care Units in Tanzanian hospitals, documented an ICU mortality rate of 41.4%. This is comparable to other studies in Africa. However, this figure reflects a higher mortality rate than in developed countries. The most common causes of mortalities in this study were chronic renal failure, acute renal failure, shock and septicaemia.[8] This could be partially explained by the fact that these hospitals did not offer dialysis facilities.

However, even with dialysis facilities, Acute Renal Failure (ARF) in the medical ICU is associated with a high mortality rate. In the study by Friedericksen *et al*[9] on all patients admitted with renal failure, or who developed renal failure after admission to the ICU at Tygerberg Hospital, a South African hospital located in Cape Town, the main cause of ARF was acute tubular necrosis. The ICU mortality rate for ARF was 47.8% compared with 17.5% in ICU patients without ARF.[9]

The study by Sawe *et al*[8] on Tanzanian tertiary referral hospitals highlights areas of concern that shares common elements with the South African situation. The percentage of ICU/HCU beds is below internationally recommended standards. There is also a critical shortage of personnel in ICU facilities. The study points to the severe challenges that persistently plague Intensive Care Units in African hospitals.[8]

The South Africa Situation

Currently South Africa has the highest prevalence of HIV AIDS in the world. The total number of people living with HIV AIDS was estimated to be 6,19 million in 2015.[10] For adults aged 15-49 years, an estimated 16.6% of the population is HIV positive.[10] Provincially, KwaZulu-Natal also has one of the highest burdens of disease. Statistics South Africa have also reported that 3.4% of total deaths in South Africa are HIV/ AIDS related.[11]

In South African public hospitals, the need for critical care facilities would be further exacerbated by the increasing burden of Human Immunodeficiency Virus (HIV) and Tuberculosis (TB). Provincial TB notification statistics in 2012 showed that Kwa-Zulu Natal had the most notifications with 103 986 cases. The second highest was the Eastern Cape with 55 843 notified cases. A total number of 7283 patients (7%) diagnosed with TB in 2012 succumbed to the illness.[12] Figures from the South African Department of Health showed that 73% of patients are co-infected with HIV and TB.[13]

Nyamande et al[14] looked specifically at all patients presenting with community acquired pneumonia at King Edward Hospital situated in Kwa-Zulu Natal over a seventeen-month period between June 2000 and October 2001. Four hundred and thirty patients were reviewed. Three hundred and eighty-two patients were tested for HIV. HIV infection was found in 81.4 % of these patients. Pathogens were isolated in 222 patients. *Mycobacterium Tuberculosis* was the most common organism identified in both the HIV positive and HIV negative groups. The mean age of the study population was 33.[14] This study was done before the introduction of the High Care Unit at King Edward VIII Hospital.

One would expect that a large number of these patients would have been admitted to the High Care Unit if it was available at that time. This study would therefore expect to find a younger patient profile admitted to this critical care facility as opposed to developed countries. This was evident in a retrospective review of all patients discussed for referral to the ICU units at the Greys and Edendale hospitals in the Pietermaritzburg complex of KwaZulu-Natal, South Africa. The majority of patients were between 21 and 40 years. The mean age was 32 years.[15]

Critical Care Units in South Africa are graded from level 1 to level 4:[3]

Level 1: These units are found in university affiliated tertiary referral hospitals. They provide intensive care and monitoring generally with a nurse/patient ratio of 1:1 basis. The unit is able to provide artificial life support with sophisticated equipment for patients.

Level 2: These units describe specialized units with specific purposes like Coronary Care Units (CCU) or a neurological Intensive Care Unit.

Level 3: Such units are community hospital based ICUs.

Level 4: This category describes High Care Units.[3] The High Care Unit at King Edward VIII Hospital is an example of a Level 4 facility.

The *Level 4* facility at King Edward VIII Hospital is an attempt to addresses the need for a critical resource at a South African state hospital. A national audit of critical care resources in South Africa, done by Scribante and Bhagwanjee[16] in 2005, showed that only 23% (92/396) of public sector hospitals in South Africa had ICU/High Care Facilities. This translates to 1783 public critical care beds. Only 18% of these were high care beds.[16]

In their critical analysis of ICU/HCU beds in South Africa from 2008 to 2009 Naidoo et al[17] found that the majority of the ICU beds were in only 3 of the country's 9 provinces. The analysis included both public and private centre critical care beds. Gauteng had 2 311 beds (49%), Western Cape had 719 beds (15%) and KwaZulu-Natal 672 beds (14%). This accounted for 78 % of all ICU beds in South Africa. These three provinces only serve 54% of South Africa's population. A critical shortage of Intensive Care beds is clearly evident in Eastern Cape which had fewer than 300 beds. Furthermore, North West Province and Mpumulanga had fewer than 150 beds while Limpopo and Northern Cape had 66 and 47 beds respectively.[17]

The disparity between the public and private sectors will have dire consequences for health care management for South Africans in the near future. The analysis done by Naidoo *et al*[17] in 2008-2009 revealed that 3 533 of the available 4 719 ICU beds were in the private sector. This translated to 75% of the available beds. Eight four per cent of private hospitals had

Intensive Care facilities.[17] As evident in the figures above this is in stark contrast to the public sector.

In the public sector, the ratio of beds to the population in the Western Cape was 1:20 000, for Gauteng 1:25 000, and for KwaZulu-Natal it was 1:45 000. Limpopo province had the worst bed to population ratio of 1:150 000.[17] This lack of critical care resources has a direct effect on patient care. De Vries *et al*[18] looked at the acute hospitalization needs of adults admitted to the 11 public hospitals in the Cape Town Metro District from August to November 2008. Of the 802 available medical beds only 20 (2.5%) were high care beds. Forty-five percent of patients admitted were severely to critically ill on admission. However, 61% of these patients were sent to general medical wards with less intensive monitoring.[18]

In KwaZulu-Natal the lack of critical care resources was highlighted by Gordon and Wise.[15] They looked at the need for critical care resources in the Pietermaritzburg metropolitan area in KwaZulu-Natal. A retrospective review was done of all patients discussed for ICU admission to the Greys Hospital and Edendale Hospitals. Combined, the two hospitals had 12 ICU beds and 3 HCU beds. Their study revealed that 2 081 were discussed for referral. Only 938 patients could be accepted. 589 patients were admitted immediately while there was a delayed admission for 349 patients.[15]

The main reason for delayed admission was a lack of beds. Five hundred and fifty-six patients (48.6%) of the 1143 patients not admitted were considered to benefit from admission to a critical care unit.[15] This lack of critical care resources can be explained by South Africa's emphasis on primary health care.[16,19] Limited budgets have been allocated for critical care resources in South Africa as it is deemed to be too expensive. However, as Rivello *et al*[20] state, "Some of the most effective critical care interventions, initiating rapid fluid resuscitation, early antibiotics and patient monitoring are relatively inexpensive."[20]

Patient Profile

Admissions to the ICUs at Greys and Edendale Hospitals were 39.9% for general surgery, 20.3% for trauma surgery, 15.9% for internal medicine and 12.2% for obstetrics and gynaecology.[15] This could be explained by the ICU at Greys Hospital being perceived as predominantly a surgical ICU.[15]

In their study, van Zyl-Smit et al[21] surveyed all medical patients admitted to an 8 bed High Care Unit at the G.F. Jooste Hospital in Cape Town, South Africa over a twelve-month period. Mechanical ventilation was available in this facility. Acute coronary syndromes, diabetic emergencies, drug overdose/poisoning and sepsis accounted for 76.6% of patients admitted. The remaining admissions included conditions such as congestive cardiac failure, cerebrovascular accidents and chronic obstructive pulmonary disease.[21]

Lufuno R. Mathiva[3] also looked at the adult patient profile admitted to the ICU at Chris Hani Baragwanath Hospital. The ICU comprised of 18 beds and catered for both medical and surgical patients. Thirty percent of the admissions to the ICU were due to medical causes. Again common medical admissions included sepsis, metabolic disorders and overdoses. A further 8% of the admissions were for infectious diseases which included tetanus, malaria and cholera.[3]

Peritoneal Dialysis

In 2007 Africa constituted only 4.5 % of the world's dialysis population.[22] The prevalence of peritoneal dialysis was 2.2 persons per million population (pmp) compared to a global prevalence of 27 pmp. 85% of African PD patients were residing in South Africa.[22] In a resource limited setting PD provides a more accessible means to dialyse patients. Due to a lack of beds in the public sector and at the ICU at King Edward VIII Hospital, peritoneal dialysis becomes the only viable option for many critically ill patients at the latter hospital. It is simple to perform, requires minimal technical skills, is not machine dependent and no anticoagulation is required.

The causes of acute kidney injury (AKI) are similar in HIV positive and negative patients. The most common cause being acute tubular necrosis, secondary to sepsis, hypotension, dehydration and nephrotoxicity.[23] From 1999 to 2006 South Africa has also seen a 67% increase in deaths due to chronic kidney disease.[23] The main causes of chronic kidney disease include hypertension, diabetes and HIV related kidney disease. HIV Associated Nephropathy is the most common biopsy finding.[24] With the introduction of anti-retroviral therapy patients are also living longer and diseases like hypertension and diabetes are also resulting in kidney disease in HIV positive patients.[24]

Mortality Rate

The mortality rate in high care units in South Africa is also poorly documented. As Scribante and Bhagwanjee[16] state:

> "The current practice of having High Care Units in wards is unacceptable. This practice increases the risk of morbidity and mortality since it is impossible to offer the appropriate level of care and prevent the risks of intensive care practice in an uncontrolled environment."[16]

Sinuff et al[25] also support this view by asserting that hospital mortality rate was increased in patients refused ICU admission.[25]

Delayed admission to an ICU facility due to a lack of beds has also shown to increase mortality rate internationally. A UK study looked at 817 patients referred for ICU admissions. 168 (21%) of patients were initially refused ICU admission. This was due to a lack of beds. The ICU mortality rate was found to be higher in the patients initially refused admission.[26] In a study looking at the USA and the UK, 58% of patients were transferred directly to ICU from the Emergency Department in the US, 33 % in the UK. An indirect transfer of patients from the Emergency Department to the ICU in the UK resulted in higher mortality rates.[7]

In their study Simchen *et al*[27] looked at five acute care Israeli hospitals. They found that admission to an intensive care unit was associated with better survival during the first three days of deterioration, after they adjusted for age and severity of illness. These studies highlight the need for early referral to an ICU setting. As Simchen *et al*[27] state, "The early survival advantage in the intensive care unit suggests a window of critical opportunity for these patients."[27]

At the Chris Hani Baragwanath Hospital in Johannesberg, the ICU had a documented mortality rate of 31.5%.[3] The study done by van Zyl-Smit *et al*[21] conducted at Cape Town's G.F. Jooste hospital over a twelve-month period showed a mortality rate of 10.7%.[21] The mortality rate was higher in ventilated patients (30.1%) than non-ventilated patients (4.5%). Patients with sepsis syndrome (pneumonia, meningitis, septic shock) also had a high mortality rate as compared to the other medical conditions.[21] The median stay in high care in this facility was 2 (0.5-14) days. The two-day duration indicates the demands placed on this facility.[21] Internationally in the United States the length of stay in critical care units is estimated at 3,8 days.[28] In the USA the leading causes of mortality in the ICU are multi-organ failure, cardiac failure and sepsis.[28] It is evident that countries with more critical care resources would be able to admit more patients, and would be able to keep them longer in ICU, as opposed to a resource limited country.

Patients admitted for longer lengths of stay have been shown to have increased mortality. Studies have shown that the mortality rate for patients admitted 14 days or longer was 50%.[29] A study done by Wong *et al*[29] looking at patients admitted for 14 days or longer to a combined medical and surgical ICU at a Canadian hospital showed that the main reasons for admission were neuromuscular weakness, pneumonia, multiple trauma and septic shock. Respiratory arrest, congestive cardiac failure and exacerbation of chronic obstructive pulmonary disease were other conditions associated with prolonged hospital stay.[29]

The mortality rate in these units would depend on the facilities available in the unit and the severity of disease of the patients admitted into the unit. Another important determining factor is the level of expertise of the critical care units. The High Care Unit at King Edward VIII Hospital is in a unique position in that it is a physician run High Care Facility, as opposed to most Intensive Care Units which are usually run by intensivists.

In a study done by M. Engoren[30] in the US, prompt physician review of patients in ICU resulted in shorter length of stay. The longer patients had to wait before being reviewed by a physician also resulted in increased mortality.[30]

The fact that the medical High Care Unit at King Edward VIII Hospital is being managed by physicians would hopefully result in a lower mortality rate. It is also anticipated that should the introduction of physician run High care Units increase incrementally in South African state hospitals, there will eventually be a significant decrease in the mortality rate figures.

The Intensive Care Unit at King Edward VIII Hospital is a 14 bedded facility catering for medical, surgical and obstetric patients. There is currently minimal information available on the clinical disease spectrum and clinical outcomes of patients admitted to this unit.

It is hoped that patients who are not admitted to the ICU facility at King Edward VIII Hospital due to a lack of beds will be transferred to the High Care Unit for more intensive monitoring and care. It is anticipated that this will improve the mortality rates of these critically ill patients. The studies described above have supported this view. It is also hoped that the establishment of such a unit will reduce the burden on in Intensive Care Units. As Naidoo *et al*[17] state in their Critical Analysis of ICU/ HC beds in South Africa, "The development of sub-intensive, intermediate and step down units will decrease the need for ICU beds, which are always in demand and in short supply."[17]

HIV Disease

The clinical outcomes specifically in HIV positive patients need to be reviewed. At the beginning of the HIV epidemic ICU outcomes were dismal. Many physicians did not see the need for patients to be managed in an ICU setting due to poor outcomes.[31] A study from the San Francisco General Hospital looking at HIV positive patients who required ICU admission from 1981-1985 showed that only 31% of patients survived after ICU admission. Only 13% of patients who presented with respiratory failure secondary to PCP survived.[31] In 2000 Bekele and Green[32] looked at the clinical course, prognostic factors and outcome prediction for HIV patients in ICU. The most common reason for ICU admission in these patients was respiratory failure. Pneumocystis Jiroveci Pneumonia (PJP) was the most common diagnosis. The mortality rate was 29.6% for HIV positive patients. The median CD4 lymphocyte count for the patients who demised was 27.5 as compared to 59 for the patients who survived.[32]

Due to the availability of antiretroviral therapy (ART) hospital survival has improved form the pre ART era.[33] South Africa has the biggest anti-retroviral rollout programme in the world with more than 2 million people receiving treatment.[34] HIV-positive patients are now living longer. A study in rural South Africa showed that the ART rollout programme has resulted in a reduction in HIV related mortality by approximately 29% in women and 22% in men.[35] Vertical HIV transmission rates have also reduced from approximately 14% in 2004 to less than 3% in 2011.[36]

Comorbid disease and non-infectious complications are becoming more common.[37] Recent studies have shown that during the ART era more than half of ICU admissions are now for non-HIV related critical illness.[33] Furthermore, Immune Reconstitution Syndrome and toxicities from ART may also result in admission to critical care facilities. Risk factors for poor ICU outcomes include higher severity of illness scores (APACHE II), need for ventilation, PCP and low albumin levels.[38,39] The following ICU diagnoses were associated with poorer outcomes: renal failure, sepsis and coma state.[40]

Much of the literature reviewed provides statistical evidence to support the need for more High Care Units in public hospitals. However, currently there is a lack of data on the clinical outcomes of patients admitted to such units, in South Africa, and internationally. The existing body of research, therefore, is inadequate in providing insight into an increasing important aspect of critical health care in public hospitals.

This study will describe the clinical disease spectrum in the High Care Unit at King Edward VIII Hospital. This High Care Unit is unique in that there are four beds designated for peritoneal dialysis (PD) patients. One would therefore expect to see more renal admissions as opposed to the other studies done in critical care units in South Africa. This study will also look at the disease spectrum and mortality rate in HIV positive patients at King Edward VIII Hospital. It is hoped that this study will help assist in motivating the need for such units in public sector hospitals in South Africa.

Research Question/ Hypothesis

The following objectives will be described in this study:

1.The length of stay of patients admitted to the High Care Unit

2.The clinical disease spectrum and the impact of HIV (Human Immunodeficiency Virus) on the clinical disease spectrum. The hope is that this data will add to the pool of available knowledge that will assist in the management and control of HIV AIDS.

3. The outcome of patients, either being stepped up to a higher level of care (ICU or quaternary care) or stepped down from the High Care Unit (to the general medical wards) will also be reviewed.

4. The mortality rate within the unit as well as the mortality rate amongst the HIV positive population admitted to the unit will be described.

The study will describe:

The clinical outcomes in patients admitted to the newly established High Care Unit at King Edward VIII Hospital from 1 August 2015 to 31 January 2016.

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Chapter 2: Manuscript

A retrospective review of the clinical outcomes in patients admitted to a newly established medical high care unit at King Edward VIII Hospital

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Abstract

Background: A medical high care unit (HCU) was established in May 2015 at King Edward VIII Hospital. It was decided that a HCU that provided more intensive monitoring and management of critically ill patients, who were not admitted to the Intensive Care Unit (ICU) would be beneficial. Currently there is a paucity of data regarding the benefits of HCUs in South Africa.

Objectives: To describe the clinical outcomes in patients admitted to the HCU at King Edward VIII Hospital for the period 1 August 2015 to 31 January 2016.

Methods: A retrospective chart review of patients admitted to the HCU was performed over a six month period.

Results: The population consisted of 171 patients divided into general medical cases (n=107, 62.6%) and peritoneal dialysis cases (n=64, 37.4%). HIV positive patients accounted for 47.4% of the study population. The median length of stay (LOS) in the unit was 5 (2-8) days. There was a significant difference in LOS between HIV positive and HIV negative patients, p=0.029, with HIV negative patients staying longer. The overall mortality was 33.9%. The majority of patients had renal disease, followed by respiratory and cardiac disease. 5.3% of the study population was transferred to a quaternary level of care. No patients were transferred to ICU. 62% of the patients were stepped down to the general medical wards.

Conclusion: The role of HCUs in our health care system needs to be reviewed. In a resource limited country like South Africa, HCUs could potentially ease the burden on ICUs for treating critically ill patients. HIV-related disease still poses a significant health burden despite antiretroviral therapy. A large proportion of the HIV positive patients in this study were unaware of their viral load status. Non infectious diseases including cardiovascular disease has increased in the HIV positive population.

Introduction:

The High Care Unit (HCU), established at King Edward VIII Hospital in May 2015, sought to address the need for critical care to patients in need. In South African public hospitals the inordinate demand for the Intensive Care Unit (ICU) is exacerbated by the critical shortage of such units.

An ICU provides intensive monitoring and support to critically ill patients requiring, or likely to require, advanced respiratory support alone, or support of two or more organ systems. When compared to an ICU, a HCU provides less intensive nursing care, with generally a nurse to patient ratio of 1:2. A HCU is suitable for patients requiring support for a single failing organ system but excludes those needing advanced respiratory support.[1] A HCU does, however, provide intensive monitoring and more comprehensive care than a general medical ward.

The burden of critical illness is higher than generally accepted and will increase as the population ages.[2] In South Africa the need for critical care facilities would be further intensified by the increasing burden of Human Immunodeficiency Virus (HIV) and Tuberculosis.[3] However, minimal expenditure has been allocated for critical care resources in South Africa. A national audit of critical care resources in South Africa, done by Scribante and Bhagwanjee[4] in 2005, showed that only 23% (92/396) of public sector hospitals in South Africa had ICU/ High care Facilities.[4] A further analysis done by Naidoo *et al*[5] in 2008-2009 revealed that 3533 (75%) of the available beds were in the private sector.

Very little data exists on the clinical outcomes of patients admitted to medical HCUs in the country. The importance of these units therefore needs to be established. It is anticipated that HCUs which provide more intensive monitoring and care than general medical wards will improve the mortality rate of critically ill patients. It is also hoped that the establishment of such units will reduce the burden on ICUs.

Background

King Edward VIII Hospital is located in Durban, KwaZulu-Natal, a province in South Africa. It is the second largest hospital in Southern Africa. In May 2015 a medical HCU was established at King Edward VIII Hospital. Previously, critically ill patients who were not admitted to the Intensive Care Unit (ICU) were transferred to the general medical wards for continuation of care. In view of this, it was decided that a HCU that provided more intensive monitoring and management of critically ill patients, who were deemed unsuitable for the ICU, or who could not be transferred to ICU due to a lack of beds, would be beneficial to such patients.

The HCU at King Edward VIII is an eight-bed unit. Monitoring and care of patients is more intensive than a general medical ward with one nurse being allocated for every two patients. Four of the beds in the unit are reserved for general medical cases, and the remaining four beds are allocated for patients requiring peritoneal dialysis. The HCU does not offer mechanical ventilation. The unit is a 24 hour run physician unit.

Aim/Objectives

To describe the clinical outcomes in patients admitted to the newly established HCU at King Edward VIII Hospital for a six month period, from 1 August 2015 to 31 January 2016.

The median length of stay of patients in the HCU, the mortality rate within the unit, the clinical disease spectrum in the unit and the impact of HIV disease on the clinical outcomes was reviewed. The number of patients stepped up to the ICU or a quaternary level of care (Inkosi Albert Luthuli Central Hospital, IALCH) and stepped down from the HCU to the general medical wards was also reviewed.

Methods

Study Approval: Ethical approval for this study was obtained from the Biomedical Research Ethics Committee affiliated to the University of Kwa-Zulu Natal.

Type of study: A retrospective chart review of all the patients admitted to the High Care Unit was undertaken.

Duration of study: A six month period from 1 August 2015 to 31 January 2016.

Data Collection: An excel spreadsheet was used to collect the relevant data for each patient anonymously according to the pre-determined variables. Patients were captured using a study identity number. There was no patient contact and confidentiality was maintained.

Variables described:
Demographics (age, gender, race)
Length of stay
Mortality
Spectrum of disease
HIV co-infection including CD4 count, viral load, and ART treatment
Outcomes (step up to a higher level of care, step down to lower level of care)

Inclusion criteria: All medical patients older than 12 years who were admitted to the Medical HCU were included in this study.

Exclusion criteria: Patients who were admitted to the unit but whose files could not be found were excluded from this study. A total of 34 patient files were not retrieved.

There was no conflict of interest.

Statistical Methods

Data was analysed using Stata version 14 (StataCorp. 2015. Stata Statistical Software: Release 14. College Station, TX: StataCorp LP). Means/medians and frequencies were used to describe the data. Differences in continuous variables between HIV groups were analysed using the Wilcoxon Mann-Whitney test. Associations between categorical variables were analysed using the Pearson chi square test or, where applicable, Fisher's exact test. Results were considered statistically significant for p-values less than 0.05.

Results

Demographics:

The population consisted of 171 patients divided into general medical cases (n=107, 62.6%) and peritoneal dialysis cases (n=64, 37.4%) (Table 1). There were 79 (46.2%) male patients and 92 (53.8%) female patients admitted to the unit. The mean age was found to be 46.7 (16.3) years with black patients being in the majority (81.3%). HIV positive patients contributed 47.4% of the population while 36.2% had an unknown HIV status – most being among the general medical cases.

Table 1. Demographics n (%)

	General Medical (n = 107)	Peritoneal Dialysis (n = 64)	Total
Gender			
Male	38 (35.5)	41 (64.0)	79 (46.2)
Female	69 (64.5)	23 (36.0)	92 (53.8)
Age			
Mean (SD)	44.4 (16.6)	50.6 (15.1)	46.7 (16.3)
Race			
Black	84 (79.0)	55 (85.9)	139 (81.3)
Indian	9 (8.0)	5 (7.8)	14 (8.2)
Coloured	1 (1.0)	0 (0.0)	1 (0.5)
White	1 (1.0)	1 (1.6)	2 (1.2)
Unknown	12 (11.0)	3 (4.7)	15 (8.8)
HIV			
Positive	49 (45.8)	32 (50.0)	81 (47.4)
Negative	13 (12.2)	15 (23.4)	28 (16.4)
Unknown	45 (42.0)	17 (26.6)	62 (36.2)

SD: Standard Deviation
HIV: Human Immunodeficiency Virus

Length of stay:

The median length of stay (LOS) in the HCU was 5 (2-8) days (Table 2). The median LOS for patients admitted to the general medical beds was 4 (1-7) days and for patients receiving peritoneal dialysis was 6 (3-8) days. The median LOS for patients who had demised, and those who had survived, differed vastly (1 day versus 6 days respectively, $p<0.0001$).

Table 2. Length of Stay n (%)			
	General Medical (n = 107)	**Peritoneal Dialysis (n = 64)**	**Total**
Median (IQR)	4 (1 – 7)	6 (3 – 8)	5 (2 – 8)
Demised, median (IQR)	1 (1 – 3)	1 (1 – 4)	1 (1 – 3)
Survived, median (IQR)	6 (3 – 9)	7 (5 – 8)	6 (4 – 8)
7 days or less	81 (75.7)	43 (67.2)	124 (72.5)
More than 7 days	26 (24.3)	21 (32.8)	47 (27.5)
IQR: Interquartile Range			

Mortality:

A third of the population demised with a greater percentage among the general medical cases (Table 3). Of the mortalities 39 (36.5%) were admitted for general medical conditions and 19 (29.7%) were admitted for acute peritoneal dialysis.

Table 3. Mortality n (%)			
	General Medical (n = 107)	**Peritoneal Dialysis (n = 64)**	**Total**
Overall mortality	39 (36.5)	19 (29.7)	58 (33.9)
HIV mortality	25 (23.4)	12 (18.8)	37 (21.6)
CD4, median (IQR)	124 (70 – 317)	63 (49 – 294)	97 (51 – 298)
Viral Load			
Suppressed	5 (20.0)	2 (16.7)	7 (18.9)
Unsuppressed	4 (16.0)	2 (16.7)	6 (16.2)
Unknown	16 (64.0)	8 (66.6)	24 (64.8)
ART	20 (80.0)	10 (83.3)	30 (81.1)
LOS ≤ 7 days	36 (92.3)	18 (94.7)	54 (93.1)
LOS > 7 days	3 (7.7)	1 (5.3)	4 (6.9)
HIV: Human Immunodeficiency Virus **IQR: Interquartile Range** **ART: Anti-retroviral Therapy** **LOS: Length of Stay**			

Spectrum of Disease:

Patients admitted to the high care unit presented with multisystem involvement. Almost 60% of the cases were renal, followed by respiratory and cardiac. Patients afflicted by other diseases contributed 36.8% of the population.

Looking specifically at general medical admissions (Figure 1), 48 patients (44.9%) presented with cardiac disease. A further 37 (34.6%) of the patients presented with respiratory disease. Renal disease accounted for 36 (33.6%) of the admissions and a further 24 (22.4%) patients presented with gastro-intestinal disease. There were 15 (14.0%) patients admitted for central nervous system disease. A large proportion of the patients, 40 (37.4%), presented with 'other diseases' not typical of the major systems analysed. The major contributing diseases within this group were septicaemia of unknown origin, haematological diseases, metabolic and lactic acidosis.

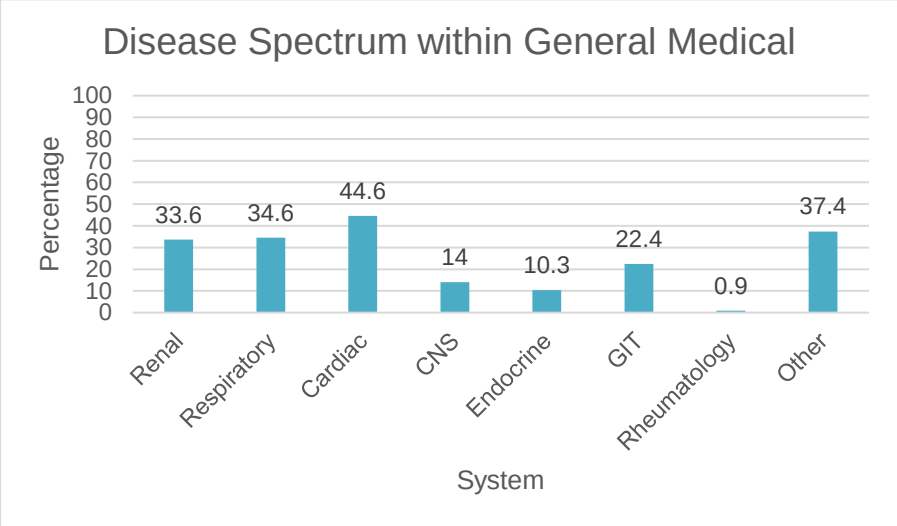

Figure 1. Disease spectrum for general medical admissions.

HIV Positive Population:

HIV positive patients accounted for 47.4% (n=81) of the study population (Table 4). The overall median length of stay for the HIV positive patients was 5 (1-8) days. Mortality occurred in 45.7% of the HIV positive patients. General medical cases accounted for 25 (51.0%) of the mortalities, and 12 (37.5%) were peritoneal dialysis (PD) cases. The overall median CD4 count was 86 cells/uL (30-294). PD patients had a lower median CD4 count than general medical patients, 79 (27-277) and 219 (73-347) cells/uL respectively. Viral load was unknown in 61.7% of the patients. A large proportion 61 (75.3%) of the patients admitted to the unit were on antiretroviral therapy. Care was stepped up in 2.5 % of the patients, and stepped down in 49.4%.

Table 4. HIV+ Population n (%)

	General Medical (n = 49)	**Peritoneal Dialysis (n = 32)**	**Total**
Length of stay, median (IQR)	3 (1 – 8)	6 (3.5 – 8)	5 (1 – 8)
Mortality	25 (51.0)	12 (37.5)	37 (45.7)
CD4, median (IQR)	219 (73 – 347)	79 (27 – 277)	86 (30 –

			294)
Viral Load			
Suppressed	10 (20.4)	6 (18.8)	16 (19.8)
Unsuppressed	7 (14.3)	8 (25.0)	15 (18.5)
Unknown	32 (65.3)	18 (56.2)	50 (61.7)
ART	38 (77.6)	23 (71.9)	61 (75.3)
Outcomes			
Step Up	1 (2.0)	1 (3.1)	2 (2.5)
ICU	0 (0.0)	0 (0.0)	0 (0.0)
IALCH (Quaternary)	1 (2.0)	1 (3.1)	2 (2.5)
Step Down	21 (42.9)	19 (59.4)	40 (49.4)

HIV: Human Immunodeficiency Virus
IQR: Interquartile Range
ART: Anti-retroviral Therapy
ICU: Intensive Care Unit
IALCH: Inkosi Albert Luthuli Central Hospital

Spectrum of Disease in the HIV Positive Population:

Renal, gastrointestinal and other were the most common systems within the HIV positive group admitted to the unit (Table 5). Again, patients presented with multisystem involvement.

Looking specifically at general medical admissions (Figure 2), 19 patients presented with renal disease. These patients were not dialysis requiring at the time. A further 19 (38.8%) of the patients presented with gastrointestinal disease. Cardiac disease accounted for 17 (34.7%) of the admissions and 16 (32.7%) of the patients presented with respiratory disease. A large proportion, 26 (53.1%), of the patients presented with diseases other than the major systems analysed. This included haematological conditions, septicaemia of unknown origin, lactic acidosis, metabolic derangements, gynaecological pathology, dermatological manifestations and psychiatric illness.

Table 5. Disease Spectrum for HIV+ Population n (%)

	General Medical	**Peritoneal Dialysis**	**Total**
Renal	19 (38.8)	32 (100.0)	51 (63.0)
Respiratory	16 (32.7)	9 (28.1)	25 (30.9)
Cardiac	17 (34.7)	3 (9.4)	20 (24.5)
Central Nervous System	6 (12.2)	2 (6.3)	8 (9.9)
Endocrine	3 (6.1)	1 (3.1)	4 (4.9)
Gastro-Intestinal Tract	19 (38.8)	8 (25.0)	27 (33.3)
Rheumatology	0 (0.0)	0 (0.0)	0 (0.00
Other	26 (53.1)	12 (37.5)	38 (46.9)

HIV: Human Immunodeficiency Virus

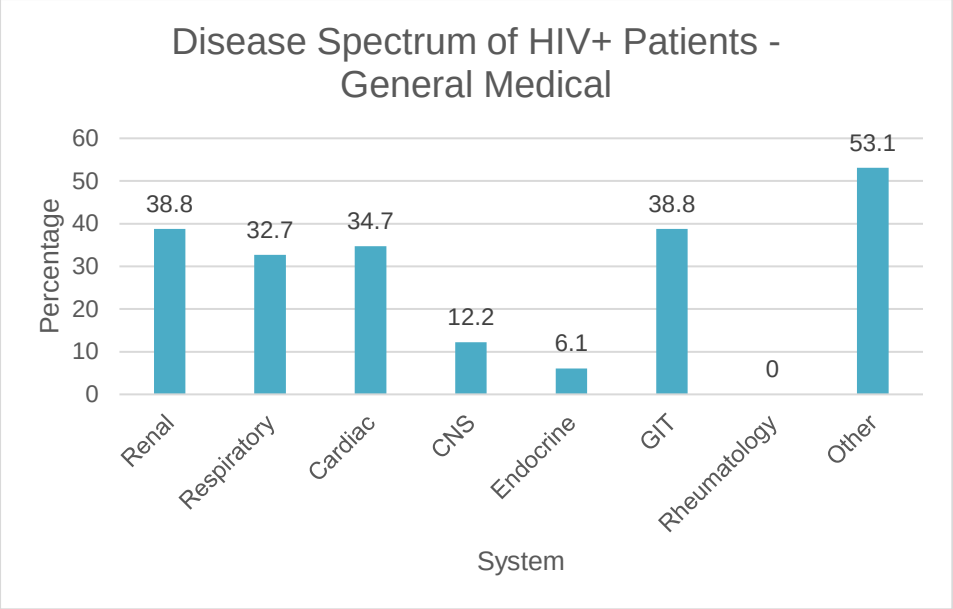

Figure 2: Disease spectrum for HIV positive patients under general medical admissions

Comparison: HIV Positive Population versus HIV Negative Population

Length of stay differed significantly between the groups with the HIV negative people tending to stay longer (p=0.029) (Table 6). However, this statistic is limited by having almost 3 times more HIV positive patients than HIV negative patients. Mortality was higher in the HIV positive population (p<0.0001) but again, this result is limited by not having the HIV status in 62 of the patients. GIT system involvement also differed by HIV group (p<0.0001). All patients with GIT involvement were HIV positive. In addition, more HIV negative patients were stepped down (p<0.0001).

Table 6. HIV Population n (%)

	HIV Positive (n = 81)	HIV Negative (n = 28)	HIV Unknown (n = 62)	p-value*
Length of stay, median (IQR)	5 (1 – 8)	7 (3.5 – 9.5)	4 (1 – 6)	0.0291
Demised, median (IQR)	1 (1 – 3)	3 (3 – 3)	1 (1 – 2.5)	
Survived, median (IQR)	7 (5 – 9)	7 (4 – 10)	5 (4 – 8)	
Mortality	37 (45.7)	1 (3.6)	20 (32.3)	< 0.0001
Disease spectrum				
Renal	51 (63.0)	18 (64.3)	31 (50.0)	0.9
Respiratory	25 (30.9)	10 (35.7)	19 (30.7)	0.636
Cardiac	20 (24.5)	8 (28.6)	26 (41.9)	0.685
Central Nervous System	8 (9.9)	1 (3.6)	10 (16.1)	0.442
Endocrine	4 (4.9)	0 (0.0)	8 (12.9)	0.571
Gastro-Intestinal Tract	27 (33.3)	0 (0.0)	6 (9.7)	< 0.0001
Rheumatology	0 (0.0)	1 (3.6)	0 (0.0)	0.257

Other	38 (46.9)	9 (32.1)	16 (25.8)	0.174
Outcomes				
Step Up	2 (2.5)	3 (10.7)	4 (6.5)	0.175
ICU	0 (0.0)	0 (0.0)	0 (0.0)	
IALCH (Quaternary)	2 (2.5)	1 (3.6)	4 (6.5)	
Step Down	40 (49.4)	26 (92.9)	40 (64.5)	< 0.0001
*** p-value for comparison of HIV positive to HIV negative**				
HIV: Human Immunodeficiency Virus **IQR: Interquartile Range** **ICU: Intensive Care Unit** **IALCH: Inkosi Albert Luthuli Central Hospital**				

Outcomes:

When reviewing the outcomes of patients (Table 7) admitted into the unit, 9 (5.3%) of the patients were stepped up to a quaternary level of care. None of the patients were transferred to the Intensive Care Unit at King Edward VIII Hospital. Two patients were transferred to a quaternary centre and were subsequently transferred back to the HCU. 106 (62.0%) of the patients were stepped down to a lower level of care. This included 62 (57.9%) of the general medical patients, and 44 (68.8%) of the peritoneal dialysis patients.

Table 7. Outcomes n (%)

	General Medical (n = 107)	Peritoneal Dialysis (n = 64)	Total
Mortality	39 (36.5)	19 (29.7)	58 (33.9)
Step Up	7 (6.5)	2 (3.1)	9 (5.3)
ICU	0 (0.0)	0 (0.0)	0 (0.0)
IALCH (Quaternary)	7 (6.5)	2 (3.1)	9 (5.3)
Step Down	62 (57.9)	44 (68.8)	106 (62.0)

ICU: Intensive Care Unit
IALCH: Inkosi Albert Luthuli Central Hospital

Discussion

One hundred and seventy-one patients admitted to the unit from 1st August 2015 to 31 January 2016 were reviewed. The unit had a documented mortality of 33.9% for the period under review. The general medical admissions had a greater mortality (36.5%) compared to peritoneal dialysis (29.7%) patients. There is currently a paucity of data to compare this mortality rate to other HCUs in South Africa. However, this figure compares with mortality rates for patients in South Africa ICUs with a documented mortality of 31.5%.[6] The median length of stay for patients that demised was 1 day (1-3) with 93.1% of the total mortalities having a length of stay of less than 7 days.

Many of these patients presented *in extremis*. Admission into the HCU was subjective, as it was dependent on the physician in charge of the patient. A more objective admission policy criteria may be beneficial to determine admission into the HCU and ICU. Reasons for not being transferred to ICU in this study could have included a lack of beds or on the decision made by the physician in charge of the patient.

A scoring system to identify patients most at risk for deterioration and a possible step up to ICU, as well as an effective scoring system that predicts outcomes may be beneficial in assessing suitability for a HCU or ICU admission. Such a system can also identify patients that are unsuitable for the HCUs due to poor prognosis. These patients could be transferred to general medical wards for palliative care. The Modified Early Warning Score (MEWS) is an example of a tool that can be used to identify patients most at risk for deterioration,[7] while scoring systems like the simplified APACHE II Scoring system[8] can be used as a guide to predict patient outcomes. In a South African context further research is required to implement a scoring system that could be used as a reliable aid to guide management decisions.

In this study no patients were transferred to the ICU unit at King Edward VIII hospital. This could be due to the fact that most of the critically ill patients were presenting *in extremis* with a very high early mortality rate. Other reasons for a lack of transfer could have been due to a lack of beds or patients not meeting criteria for ICU admission due to poor prognosis. Sixty-two percent of this study population was transferred back to the general medical wards after being seen in the HCU. Possible reasons for transfer back to the wards could have been patient improvement, completion of peritoneal dialysis or patients being reassessed as requiring palliative care.

This HCU was unique as 4 beds were allocated for patients who required PD. In 2007, Africa constituted only 4.5% of the world's dialysis population. The prevalence of PD was 2.2 persons per million of the population (pmp) compared to a global prevalence of 27 pmp.[9] However, in a resource limited country like South Africa PD is more accessible than haemodialysis. A large proportion of the PD patients in this study had a positive outcome with a 70.3 % survival rate after receiving peritoneal dialysis. Many of these patients would not have gained access to haemodialysis facilities. The implementation of peritoneal dialysis facilities in more public hospitals in South Africa should be looked at.

Patients admitted into the HCU presented with multi system involvement. The majority of general medical admissions presented with cardiac disease (44.9%). The major contributing cardiac diseases were congestive cardiac failure, ischaemic heart disease, cardiomyopathies, arrhythmias and hypertensive emergencies with acute left ventricular failure. Respiratory disease contributed 34.6% of general medical admissions. The predominant respiratory diseases requiring admission were pneumonias, pulmonary hypertension, pleural effusions and pulmonary emboli.

A large proportion (47.4%) of this study population was HIV positive. In 2015 an estimated 6.19 million people were living with HIV in South Africa.[10] A study done at the San Francisco General Hospital looking at HIV positive patients who required ICU admission from 1981-1985 showed that only 31% of patients survived after ICU admission.[11] This study had a documented survival rate within the HIV positive population of 54.3%. A large proportion of the population (75.3%) was on antiretroviral therapy (ART).

In this study, renal and gastro-intestinal disease accounted for the majority of the general medical admissions in the HIV positive population. Respiratory disease continues to result in a large number of high care admissions. This has been well documented in previous studies.

Of note in this study cardiovascular disease accounted for 34.7% of the high care admissions. As a result of antiretroviral therapy (ART) AIDS related deaths have decreased by 43% since 2003.[12] However, non-infectious diseases have increased.[13] Cardiovascular disease has increased in HIV positive patients both on ART and patients not on ART. This could be due to the HIV virus itself, toxic effects of ART as well as an increase in traditional risk factors like hypertension, diabetes mellitus and dyslipdaemia in the HIV positive population.[14]

The burden of HIV-related disease, however, remains despite ART. This was also evident in a study done by *Meintjies et al*[15] looking at all HIV positive medical admissions at the GF Jooste Hospital over a 17 month period. Forty five percent of patients in that study were on ART. This is in contrast to Europe and North America where patients initiated on ART are mainly managed as out-patients.[15] In this study, 19.8% of HIV positive patients on ART with a suppressed viral load were admitted into the HCU. In the study done by *Meintjies et al*,[15] 25% of HIV infected individuals were on effective ART with suppressed viral loads but still required admission. Possible reasons for this, could include commencing ART at low CD4 counts, predisposing them to opportunistic infections, and treatment interruption.[15]

A large proportion of the study population (36.2%) was unaware of their HIV status. Another point of concern was the poor documentation of viral loads in the HIV positive population. A significant number (61.7%) of the HIV positive population had an undocumented viral load, and 18.5% remained virologically unsuppressed. Reasons why patients may not be virologically suppressed could include recent ART initiation, poor adherence and ART resistance.[15] This needs to be urgently addressed in order for the 2020 UNAIDS campaign to gain momentum. By 2020 it is hoped that 90% of all people living with HIV will know their status, and 90% of patients will receive sustained antiretroviral therapy and 90% of all people receiving antiretroviral therapy will be virologically suppressed.[16]

Study Limitations

Admission into the HCU was dependent on the decision of the attending physician. Tolerance for admitting patients into the unit may have varied among the physicians. The unit comprised of 4 general medical beds and 4 peritoneal dialysis beds. The overall disease spectrum therefore favoured renal admissions.

Conclusions/ Future Implications

There is currently a lack of emphasis placed on critical care resources in South Africa. In a resource limited country like South Africa HCUs can help ease the burden on ICUs for treating critically ill patients. However, an objective scoring system that can be used to evaluate patients who would benefit most from intensive monitoring and care is required to ensure optimum functioning of intensive care facilities. Prognostic factors in the HIV positive population should also be looked at to evaluate patients most at need for intensive care facilities. In patients deemed unsuitable for high care facilities palliative care facilities should be looked at to ease the burden on general medical wards as well. The role of critical care and establishing HCUs in our health care system must be reviewed.

HIV-related disease remains despite improved ART roll-out. The ‘test-and-treat’ campaign where patients are commenced on ART on diagnosis could be beneficial in reducing the burden of disease. Patients initiated on treatment at higher CD4 counts may result in less patients presenting with opportunistic infections. However, patients also need to be educated about the need to know their viral loads. A large proportion of the HIV positive patients in this study did not know their viral loads. Monitoring of viral loads could also assist in

monitoring treatment compliance and treatment resistance. Virological suppression could also aid in reducing transmission of HIV.

It should also be noted however, that with the greater accessibility to ART non-infectious diseases have also increased. This study showed that a large proportion of the HIV positive population presented with cardiovascular disease. While emphasis should be placed on early initiation of ART and prevention of opportunistic infections, more emphasis should also be placed on early screening for traditional cardiovascular risk factors. This would aid in preventing non infectious diseases in the HIV positive population as well.

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Appendices

Appendix 1: The Final Study Protocol

Dr. Darrin Ryan Naidoo

Masters in Medicine Protocol Submission

Department of Internal Medicine

University of KwaZulu-Natal

A Retrospective Review of the Clinical Outcomes in Patients Admitted to a Newly Established Medical High Care Unit at King Edward VIII Hospital

Supervisor: Dr. N.P Magula

Research Topic: A retrospective review of the clinical outcomes in patients admitted to a newly established Medical High Care Unit at a tertiary setting in South Africa.

Background:

A medical high care unit was established in May 2015 at King Edward VIII Hospital by the Department of Internal Medicine, which is affiliated to the University of KwaZulu-Natal. Previously, critically ill patients who did not meet the criteria for admission to an intensive care unit (ICU) either remained in the Acute Medical Unit (AMU) or were transferred to the general medical wards for continuation of care. In view of this, it was decided that a high care unit (HCU) that provided intensive monitoring and management of critically ill patients who were deemed unsuitable for the ICU, would be beneficial to the patients.

The High Care Unit at King Edward VIII is an eight-bed unit catering for critically ill patients. Four of these beds are reserved for general medical cases, and the remaining four beds are used for patents that require peritoneal dialysis. Inotropic support is also available in the unit. Unlike the Intensive Care facility at King Edward Hospital, however, the HCU does not offer mechanical ventilation or haemodialysis facilities. This critical, evidence based study, will describe the clinical outcomes of patients admitted to the High Care Unit at King Edward VIII hospital.

Aim:

To describe the clinical outcomes in patients admitted to the newly established High Care Unit at King Edward VIII Hospital from 1 September 2015 to 31 December 2015.

Objectives:

Conduct chart reviews of patients admitted from September 2015 to December 2015 to describe the following:

1. The length of stay of patients in the High Care Unit.
2. The mortality rate within the High Care Unit.
3. The disease spectrum in the High Care Unit.
4. The impact of Human Immunodeficiency Virus (HIV) on the clinical disease spectrum.
5. The number of patients either stepped up to the Intensive Care Unit or stepped down from the High Care Unit to the general medical wards.

Literature Review

A High Care Unit provides comprehensive care and constant monitoring of critically ill patients. It provides a higher level of care and more intensive monitoring than a general medical ward. This concept of an intensive care monitoring facility was first pioneered in 1952 by Dr. Bjorn Ibsen, an anesthetist in Denmark, to treat critically ill polio patients[1] (3). The last documented national audit of critical care resources in South Africa done by Scribante and Bhagwanjee in 2007 showed that only 23% (92/396) of public sector hospitals in South Africa had ICU/High Care Facilities.[2] (2)

Currently, there is a paucity of data regarding the clinical outcomes and disease spectrum of patients admitted to High Care Units in South Africa. Most of the current data looks at ICU facilities. In one study Van Zyl-Smit *et al*[3] surveyed all medical patients admitted to an 8 bed high care unit at G.F. Jooste Hospital in Cape Town over a twelve month period. Mechanical ventilation was available in this facility. Acute coronary syndromes, diabetic emergencies, drug overdose/poisoning and sepsis accounted for 76.6% of patients admitted. The remaining admissions included conditions such as congestive cardiac failure, cerebrovascular accidents and chronic obstructive pulmonary disease.[3] (6) Lufuno R. Mathiva[4] also looked at the adult patient profile at the ICU at Chris Hani Baragwanath Hospital. The facility catered for both medical and surgical patients. Thirty percent of the admissions to the ICU were due to medical causes. Again common medical admissions included sepsis, metabolic disorders and overdoses. A further 8% of the admissions were for infectious diseases which included tetanus, malaria and cholera.[4] (7)

The mortality rate in high care units in South Africa is also poorly documented. As Scribante and Bhagwanjee[2] state, "The current practice of having High Care Units in wards is unacceptable. This practice increases the risk of morbidity and mortality since it is impossible to offer the appropriate level of care and prevent the risks of intensive care practice in an uncontrolled environment."[2] (2) Sinuff *et al*[5] also support this view by asserting that hospital mortality rate was increased in patients refused ICU admission.[5] (5)

The study done by Van Zyl-Smit *et al*[3] conducted at G.F. Jooste hospital over a twelve month period showed a mortality rate of 10.7%.[3] (6) In the much bigger Chris Hani Baragwanath ICU there was a documented mortality rate of 31.5%.[4] (7) One would have to appreciate that the mortality rate would depend on the facilities available in the unit and the disease spectrum of the patients admitted into the unit.

A study done by Sawe *et al*[6] (4), looking specifically at disease patterns of patients in Intensive Care Units in Tanzanian hospitals, documented an ICU mortality rate of 41.4%. This is comparable to other studies in Africa. However, this figure reflects a higher mortality rate than in developed countries. The most common causes of mortalities in this study were chronic renal failure, acute renal failure, shock and septicaemia.[6] This could be partially explained by the fact that these hospitals did not offer dialysis facilities.

The study by Sawe *et al*[6] on Tanzanian tertiary referral hospitals highlights areas of concern that share common elements with the South African situation. The percentage of ICU/HCU beds is below internationally recommended standards. There is also a critical shortage of personnel in ICU facilities. The study points to the severe challenges that persistently plague Intensive Care Units in African hospitals.[6] (6) The introduction of the High Care Unit attempts to resolve these challenges.

South Africa also has the highest prevalence of HIV AIDS in the world. The total number of people living with HIV AIDS was estimated to be 6,19 million in 2015.[7] (8) For adults aged 15-49 years, an estimated 16.6% of the population is HIV positive.[7] (8) The clinical outcomes specifically in HIV positive patients need to be reviewed. In their study Bekele and Green[8] (1) look at the clinical course, prognostic factors and outcome prediction for HIV patients in ICU. The most common reason for ICU admission in these patients was respiratory failure. Pneumocystis Jiroveci Pneumonia was the most common diagnosis. The mortality rate was 29.6% for HIV positive patients. The median CD4 lymphocyte count for the patients who demised was 27.5 as compared to 59 for the patients who survived.[8] This study will also look at the clinical disease spectrum and mortality rate in HIV positive patients at King Edward VIII Hospital.

References

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Research Design

A retrospective descriptive study.

This is a quantitative study. It will be a retrospective chart review from 1 September 2015 to 31 December 2015. All patients admitted to the High Care Unit during the specified period will be included. It will be a descriptive study that will meet the aims of the research.

Inclusion Criteria

- All medical patients older than 12 years who were admitted to the Medical High Care Unit.

Exclusion Criteria

- Patients requiring mechanical ventilation.
- All patients requiring isolation facilities.

Sampling Strategy

Consecutive patients admitted to the High Care Unit will be included.

Statistical Approach

A thorough statistical analysis will be done to understand in detail the different clinical outcomes.

Study Population

All patients admitted to the Medical High Care Unit at King Edward VIII for the period 1 September 2015 to 31 December 2015 will be included.

Sample Size

The population sample will include all patients who met the criteria for inclusion during September 2015 to December 2015. The sample size will be approximately 120 patients.

Data Collection

The hospital files for each patient admitted to the High Care Unit for the period under review will be extrapolated using a data collection tool. Thereafter all the data will be captured on a software programme such as Microsoft Excel and analyzed.

Study Location

King Edward VIII Hospital is located in Durban, KwaZulu-Natal. It is the second largest hospital in the Southern hemisphere. It is a 922 bed hospital. It has 8 beds in its Medical High Care Unit. Four of these beds are reserved for patients who require peritoneal dialysis. The remaining 4 beds are for all other general medical cases. The drainage area for the hospital includes KwaZulu-Natal and the Eastern Cape.

Limitations of the Study

1. The reason for admission to the High Care Unit depends on the decision of the attending physician. Tolerance for admitting patients to High Care may vary among physicians.
2. Poor document and note keeping in the patients file may skew data.
3. The High Care facility only caters for four general medical cases. If the Unit is full critically ill patients will be managed in the wards.

Ethical Consideration

1. Scientific validity.
   Currently there is a lack of data on the efficacy and validity of the High Care Unit at King Edward VIII. This study is valid as it will provide relevant knowledge on the management and care of patients admitted to the Medical High Care Unit at King Edward Hospital.
2. Confidentiality
   This is a retrospective chart review study. There will be no patient contact. Patients will be captured on the data collection tool using only their initials and study identity number.
3. Informed Consent
   Informed consent was not obtained for the study as it is a retrospective chart review. Informed consent was obtained at the time of admission for any invasive procedures that were performed.
4. Conflict of Interest
   There is no conflict of interest.

Appendix 2: Ethical Approvals

health
Department:
Health
PROVINCE OF KWAZULU-NATAL

KING EDWARD VIII HOSPITAL

Private Bag X02, CONGELLA, 4013
Corner of Rick Turner (Francois Road) & Sydney Road
Tel: 031-3603853, Fax:031-2061457; Email: rejoice.khuzwayo@kznhealth.gov.za
www.kznhealth.gov.za

Ref.: KE 2/7/1/(09/2016
Enq.: Mrs. R. Sibiya
Research Programming

25 February 2016

Dr. DR. Naidoo
Discipline of Medicine
Nelson R. Mandela School of Medicine
UNIVERSITY OF KWAZULU-NATAL

Dear Dr. Naidoo

Protocol: A retrospective review of the clinical outcomes in patients admitted to a newly established Medical High Care Unit tertiary setting South Africa. Degree: Med; BREC No. BE049/16

Permission to conduct research at King Edward VIII Hospital is provisionally granted, pending approval by the Provincial Health Research Committee, KZN Department of Health.

Kindly note the following:-

- The research will only commence once confirmation from the Provincial Health Research Committee in the KZN Department of Health has been received.
- Signing of an indemnity form at Room 8, CEO Complex before commencement with your study.
- King Edward VIII Hospital received full acknowledgment in the study on all Publications and reports and also kindly present a copy of the publication or report on completion.

The Management of King Edward VIII Hospital reserves the right to terminate the permission for the study should circumstances so dictate.

Yours faithfully

SUPPORTED/NOT SUPPORTED

DR. GMO MAZIZI
CHIEF EXECUTIVE OFFICER

25/2/2016
DATE

Fighting Disease, Fighting Poverty, Giving Hope

APPENDIX 9

PERMISSION TO CONDUCT A RESEARCH STUDY/TRIAL

This must be completed and submitted to the Medical Superintendent/s / Hospital Manager for signature.

For King Edward VIII Hospital (KEH) and Inkosi Albert Luthuli Central Hospital (IALCH) studies please submit together with the following:

i) **Two copies of the final, approved protocol**
ii) **Letter giving provisional ethical approval**
iii) **Details of other research presently being performed by yourself (individually or as a collaborator)**
iv) **Details of any financial or human resource implications to King Edward VIII Hospital**
v) **If a clinical trial, please produce proof of payment or intention thereof to KEH**

Once the document has been signed it should be returned to this office so that full ethical approval can be granted.

To: Hospital Manager

PROTOCOL

Permission is requested to conduct the above research study at the hospital/s indicated below:

Site 1 address: **Investigator/s:**

KING EDWARD VIII — **Principal:** DR. D.R. NAIDOO

_____ **Co-investigator:** _____

_____ **Co-Investigator:** _____

Signature of Hospital Manager: _____ **Date:** 25/2/2016

Site 2 address: **Investigator/s**

_____ **Principal:** _____

_____ **Co-investigator:** _____

health
Department:
Health
PROVINCE OF KWAZULU-NATAL

DIRECTORATE:
Health Research & Knowledge Management

Physical Address: 330 Langalibalele Street, Pietermaritburg
Postal Address: Private Bag X9051
Tel: 033 395 2805/ 3189/ 3123 Fax: 033 394 3782
Email: hrkm@kznhealth.gov.za
www.kznhealth.gov.za

Reference: 56/16
KZ_2015RP7_405

Date: 11 March 2016

Dear Dr D.R. Naidoo
Email: darrinnaidoo@gmail.com

Approval of research

1. The research proposal titled **'A retrospective review of the clinical outcomes in patients admitted to a newly established Medical High Care Unit at a tertiary setting in South Africa'** was reviewed by the KwaZulu-Natal Department of Health.

   The proposal is hereby **approved** for research to be undertaken at King Edward VIII Hospital.

2. You are requested to take note of the following:
   a. Make the necessary arrangement with the identified facility before commencing with your research project.
   b. Provide an interim progress report and final report (electronic and hard copies) when your research is complete.

3. Your final report must be posted to **HEALTH RESEARCH AND KNOWLEDGE MANAGEMENT, 10-102, PRIVATE BAG X9051, PIETERMARITZBURG, 3200** and e-mail an electronic copy to hrkm@kznhealth.gov.za

For any additional information please contact Mr X. Xaba on 033-395 2805.

Yours Sincerely

Dr E Lutge
Chairperson, Health Research Committee
Date: 09/03/15

Fighting Disease, Fighting Poverty, Giving Hope

UNIVERSITY OF KWAZULU-NATAL
INYUVESI YAKWAZULU-NATALI

17 March 2016

Dr DR Naidoo (200266694)
Discipline of Medicine
School of Clinical Medicine
darrinnaidoo@gmail.com

Protocol: A retrospective review of the clinical outcomes in patients admitted to a newly established medical High Care Unit tertiary setting South Africa.
Degree: MMed
BREC reference number: BE049/16

EXPEDITED APPLICATION

The Biomedical Research Ethics Committee has considered and noted your application received on 02 February 2016.

The study was provisionally approved pending appropriate responses to queries raised. Your responses dated 10 March 2016 to queries raised on 02 March 2016 have been noted and approved by a sub-committee of the Biomedical Research Ethics Committee. The conditions have now been met and the study is given **full ethics approval.**

This approval is valid for one year from **17 March 2016.** To ensure uninterrupted approval of this study beyond the approval expiry date, an application for recertification must be submitted to BREC on the appropriate BREC form 2-3 months before the expiry date.

Any amendments to this study, unless urgently required to ensure safety of participants, must be approved by BREC prior to implementation.

Your acceptance of this approval denotes your compliance with South African National Research Ethics Guidelines (2015), South African National Good Clinical Practice Guidelines (2006) (if applicable) and with UKZN BREC ethics requirements as contained in the UKZN BREC Terms of Reference and Standard Operating Procedures, all available at http://research.ukzn.ac.za/Research-Ethics/Biomedical-Research-Ethics.aspx.

BREC is registered with the South African National Health Research Ethics Council (REC-290408-009). BREC has US Office for Human Research Protections (OHRP) Federal-wide Assurance (FWA 678).

The sub-committee's decision will be **RATIFIED** by a full Committee at its meeting taking place on **12 April 2016.**

We wish you well with this study. We would appreciate receiving copies of all publications arising out of this study.

Yours sincerely

Professor J Tsoka-Gwegweni
Chair: Biomedical Research Ethics Committee

cc supervisor: magulan@ukzn.ac.za
cc postgrad: konar@ukzn.ac.za

Biomedical Research Ethics Committee
Professor J Tsoka-Gwegweni (Chair)
Westville Campus, Govan Mbeki Building
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Telephone: +27 (0) 31 260 2486 **Facsimile:** +27 (0) 31 260 4609 **Email:** brec@ukzn.ac.za
Website: http://research.ukzn.ac.za/Research-Ethics/Biomedical-Research-Ethics.aspx

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Website http://research.ukzn.ac.za/Research-Ethics/Biomedical-Research-Ethics.aspx

27 July 2016

Dr DR Naidoo (200266694)
Discipline of Medicine
School of Clinical Medicine
darrinnaidoo@gmail.com

Dear Dr Naidoo

Protocol: A retrospective review of the clinical outcomes in patients admitted to a newly established medical High Care Unit tertiary setting South Africa.
Degree: MMed
BREC reference number: BE049/16

We wish to advise you that correspondence received 21 July 2016 submitting an application for Amendments to increase the study period for the above study has been **noted and approved** by a sub-committee of the Biomedical Research Ethics Committee.

The committee will be advised of the above at the next meeting to be held on **16 August 2016.**

Yours sincerely

Mrs A Marimuthu
Senior Administrator: Biomedical Research Ethics

cc supervisor: magulan@ukzn.ac.za
cc postgrad: konar@ukzn.ac.za

Appendix 3: Additional Statistical Analysis

Table i. Disease Spectrum (n, %)			
	General Medical (n = 107)	**Peritoneal Dialysis (n = 64)**	**Total**
Renal	36 (33.6)	64 (100.0)	100 (58.5)
Respiratory	37 (34.6)	17 (26.6)	54 (31.6)
Cardiac	48 (44.9)	6 (9.4)	54 (31.6)
CNS	15 (14.0)	4 (6.3)	19 (11.1)
Endocrine	11 (10.3)	1 (1.6)	12 (7.0)
GIT	24 (22.4)	9 (14.1)	33 (19.3)
Rheumatology	1 (0.9)	0 (0.0)	1 (0.6)
Other	40 (37.4)	23 (35.9)	63 (36.8)

Table ii. Indications for Peritoneal Dialysis (n, %)	
Fluid Overload	15 (23.4)
Oliguria/Anuria	13 (20.3)
Refractory Hyperkalaemia	17 (26.6)
Severe Acidosis	44 (68.8)
Increased Urea/Creatinine	63 (98.4)
Uraemic Encephalopathy	24 (37.5)
Uraemic Gastropathy	4 (6.3)
Other	0 (0.0)

Table iii. Co-morbidities for Peritoneal Dialysis (n, %)	
Hypertension	36 (56.3)
Diabetes	21 (32.8)
Hypertension and Diabetes	18 (28.1)
HIV	32 (50.0)

Table iv. HIV- Population (n, %)			
	General Medical (n = 13)	**Peritoneal Dialysis (n = 15)**	**Total**
Length of stay, median (IQR)	7 (3 – 13)	7 (6 – 8)	7 (3.5 – 9.5)
Mortality	1 (7.7)	0 (0.0)	1 (3.6)
Disease spectrum			
Renal	3 (23.1)	15 (100.0)	18 (64.3)
Respiratory	7 (53.9)	3 (20.0)	10 (35.7)
Cardiac	6 (46.2)	2 (13.3)	8 (28.6)
CNS	1 (7.7)	0 (0.0)	1 (3.6)
Endocrine	0 (0.0)	0 (0.0)	0 (0.0)
GIT	0 (0.0)	0 (0.0)	0 (0.0)
Rheumatology	1 (7.7)	0 (0.0)	1 (3.6)
Other	2 (15.4)	7 (46.7)	9 (32.1)
Outcomes			
Step Up	2 (15.4)	1 (6.7)	3 (10.7)
ICU	0 (0.0)	0 (0.0)	0 (0.0)
IALCH	2 (15.4)	1 (6.7)	1 (3.6)
Step Down	11 (84.6)	15 (100.0)	26 (92.9)

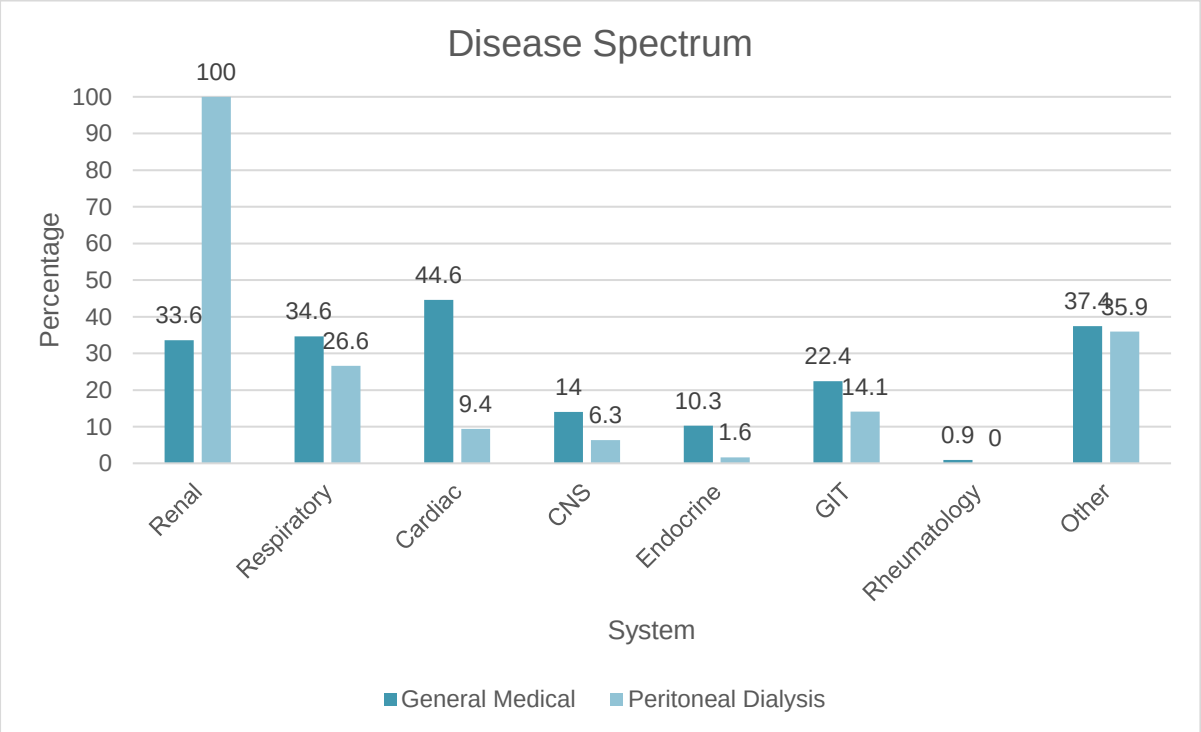

Figure i: Disease spectrum

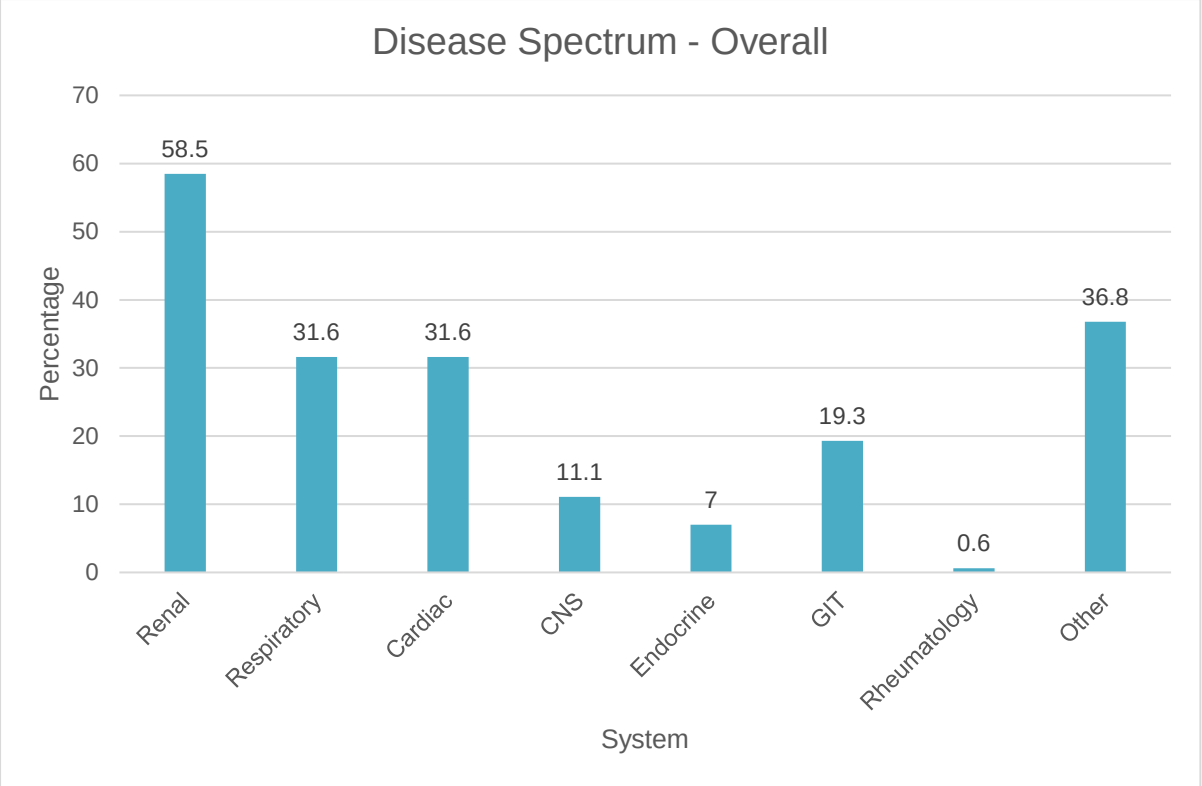

Figure ii: Disease spectrum of the overall population

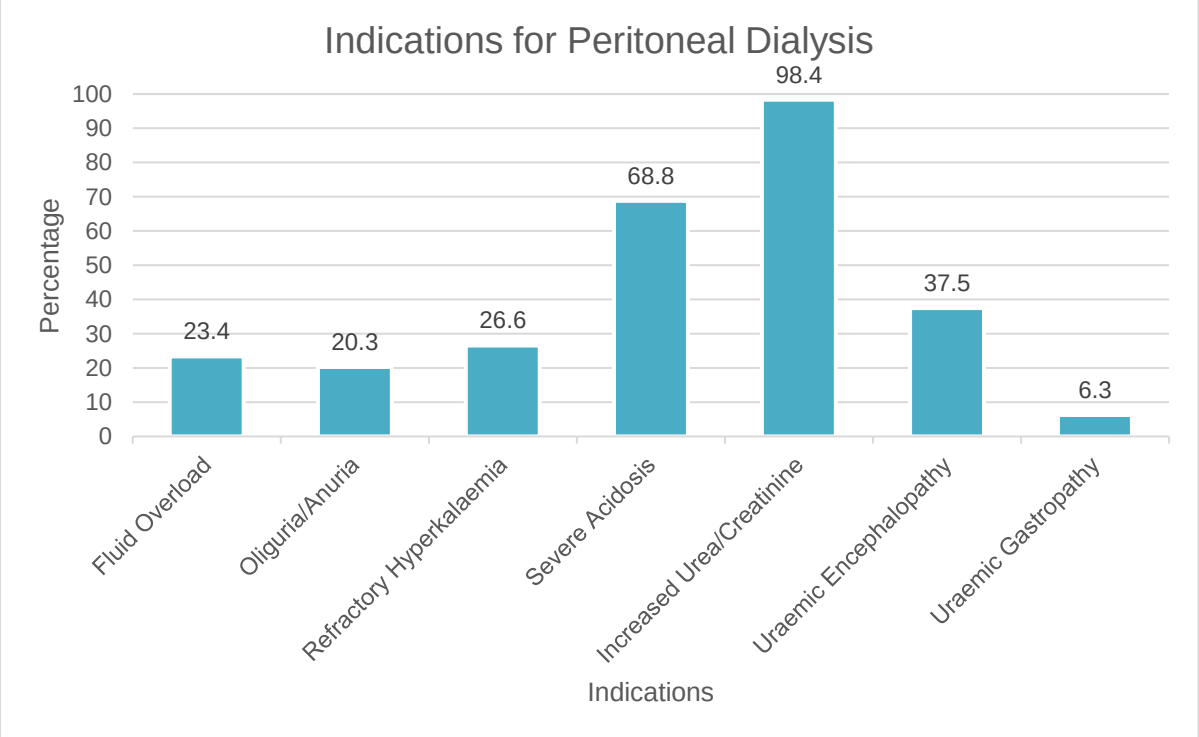

Figure iii: Indications for peritoneal dialysis

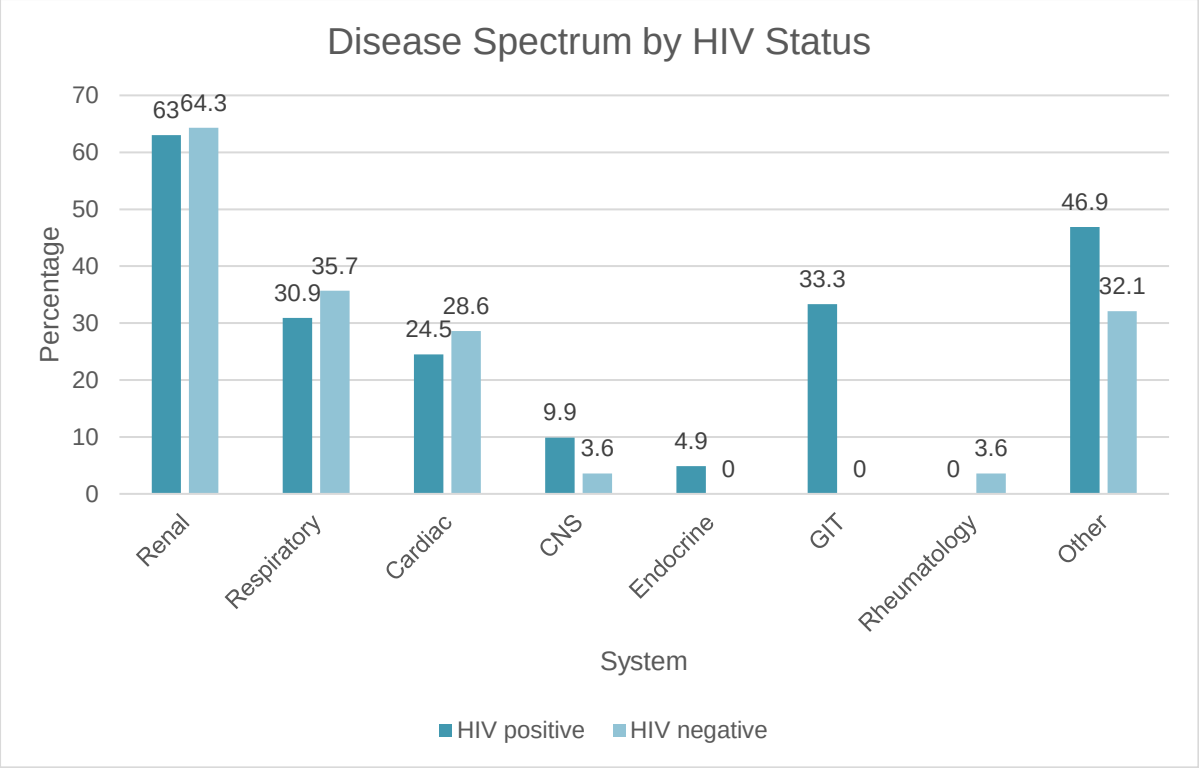

Figure iv: Disease spectrum comparison between HIV positive and HIV negative patients

Appendix 4: Raw data

Please note Data Spreadsheet saved as separate file.