

**Acute Kidney Injury: A comparative study of
outcomes in human immunodeficiency virus-
positive and human immunodeficiency virus-
negative patients**

by

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Table of contents

<u>List of tables</u>	iii
<u>Supervisors</u>	iv
<u>Declaration on plagiarism</u>	vi
<u>Acknowledgements</u>	vii
<u>Acronyms and abbreviations</u>	viii
<u>Abstract</u>	ix
<u>Chapter 1: Introduction</u>	1
<u>1.0 Introduction</u>	1
<u>Chapter 2: Literature review</u>	4
<u>2.1 AKI definitions (KDIGO versus RIFLE)</u>	4
<u>2.2 HIV and AKI</u>	4
<u>2.3 Epidemiology and genetic influence</u>	5
<u>2.4 Aetiology</u>	5
<u>2.5 Mechanisms of AKI in HIV patients</u>	6
<u>2.6 Pathogenesis and medication-induced nephrotoxicity</u>	6
<u>2.7 Clinical manifestations</u>	7
<u>2.8 Outcomes</u>	7
<u>2.9 Conclusion</u>	9
<u>Chapter 3: Aim and Objectives</u>	10
<u>3.1 Aim</u>	10
<u>3.2 Objectives</u>	10
<u>Chapter 4: Research Methods</u>	11
<u>4.1 Study design</u>	11
<u>4.2 Study setting</u>	11
<u>4.3 Study Population</u>	11
<u>4.4 Sample Size and Sampling Technique</u>	11
<u>4.5 Data Collection</u>	11
<u>4.6 Definitions</u>	12
<u>4.7 Data analysis</u>	12
<u>4.8 Ethical Considerations</u>	12

<u>4.9 Funding</u>	12
<u>4.10 Potential sources of bias</u>	13
<u>CHAPTER 5: Results</u>	14
<u>5.0 Results</u>	14
<u>CHAPTER 6: Discussion</u>	22
<u>6.0 Discussion</u>	22
<u>6.1 Limitations</u>	26
<u>6.2 Conclusion</u>	26
<u>6.3 Recommendations</u>	26
<u>References</u>	27

List of tables

Table 1. Patient demographics.....	15
Table 2. Results for demographic data influence on patient outcomes	16
Table 3. Results for patients admission laboratory blood tests.....	17
Table 4. Results for patients final laboratory blood tests.....	18

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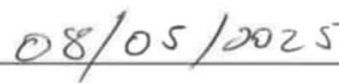
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Declaration

I, Mpumelelo Shadrack Smith, declare that this research report is my own work which is being submitted in partial fulfilment of the degree Master of Medicine (in the submissible format with my protocol and an extended literature review) in the branch of Internal Medicine at the University of the Witwatersrand, Johannesburg. This work has not been submitted before for any degree or examination at this or any other University.

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Signature

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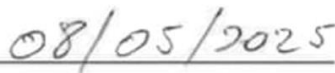
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This work in this thesis is dedicated to my parents: for their love and encouragement.

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Acronyms and abbreviations

AIDS	Acquired Immunodeficiency Syndrome
AKI	Acute Kidney Injury
APLO	Apolipoprotein
ART	Antiretroviral Therapy
ATN	Acute Tubular Necrosis
CD	Cluster of Differentiation
CHBAH	Chris Hani Baragwanath Academic Hospital
CKD	Chronic Kidney Disease
ESRD	End Stage Renal Disease
HAART	Highly Active Anti-Retroviral Therapy
HBV	Hepatitis B Virus
HCV	Hepatitis C Virus
HIV	Human Immunodeficiency Virus
HIVAN	Human Immunodeficiency Virus-Associated Nephropathy
NNRTI	Non-Nucleotide Reverse Transcriptase Inhibitor
NRTI	Nucleotide Reverse Transcriptase Inhibitor
RRT	Renal Replacement Therapy
SSA	sub-Saharan Africa
UNAIDS	Joint United Nations Programme on HIV/AIDS

Abstract

Background: The intersection between HIV/AIDS and renal health is critical in South Africa for multifactorial reasons. We aimed to compare the renal outcomes in HIV subsets on dialysis for AKI.

Methods: This retrospective study was at Chris Hani Baragwanath Academic Hospital (CHBAH) renal unit, between January and December 2017. Records of 103 patients above 18 years who received dialysis for AKI irrespective of their HIV status were examined. The KDIGO criteria were used to define AKI and renal outcomes included renal recovery, progression to CKD, or death. We determined the clinical causes of AKI and renal outcomes stratified by HIV status. Data was analysed using RStudio 2023.09.1 Build 494 and a P value of ≤ 0.05 considered significant.

Results: Mean age of the study population was 39.5 ± 12.4 years, male: female ratio of 1:1.2. Majority were African (93.2%), being HIV-positive (48.5%) versus HIV-negative (46.6%) patients and five (4.9%) of unknown HIV status. Categories of AKI were 86.4% medical, 11.6% surgical and 2.0% obstetric. Renal outcomes were not significantly different in HIV patient groups. Higher urea, creatinine, potassium and phosphate, plus lower sodium and chloride were observed with poor outcomes ($P < 0.05$). Those with shorter duration on dialysis had a poorer outcome [37 ± 52 days (alive) versus 7 ± 7 days (demised)] ($P = 0.000$).

Conclusion: HIV remains a risk factor for AKI in South Africa. Electrolyte abnormalities may worsen AKI outcomes. We suggest further studies to unravel how HIV infection affects AKI outcomes.

Keywords: AKI, HIV, CKD, renal outcomes

Chapter 1: Introduction

1.0 Introduction

Acute kidney injury (AKI) is a significant global health concern, and with a high prevalence in sub-Saharan Africa (SSA), South Africa inclusive (1). Recent meta-analyses have revealed that the worldwide incidence of AKI in hospital settings is approximately 21% in adults and 33% in children, with mortality rates of nearly 24% and 14% respectively (2, 3). These high rates are even more pronounced in countries with lower income levels and healthcare spending, highlighting the disparity between developed and developing nations (2, 3). The diagnosis of AKI has significant impacts on healthcare costs (4). For example, a diagnosis of AKI in the United States in 2017, added US\$ 1700 to a patient's admission cost, increasing to US\$ 11000 if acute dialysis was needed (4). The financial burden arises from various factors, including extended hospital stays, increased need for intensive care, and more complex medical treatments (4, 5). This increase in expenditure is a major concern, especially for healthcare systems with limited financial resources (5). AKI presents a significant healthcare challenge for countries within SSA (5-7). Factors unique to SSA and other low-income regions globally, such as limited healthcare resources and high prevalence of infectious diseases exacerbate the severity of AKI (7). The distinct socioeconomic and healthcare contexts within SSA require tailored strategies for AKI management, emphasizing prevention, early diagnosis, and resource-efficient treatment modalities to mitigate the impact of AKI on both individual health and healthcare systems (7). In a single-centre South African (tertiary hospital) study, the prevalence of hospital-acquired AKI was observed to be 6.2%, with significant implications for hospitalization duration and readmission rates (8). Effective management and prevention strategies for AKI are therefore crucial not only for patient health but also for reducing the economic strain it imposes on healthcare systems globally (2, 4).

In South Africa, there are unique factors contributing to AKI, ranging from infectious diseases to toxins and complications of surgery; all significantly impact the healthcare system negatively (1). One major factor is the burden of HIV/AIDS. The human immunodeficiency virus (HIV) infection and acquired immunodeficiency syndrome (AIDS) are serious health concerns for South Africa, as the country has one of the highest

prevalence rates of adult HIV infections in the world (9). Currently, the HIV-infected population in South Africa is approximately 7.06 million, with a prevalence of 12.6% in 2017 (10). This is considerably higher than the average global HIV prevalence rate, estimated to be 0.8%, with approximately 36.7 million people living with the virus globally (11, 12). Fifty-one percent of the infected population are female, with the vast majority of patients living in low- and middle-income countries (13). Over two-thirds (~25.5 million) of the global HIV infections occur within Sub-Saharan Africa (SSA) (14).

It is worthy of note that the rate of new HIV infections in South Africa has declined from 1.9% in 2002 to 0.9% in 2017 (15). However, the burden of the disease on patients and the country's healthcare system remains high due to both the virus itself and treatment-related complications. Further, non-HIV related comorbidities have increased due to improved life expectancy associated with treatment (16). These include renal complications such as AKI which may progress to chronic kidney disease (CKD). The intersection between HIV/AIDS and renal health is particularly critical in SSA countries like South Africa. Renal diseases in HIV-positive patients vary from glomerular diseases to drug-induced nephropathies (7, 17, 18). Antiretroviral therapy (ART), while considered to improve immune function, can also contribute to nephrotoxicity and increase the risk of both CKD and AKI (5-7, 19).

AKI in South Africa demonstrates varied prevalence and risk factors across different patient groups. Studies show a 6.2% prevalence in hospitalised patients, 11.2% post major non-cardiac surgery with higher risks associated with specific surgeries and conditions, and a 27% prevalence among burn victims, linked to higher mortality rates (8, 20, 21). ICU studies reveal a 39.4% incidence of AKI, with late initiation of renal replacement therapy (RRT) commonly observed in the young, in males, or post-emergency surgery patients, and predominantly with sepsis and HIV (22, 23). These findings highlight the need for targeted AKI management and prevention strategies in the South African healthcare system.

The interplay between HIV/AIDS and renal health is particularly complex in South Africa, where high HIV prevalence adds an additional layer to AKI management. The introduction of ART in South Africa has led to a reduction in opportunistic infections but has also highlighted non-infective comorbidities, especially renal conditions in HIV-

positive individuals. Patients with HIV face an increased risk of both CKD and AKI, with factors like low CD4 count and high viral load elevating the risk of AKI (24). Studies demonstrate the significant impact of ART on reducing mortality in HIV-associated nephropathy (HIVAN) patients, though certain drugs like Tenofovir can exacerbate renal issues (5, 6, 25).

These findings underline the need for targeted strategies to manage AKI effectively, especially in settings with a high prevalence of HIV-positive patients, and limited healthcare resources, where South Africa falls. The integration of international guidelines like Kidney Disease: Improving Global Outcomes (KDIGO) and localized research is essential for improving outcomes in AKI patients across diverse populations (1, 26).

In light of the aforementioned, studies like ours, to determine the contribution of HIV to AKI and its outcomes, are needed. The focus of the study was on patients requiring acute dialysis for AKI, in a bid to determine the effects of HIV status on their possible outcomes.

Chapter 2: Literature review

2.0 Literature review

2.1 AKI definitions (KDIGO versus RIFLE)

The term acute renal failure has been replaced by acute kidney injury (AKI), with the latter being defined as an acute syndrome characterised by an abrupt deterioration in renal function, typically diagnosed by retention of end products of nitrogen metabolism and dysregulation of extracellular volume and electrolytes (29). The 2012 KDIGO guidelines provide a preferred definition of AKI, which includes one or more of the following criteria: a rise in serum creatinine either by $>0.3\text{mg/dl}$ ($26,5\text{micromol/L}$) over a 48 hour period or >1.5 times the baseline value within seven days prior, or a reduction in urine output to $<0.5\text{ml/kg}$ per hour for six hours (26, 30).

In patients presenting with uraemia, the distinction between AKI and CKD can be very difficult (6), and it is for this reason that the Acute Dialysis Quality Initiative Group proposed the RIFLE criteria (risk, injury, failure, loss, end stage renal disease) which utilizes either an increase in serum creatinine or a decrease in urine output (6, 31). This set of criteria characterizes three levels of renal dysfunction (R, I, F) and two clinical outcomes (L, E) (26). Similarly, based on KDIGO classification, AKI can be categorised into three stages of increasing severity as follows; Stage 1 is classified as an increase in serum creatinine $>0,3\text{mg/dl}$ (in 48 hours) or 1.5 to 1.9 times baseline values, stage 2 is classified as an increase in serum creatinine by 2.0 to 2.9 times baseline values, and lastly, stage 3 is classified as an increase in serum creatinine by >3 times the baseline values or beginning of renal replacement program regardless of previous KDIGO (32).

2.2 HIV and AKI

The HIV epidemic, which began in 1981, has profoundly shaped global health, with approximately 86 million individuals being infected to date (33). The introduction of ART has revolutionized HIV management, enabling infected individuals to achieve a comparable life expectancy to that of the general population (16). In South Africa, ARTs were introduced in the late 1990s, with the public sector program starting in 2004 (34). Since then, standardized fixed drug combinations of ARTs have been introduced (34, 35). This combination of drugs is used to increase potency and reduce the likelihood of viral drug resistance (34). Based on WHO guidelines, an immediate initiation of ART at HIV

diagnosis is recommended, using a triple therapy, to forestall the emergence of drug-resistant viral strains. Dolutegravir, in combination with a nucleoside reverse-transcriptase inhibitor (NRTI) backbone, in combination with an NTRI backbone, are the preferred first-line ART regimen in adults and adolescents. (35). As the availability of ART prolonged the survival of HIV infected persons, noncommunicable diseases (including CKD) emerged, and these added significant challenges to the management of HIV-positive patients (36-38). Below is a comprehensive exploration of the complex interplay between HIV and kidney disease, elucidating the mechanisms, epidemiology, risk factors, and clinical outcomes associated with this coexistence.

2.3 Epidemiology and genetic influence

The coexistence of HIV and CKD presents a substantial burden, particularly among populations of African descent, where End-Stage Renal Disease (ESRD) incidence rates are disproportionately high compared to HIV-positive Caucasians (39). Genetic factors, such as the APOL1 risk variants G1 and G2 are prevalent among individuals of African ancestry and have been shown to contribute to the increased susceptibility of kidney disease significantly (40, 41). These variants evolved to protect the host from African trypanosomiasis, but are strongly associated with HIVAN and CKD progression (26, 40, 42).

2.4 Aetiology

Reports from numerous authors consistently implicate sepsis as a leading cause of AKI in HIV-positive patients. Vachiat and colleagues (43), showed that sepsis was the cause of AKI in 60% of HIV-positive patients, followed by volume depletion and haemodynamic instability, which accounted for 17% of AKI. Similar findings are documented elsewhere (39, 40). On the other hand, Peraldi et al. reported vascular and glomerular diseases as the frequent causes of acute or rapidly progressing renal failure in the HIV-infected patients they studied. Common aetiologies they identified were hemolytic uremic syndrome, toxin/ drug related, as well as HIV associated nephropathy (44). While not direct causes of acute kidney injury, certain electrolyte abnormalities such as hyperkalemia and hyponatremia can contribute to the progression and worsening of kidney damage (43).

2.5 Mechanisms of AKI in HIV patients

Choi and colleagues performed a study on a large cohort of 17,325 HIV patients analysing the long-term consequences of AKI over two decades (45). They found a high incidence of AKI prevalence among HIV-positive patients, with three times more patients hospitalised compared to HIV-negative patients (45). These findings are similar to previous works on the subject matter (46). While authors first defined AKI as a “decline in urine output and raised serum creatinine level”, this definition was largely unspecific. Arendse and colleagues (47); highlighted this issue by calling for a more precise definition of AKI, stressing that there must be “an absolute increase in serum creatinine of 0.3 mg/dl, a 50% increase in serum creatinine from the baseline or urine output less than 0.5ml/kg per hour for more than 6 hours”.

Choi and colleagues suggested that the high morbidity in HIV-positive patients with AKI may have a similar mechanism as observed in experimental studies on animals (45, 48, 49). Hence, the starting point is the HIV infection that “triggers a systemic inflammatory response, that leads to chronic immune activation and prothrombic state, which also increases interleukin-1(IL-1), interleukin-6(IL-2), and tumour necrosis factor α (TNF- α)” (45, 50, 51). Consequently, these abnormalities are the basis for the pathogenesis of atherosclerosis, progression to AIDS, and mortality in HIV patients, with AKI being a magnifier of these derangements via the common mechanism (45).

2.6 Pathogenesis and medication-induced nephrotoxicity

The pathogenesis of kidney disease in hospitalised HIV patients is multifactorial, involving systemic inflammation, immune dysregulation, and nephrotoxic effects of drugs, including some antiretroviral medications (45, 48, 49). Nephrotoxic drugs cause injury by accumulating in proximal tubular epithelial cells, leading to mitochondrial dysfunction, oxidative stress, and apoptosis—ultimately resulting in acute tubular necrosis (25, 52, 53, 54). Other mechanisms of injury include interstitial inflammation and edema, reduced renal perfusion pressure, and glomerular damage through immune complex deposition. While ART has significantly reduced the incidence of HIVAN, certain antiretrovirals, such as tenofovir disoproxil fumarate, are associated with nephrotoxicity (16, 55). Additionally, protease inhibitors and other antiretrovirals may contribute to renal tubular toxicity and interstitial nephritis, further exacerbating kidney injury (19, 55, 56).

2.7 Clinical manifestations

Presentation of AKI depends on the severity and cause of acute kidney injury, some patients present with a variety of clinical signs like fluid overloaded state, decreased urine output, severe hypertension, and in severe cases they have acute indications for dialysis like encephalopathy, pulmonary oedema, anuria, refractory metabolic acidosis and hyperkalaemia (32, 57). However, some patients may not have obvious clinical symptoms, whereas markers such as an increase in creatinine and urea have been used to determine AKI occurrence among hospitalised patients (57).

2.8 Outcomes

Globally, AKI is and remains a major complication in HIV-infected patients(43, 45). The causes of renal injury leading to AKI are similar regardless of HIV infection status: fluid depletion, cardiac failure, haemorrhage, toxin ingestion - both herbal or pharmacological (e.g., Aminoglycosides, Amphotericin B) and obstructive uropathy (29, 31). The aetiology of AKI plays a crucial role in determining the final renal outcome, including the potential for complete recovery, partial recovery, or progression to ESRD. Other factors such as age and co-morbidities may also influence renal prognosis. Despite advances in diagnosis and management, CKD remains a significant fatal outcome in HIV-positive patients with AKI (45, 52). Hence, it is unsurprising that authors have found a statistically significant association between end-stage kidney disease and death ($p < 0.001$) across all three stages of AKI (45, 46). In terms of AKI severity, higher mortality rates have been associated with patients in stage 2 or 3 compared to those patients in stage 1 (45, 46).

2.8.1 Demography

In the study by Vachiat and colleagues comparing HIV-positive and HIV-negative patients with AKI, no demographic factors were found to influence renal outcomes among the HIV-positive group. However, within the HIV-negative cohort, age and Black ethnicity were identified as predictors of mortality. Notably, this group consisted of older participants (43). While age per se is not a negative predictor for mortality, older patients usually have more comorbidities than younger patients, which places them at a higher risk of death. Patients of black ancestry are more prone to kidney disease because of their high propensity to obesity, diabetes mellitus, and hypertension (58); and due to the presence of APLO1 risk variants, as already discussed (59). Younger patients who develop

renal failure are more likely to experience a prolonged course of the condition (46, 60, 61).

2.8.2 Illness severity and AKI Aetiologies

The illness severity score is an essential factor in assessing renal failure in HIV-positive patients (43, 62). Using the RIFLE classification, Vachiat and colleagues found 76% of HIV-positive patients with more severe renal failure compared to HIV-negative patients (43). Additionally, the authors found that negative HIV patients had a 20% lower risk of renal failure compared to HIV-positive patients (28% vs 8% respectively), with sepsis being significantly higher in HIV-positive patients (43). Hypertension and diabetes mellitus are often significantly associated with poor renal outcomes (i.e., renal failure) in HIV-positive patients (43). The kidney diseases related to HIV infection include HIVAN, HIV-immune complex disease, thrombotic microangiopathies, HBV or HCV co-infection, and drug toxicity (25, 53, 54, 63). Furthermore, by comparing the exposure of the HIV-positive and the HIV-negative group to HAART, Wyatt, and colleagues (46) found that infection was associated with an increased risk of AKI and that hospital mortality rates were higher in HIV-positive patients. A high mortality rate is reported among patients with sepsis and a low CD4 count (47). Like malaria, sepsis generally has largely negative effects on morbidity and mortality when coupled with depleted renal function (60). While malaria is largely a burden in the southern hemisphere, the northern hemisphere has other factors influencing poor outcome causing ATN, that is, nephrotoxicity, rhabdomyolysis, ischemia, and dehydration (47, 64). Chronic kidney disease and hepatic diseases are strongly associated with AKI and mortality as well. Therefore, these two conditions should be diagnosed early and aggressively managed. Similar findings have been mentioned by numerous authors, suggesting a commonality between increased mortality for HIV-infected patients who have AKI or similar prognoses (36, 37, 47, 55, 60).

2.8.3 Laboratory parameters

In one study, it has been demonstrated that certain laboratory parameters differ significantly between HIV-positive and HIV-negative patients. These include hyponatremia (132 *vs.* 13 $\mu\text{mol/L}$, $p < 0.001$), hyperkalaemia (4.9 *vs.* 4.5 $\mu\text{mol/L}$, $p = 0.042$), and hypochloraemia (98 *vs.* 103 $\mu\text{mol/L}$, $p = 0.0121$). Numerous factors were

retained as significant predictors of mortality, such as acidosis, anaemia, hyponatraemia, and hyperphosphatemia (43).

2.8.4 ART use and CD4 count

The advent of ARTs has had a net positive impact on mortality reduction in patients affected with HIV (65). On the other side of the coin, morbidity emerges with kidney diseases, cardiac and liver pathologies, and coinfections (46). However, in SSA, the trends are dissimilar, probably because of the late roll-out of ARTs in many countries, while there was a much earlier introduction of these drugs in developed countries as early as 1995 (46). Arendse and colleagues (47), showed that the outcome was generally good when patients had CD4 counts (>200 cell/mm³) in the presence of sepsis, while in contrast, poor outcome was associated with elevated serum creatinine levels (>1230) and low CD4 count (<200 cell/mm³). These authors showed that all patients who had sepsis and a CD4 count (<132.0 cell/mm³) died (47).

In summary, poor outcomes are in line with black ethnicity, high severity score on hospital admission, detectable viral load, low CD4 count, positive HTLV-1, HBV or HCV, and pre-existing CKD (46, 47, 66).

2.9 Conclusion

In conclusion, the coexistence of HIV and kidney disease poses significant clinical challenges, with implications for both diagnosis and management. Genetic predisposition, viral infection, medication toxicity, and demographic factors collectively contribute to the complex interplay of kidney disease in HIV patients. A comprehensive understanding of these factors is essential for informing clinical practice and improving outcomes in this vulnerable population. This work is intended to add to the body of knowledge in this regard.

Chapter 3: Aim and Objectives

3.1 Aim

To determine the differences in outcomes between HIV-positive and HIV-negative patients with dialysis-requiring AKI and identify factors influencing prognosis.

3.2 Objectives

1. To determine the common clinical causes of AKI in HIV-positive patients.
2. To determine the renal outcomes of HIV-positive patients receiving acute haemodialysis and compare the outcomes to HIV-negative patients.
3. To determine the predictors of poor renal outcome among HIV-positive and negative groups.

Chapter 4: Research Methods

4.1 Study design

This was a retrospective descriptive study, which spanned the period between January 2017 and December 2017. Within this time frame, data was sourced from renal unit records and hospital archives by the researcher, into a case record form (Appendix 1).

4.2 Study setting

This study was conducted at the Chris Hani Baragwanath Academic Hospital's (CHBAH) renal unit, which serves Southern Johannesburg and parts of the Northwest province, it has 3,400 beds and is located in Soweto, Johannesburg.

4.3 Study Population

The study population comprised patients 18 years and above, who were diagnosed with AKI from multiple aetiologies and were initiated on dialysis within the study period. Exclusion criteria included age below 18 years, patients not on dialysis, or those with confirmed CKD. Patients with incomplete records critical to the study were excluded.

4.4 Sample Size and Sampling Technique

Being a retrospective study, all available data fitting into the study's inclusion criteria were collected, using a convenience purposive sampling technique. Therefore, no minimum sample size was considered.

4.5 Data Collection

The researcher sourced all data pertaining to this study from CHBAH renal unit archives. Using a case record form, data was collected, such as patient's demographics (age, gender, race), AKI aetiology (medical, surgical, obstetric, others), HIV status (negative versus positive), and relevant laboratory parameters (eGFR, selected electrolytes, haemoglobin (Hb) concentration and C-reactive protein [CRP]). In addition, the duration of kidney injury, antiretroviral therapy history, any comorbidities or co-therapies, and the presence of opportunistic infections were recorded. These were all transcribed into an Excel sheet (using case identifiers to ensure anonymity) for onward analysis.

4.6 Definitions

1. Acute kidney injury (AKI)

The KDIGO criteria (26) was used to define AKI as follows:

- An increase in serum creatinine by 26.5 mmol/L within 48 hours and
 - An increase in SCr to 1.5 times baseline, which is known or presumed to have occurred within the prior seven days.
 - And/or urine volume < 0.5 ml/kg/h for 6 hours.
- ### 2. Outcomes: Possible outcomes considered in the study were:
- i. Alive and off dialysis: regained renal function by the end of the study
 - ii. Alive and on dialysis: required chronic dialysis (>6weeks from commencement) by the end of the study
 - iii. Demise during the study duration

4.7 Data analysis

Statistical analysis was performed using RStudio 2023.09.1 Build 494 for Students' T-tests and chi-square tests (27). Patient characteristics were presented as mean and standard deviation for evenly distributed data or as median and range where uneven, for all continuous variables. The categorical variables were presented as frequencies and percentages with a 95% confidence interval and p-value set at ≤ 0.05 for statistical significance.

4.8 Ethical Considerations

Ethical approval was obtained from the University of Witwatersrand and the Human Research Ethics Committee of Witwatersrand, with clearance certificate number M180771 (Appendix 2). Written permission was also obtained from the CHBAH CEO, Head of internal medicine and Head of CHBAH Nephrology unit (Appendix 3-5). Patient consent was not required, being a retrospective study. However, anonymity was maintained through case identifiers. Overall, the Declaration of Helsinki principles was strictly adhered to in all aspects of the data handling (28).

4.9 Funding

The cost incurred in this project was paid by the researcher himself. The costs amounted to approximately R1500.

4.10 Potential sources of bias

Because of the study's retrospective nature, the quality of patient records ultimately limited the number of patients that could be included in the study. The small sample size and non-randomization of collected data are a source of bias as well.

CHAPTER 5: Results

5.0 Results

A total of 103 patients who required dialysis for AKI at CHBAH were recruited into the study. In Table 1, their basic demographic data is summarized. The mean age of the study population was 39.5 ± 12.4 years (range from 19 to 78 years) and a male preponderance was noted (M: F ratio 1:1.2). The majority of the cohort were patients of African ancestry (96/103; 93.2%). There was an even distribution of HIV positive (50/103; 48.5%) versus HIV negative (48/103; 46.6%) patients, while five (5/103; 4.9%) were of an unknown HIV status. Therefore, the prevalence of HIV among the study population was 48.5%. The distribution of HIV status across genders is equally represented in Table 1. Notably, HIV-positive patients were predominantly males (28/50; 56%).

Pertaining the aetiology of AKI, medical causes constituted the majority (98/103; 86.4%); surgical causes followed, at 11.6% (12/103), while only two (2.0%) obstetric causes were identified. The distribution across gender and HIV status are depicted in Table 1, with no statistically significant differences between compared subsets. The cause of AKI in the HIV population follows same pattern as the entire study population.

TABLE 1. DIFFERENCES IN DEMOGRAPHICS AMONG PATIENTS WHO RECEIVED DIALYSIS AT CHRIS HANI BARAGWANATH ACADEMIC HOSPITAL FOR ACUTE KIDNEY INJURY USING STUDENT'S T-TESTS AND CHI-SQUARE

	Category N (%)	Female (47) 47 (46%)	Male (56) 56 (54%)	T-Test / Chi- square P	HIV Positive (50) 50 (49%)	HIV Negative (48) 48 (47%)	T-Test/ Chi- square P
Demographic Data	Age (Years); Mean (SD)	38.85 (14.14)	40.46 (11.28)	0.265	40.24 (9.83)	39.29 (15.48)	0.720
	Duration of Admission (Days); Mean (SD)	29.02 (51.51)	24.02 (27.15)	0.581	26.76 (39.34)	23.67 (41.15)	0.707
	African Ancestry	44 (93.62%)	52 (92.86%)		47 (94.00%)	44 (91.67%)	
	Mixed Ancestry	1 (2.13%)	1 (1.79%)	0.547	1 (2.00%)	1 (2.08%)	0.892
	Asian Ancestry	1 (2.13%)	1 (1.79%)		1 (2.00%)	1 (2.08%)	
	European Ancestry	0 (0.00%)	2 (3.57%)		0 (0.00%)	2 (4.17%)	
	Unknown Ancestry	1 (2.13%)	0 (0.00%)		1 (2.00%)	0 (0.00%)	
	Medical Condition	39 (89.98%)	50 (89.29%)	0.274	46 (92.00%)	38 (79.17%)	0.281
	Surgical Conditions	6 (12.77%)	6 (10.71%)		4 (8.00%)	8 (16.67%)	
	Obstetric Conditions	2 (4.26%)	0 (0.00%)		0 (0.00%)	2 (4.17%)	
	HIV Negative	21 (44.68%)	27 (48.21%)	0.286	N/A	N/A	N/A
	HIV Positive	22 (46.81%)	28 (50.00%)		N/A	N/A	
	HIV Unknown	4 (8.51%)	1 (1.79%)	0.680	N/A	N/A	
	Alive off Dialysis	25 (53.19%)	25 (44.64%)	0.052	28 (56.00%)	23 (47.92%)	0.653
	Alive On Dialysis	3 (6.38%)	10 (17.86%)	0.869	4 (8.00%)	9 (18.75%)	0.170
	Demised	19 (40.43%)	28 (50.00%)		18 (36.00%)	16 (33.33%)	0.847

From the study groups, with respect to outcomes, there were no statistically significant differences observed (Table 1), despite the HIV positive arm having more patients alive and off dialysis than their HIV negative counterparts (56.00%; 28/50) versus 47.92%; 23/48; $p= 0.653$). Patients alive and on dialysis were 8.00% (4/50) versus 18.75% (9/48) among HIV positive and HIV negative groups respectively, but this difference was not significant ($p= 0.170$). Those who demised (34 out of the 98 with a known HIV status) comprised 18 (36.00%) HIV positive and 16 (33.33%) HIV negative patients ($p= 0.847$).

The results from the Chi-square test on the demographic data indicated that whether a patient demised or not was not affected by HIV status, gender, age, or ancestry (Table 2). Indeed, for patients who survived, those who required chronic dialysis were also unaffected by any of the demographics (i.e., HIV status, gender, age, or ancestry (Table 2). The only factor which had a significant effect on whether a patient died or not was the duration of the dialysis treatment, with survivors being those who received a significantly longer duration of treatment, at 37.39 ± 52.15 days (alive) versus 7.05 ± 6.65 days (demised) of the entire study population ($p=0.000$), as shown in Table 2.

TABLE 2. RESULTS FROM THE STUDENT'S T-TEST SHOWING THE INFLUENCE OF PATIENT DEMOGRAPHICS ON THE OUTCOME OF PATIENTS WHO RECEIVED DIALYSIS FOR ACUTE KIDNEY INJURY AT CHRIS HANI BARAGWANATH ACADEMIC HOSPITAL

	Category	Alive (66)	Demised	T-Test P	Alive (66)	Chronic Dialysis	T-Test P
	N (%)	66 (64%)	(37)		66 (64%)	(13)	
			37 (36%)			13 (13%)	
Demographic Data	Age (Years); Mean (SD)	28.00 (11.59)	48.81 (13.92)	0.079	38 (11.59)	39.23 (11.42)	0.728
	Duration of Admission (Days); Mean (SD)	37.29 (52.15)	7.05 (6.65)	0.000	37.29 (52.15)	47.00 (65.21)	0.621
	African Ancestry	63 (95.45%)	33 (89.18%)	0.663	63 (95.45%)	12 (92.31%)	0.636
	Mixed Ancestry	1 (1.52%)	1 (2.70%)		1 (1.52%)	0 (0.00%)	
	Asian Ancestry	1 (1.52%)	1 (2.70%)		1 (1.52%)	1 (7.69%)	
	European Ancestry	1 (1.52%)	1 (2.70%)		1 (1.52%)	0 (0.00%)	
	Unknown Ancestry	0 (0.00%)	1 (2.70%)		0 (0.00%)	0 (0.00%)	
	Medical Condition	58 (87.88%)	31 (83.78%)	0.333	58 (87.88%)	12 (92.31%)	0.749
	Surgical Conditions	6 (9.09%)	6 (16.22%)		6 (9.09%)	1 (7.69%)	
	Obstetric Conditions	2 (3.03%)	0 (0.00%)		2 (3.03%)	0 (0.00%)	
	HIV Negative	32 (48.48%)	16 (43.24%)	0.497	32 (48.48%)	9 (69.23%)	0.350
	HIV Positive	32 (48.48%)	18 (48.65%)		32 (48.48%)	4 (30.77%)	
	HIV Unknown	2 (3.03%)	3 (8.11%)		2 (3.03%)	0 (0.00%)	
	Alive and off Dialysis	N/A	N/A	N/A	N/A	N/A	N/A
	Alive and On Dialysis	N/A	N/A	N/A	N/A	N/A	N/A
	Demised	N/A	N/A	N/A	N/A	N/A	N/A

Based on laboratory parameters on admission to the renal unit (Table 3), there was only a statistically significant difference in Hb concentration of HIV positive ($8.91 \pm 2.4 \text{g/dL}$) and HIV negative ($10.28 \pm 3.07 \text{g/dL}$) patients ($p = 0.021$). Table 4 presents the final laboratory results recorded for all participants, either at hospital discharge or prior to death. The only statistically significant difference observed was a lower mean potassium

level in HIV-positive patients compared to their HIV-negative counterparts (4.02 ± 0.97 mmol/L vs. 4.53 ± 1.34 mmol/L; $p = 0.038$).

Differences in admission laboratory parameters among outcome cohorts only showed a higher sodium level in patients who required chronic dialysis upon discharge (139.08 ± 4.03 mmol) in comparison to those alive and off dialysis (135.59 ± 7.67 mmol) with a significant p value of 0.023 (Table 3).

TABLE 3. COMPARATIVE ANALYSIS OF LABORATORY PARAMETERS AT ADMISSION BETWEEN GENDER, HIV COHORTS AND OUTCOMES OF PATIENTS WHO RECEIVED DIALYSIS FOR ACUTE KIDNEY INJURY AT CHRIS HANI BARAGWANATH ACADEMIC HOSPITAL, USING STUDENT’S T-TEST.

	Category Mean (SD)	Female (47) 47 (46%)	Male (56) 56 (54%)	T-Test P	HIV Positive (50) 50 (49%)	HIV Negative (48) 48 (47%)	T-Test P	Alive (66) 66 (64%)	Demised (37) 66 (64%)	T-Test P	Alive (66) 66 (64%)	Chronic Dialysis (13) 13 (13%)	T- Test P
Admission Laboratory Data	Sodium (mmol/l)	133.02 (7.8)	136.59 (7.31)	0.019	133.9 (6.22)	136.63 (8.46)	0.074	135.59 (7.67)	133.84 (7.74)	0.272	135.59 (7.67)	139.08 (4.03)	0.023
	Potassium (mmol/l)	5.56 (4.46)	6.31 (7.03)	0.981	4.83 (1.21)	7.2 (8.53)	0.063	6.36 (7.37)	5.25 (1.37)	0.238	6.36 (7.37)	7.29 (8.56)	0.719
	Chloride (mmol/l)	93.47 (15.23)	96.57 (10.77)	0.245	94.65 (14.63)	96.25 (11.42)	0.546	97.08 (9.46)	91.74 (17.32)	0.089	97.08 (9.46)	98.23 (6.13)	0.580
	Bicarbonate (mmol/l)	14.68 (6.05)	13.71 (5.33)	0.397	13.36 (5.91)	14.92 (5.1)	0.166	14.82 (5.57)	12.97 (5.72)	0.117	14.82 (5.57)	14.77 (5.78)	0.978
	Urea (mmol/l)	27.23 (16.49)	36.66 (35.48)	0.080	36.93 (36.96)	27.69 (16.95)	0.114	32.31 (33.99)	32.44 (15.77)	0.978	32.31 (33.99)	29.44 (19.60)	0.679
	Creatinine (mmol/l)	656.79 (509.91)	804.36 (614.47)	0.186	800.68 (574.15)	668.44 (580.77)	0.260	725.58 (571.48)	757.43 (578.08)	0.788	725.58 (571.48)	1032.54 (845.75)	0.230
	GFR (mmol/l)	12.53 (18.03)	13.96 (14.07)	0.659	12.62 (17.79)	14 (13.9)	0.668	14.12 (18.02)	11.87 (11.39)	0.439	14.12 (18.02)	11.46 (14.32)	0.565
	Calcium (mmol/l)	1.97 (0.26)	2 (0.27)	0.609	1.99 (0.28)	1.98 (0.26)	0.804	1.97 (0.27)	2.02 (0.25)	0.344	1.97 (0.27)	1.94 (0.30)	0.747
	Phosphate (mmol/l)	2.23 (2.06)	2.03 (0.93)	0.599	2.1 (1.13)	2.17 (1.81)	0.838	1.92 (1.02)	2.51 (2.1)	0.168	1.92 (1.02)	1.51 (0.67)	0.103
	Albumin (mmol/l)	26.58 (8.19)	27.12 (6.57)	0.807	24.92 (6.61)	28.95 (7.68)	0.068	26.71 (6.42)	27.11 (8.52)	0.864	26.71 (6.42)	27.6 (7.96)	0.822
	White Cell Count (x10^9/l)	15.8 (13.28)	13.73 (8.54)	0.419	14.8 (12.74)	14.15 (8.72)	0.787	14.4 (9.03)	15.08 (13.88)	0.813	14.4 (9.03)	11.51 (7.73)	0.271
	Haemoglobin (g/dl)	8.97 (2.52)	10.16 (3.06)	0.043	8.91 (2.4)	10.28 (3.07)	0.021	9.39 (2.96)	10.09 (2.69)	0.260	9.39 (2.96)	9.12 (3.01)	0.772
	CRP (mg/l)	197.1 (173.09)	142.48 (118.47)	0.233	155.75 (134.45)	171 (159.53)	0.729	168.59 (151.37)	161.11 (138.52)	0.863	168.59 (151.37)	129.5 (193.14)	0.656
	CD4 (cells.mm^3)	195.13 (123.91)	124.78 (136.12)	0.125	157.88 (133.40)	N/A	N/A	160.83 (155.07)	151.73 (75.88)	0.820	160.83 (155.07)	169.25 (228.04)	0.947
	HIV Viral Load (copies.ml)	5.70 (6.10)	6.05 (6.4)	0.396	5.92 (6.32)	N/A	N/A	6 (6.38)	5.75 (6.16)	0.546	6 (6.38)	5.43 (5.65)	0.244

As shown in Table 4, the final laboratory results for the overall study population (not stratified by HIV status) revealed significantly higher levels of urea, creatinine, potassium, and phosphate among participants who experienced poorer outcomes, including progression to chronic dialysis and death ($p < 0.005$). Further, lower sodium and chloride were associated with demise compared to alive patients in the entire population studied (p values < 0.005).

TABLE 4. COMPARATIVE ANALYSIS OF FINAL LABORATORY RESULTS AMONG OUTCOME SUBGROUPS OF PATIENTS UNDERGOING DIALYSIS FOR ACUTE KIDNEY INJURY AT CHRIS HANI BARAGWANATH ACADEMIC HOSPITAL USING STUDENT’S T-TEST

	Category Mean (SD)	Female (47) 47 (46%)	Male (56) 56 (54%)	T- Test P	HIV Positive (50) 50 (49%)	HIV Negative (48) 48 (47%)	T- Test P	Alive (66) 66 (64%)	Demised (37) 66 (64%)	T- Test P	Alive (66) 66 (64%)	Chronic Dialysis (13) 13 (13%)	T- Test P
Final laboratory Data	Sodium (mmol/l)	138.93 (7.69)	139.22 (6.65)	0.844	139.22 (5.85)	139.23 (7.73)	0.991	140.3 (5.14)	136.52 (9.68)	0.048	140.3 (5.14)	137.69 (4.75)	0.091
	Potassium (mmol/l)	4.2 (1.3)	4.34 (1.09)	0.559	4.02 (0.97)	4.53 (1.34)	0.038	4.02 (0.89)	4.86 (1.52)	0.007	4.02 (0.89)	4.37 (0.81)	0.177
	Chloride (mmol/l)	100.88 (17.11)	97.96 (8.69)	0.317	101.71 (15.99)	96.74 (9.19)	0.074	102.49 (13.54)	92.42 (8.84)	0.000	102.49 (13.54)	96.15 (4.1)	0.003
	Bicarbonate (mmol/l)	19.54 (5.84)	19.37 (11.61)	0.928	19.3 (12.55)	19.81 (5.83)	0.805	19.54 (5.01)	19.23 (15.43)	0.916	19.54 (5.01)	19.77 (5.26)	0.886
	Urea (mmol/l)	14.56 (12.04)	21.12 (16.91)	0.028	16.07 (15.54)	20.08 (15.35)	0.214	12.34 (10.93)	30.72 (15.69)	0.000	12.34 (10.93)	26 (15.81)	0.010
	Creatinine (mmol/l)	289.95 (238.54)	513.44 (521.62)	0.006	389.13 (402.75)	433.81 (475.09)	0.626	283.32 (320.55)	693.39 (509.27)	0.000	283.32 (320.55)	798.54 (394.46)	0.000
	GFR (mmol/l)	40.09 (38.99)	36.01 (36.43)	0.599	39.38 (38.56)	38.3 (37.63)	0.891	49.84 (39.58)	12.23 (9.78)	0.000	49.84 (39.58)	8.62 (6.49)	0.000
	Calcium (mmol/l)	2.01 (0.36)	1.98 (0.27)	0.602	2 (0.24)	1.98 (0.37)	0.832	2.02 (0.27)	1.92 (0.4)	0.252	2.02 (0.271)	2.04 (0.29)	0.836
	Phosphate (mmol/l)	1.58 (1.04)	1.65 (1.15)	0.779	1.62 (1.08)	1.65 (1.15)	0.901	1.39 (0.87)	2.21 (1.38)	0.013	1.39 (0.87)	1.3 (0.74)	0.736
	Albumin (mmol/l)	31.21 (10.09)	28.27 (7.95)	0.423	30.77 (8.82)	28.2 (9.74)	0.522	31.33 (9.97)	26.29 (5.62)	0.127	31.33 (9.97)	39.5 (3.54)	0.088
	White Cell Count (x10 ⁹ /l)	11.56 (7.8)	9.45 (6.57)	0.217	8.86 (7.06)	11.62 (7.44)	0.116	9.59 (6.49)	12.71 (8.56)	0.143	9.59 (6.49)	9.49 (8.24)	0.970
	Haemoglobin (g/dl)	14.59 (36.94)	9.02 (2.39)	0.341	14.58 (37.93)	9.32 (2.28)	0.392	13.25 (31.31)	8.54 (2.38)	0.264	13.25 (31.31)	8.79 (1.7)	0.290
	CRP (mg/l)	98.93 (105.66)	175.91 (167.47)	0.202	154.1 (154.81)	126.69 (137.16)	0.664	88.17 (88.86)	247.57 (182.49)	0.062	88.17 (88.86)	280 ()	*

CHAPTER 6: Discussion

6.0 Discussion

In our study, the prevalence of HIV among patients with AKI was notably high at 48.5%. By comparison, Vachiat et al. (2013) reported a 14.8% HIV prevalence among 684 patients presenting with renal failure in South Africa, while Chothia and Ramsunder (2019) documented a prevalence of 40%, which is more closely aligned with our findings (43, 67). Collectively, these studies underscore the substantial burden of HIV within populations affected by renal disease. It can be argued that a complete abolition of HIV/AIDS could lead to a reduction in renal disease burden, considering the multifactorial mechanisms of HIV-related renal disease. The impact of HIV/AIDS on renal function is further exacerbated by the presence of co-morbid conditions such as sepsis. In one report, HIV magnified the influence of sepsis in causing AKI, to as high as 43% compared to HIV-negative patients with sepsis (17%) (68).

In our study, medical causes predominated as aetiology of AKI in the entire study population (89/103; 86.4%) and in the HIV-positive subset as well (46/50; 92%). The reports by Effa and colleagues as well as Chadwick et al., were similar to ours, with medical causes of AKI atop (69, 70). Though not itemized in this study, common medical conditions leading to AKI are fluid depletion, sepsis, cardiac failure, haemorrhage, toxin ingestion, and both herbal and pharmacological (29, 31, 69).

The outcome of AKI within this study was grouped into “patient alive off dialysis”, “patient alive on dialysis” or “demise”. From the study groups, with respect to outcomes, there were no statistically significant differences observed (Table 1). Chadwick and coworkers documented a similar observation in their study, “25% of AKI cases had completely resolved, 25% of patients had died, and 18.7% of AKI cases had progressed to chronic kidney disease”, with no significant difference among the outcome groups (70). Notwithstanding, the HIV-positive arm had more patients alive and off dialysis than their HIV-negative counterparts (56.00% (28/98) versus 47.92% (23/98), $p= 0.653$). The extent of other contributory factors, such as co-morbidities adding to our observation and serving as confounders, remains unknown (43, 70). Patients alive and on dialysis were 8.00% (4/98) versus 18.75% (9/98) among HIV-positive and HIV-negative groups

respectively ($p = 0.170$). Those who demised (out of the 98 with a known HIV status) were 34, comprising 18 (36.00%) HIV positive and 16 (33.33%) negative patients ($p = 0.847$). In this study, when examined collectively, the HIV-positive group demonstrated better outcomes than the HIV-negative group, but this was not significant statistically. It is expected from previous works that HIV-positive patients with renal disease have a poorer renal outcome than otherwise (43). The small sample size in our study poses a challenge and may be responsible for our finding. Larger cohorts are therefore recommended to draw a conclusion on the subject.

The predictors of poor renal outcome in AKI are multipronged. Demography, duration of hospital stay, duration of dialysis, and laboratory parameters are some considerations from earlier studies. (2, 6, 58, 59, 61, 71, 72).

From a demographic standpoint, almost all patients were of black ancestry, making it difficult to draw any substantial conclusion. Also, the statistically significant gender-related differences in sodium and haemoglobin levels, noted on admission (Table 3) and discharge (Table 4) laboratory parameters, are likely related to dietary preferences or are physiological (73, 74). Notably, all the patients included in this study, based on their admission bloods, were anaemic by World Health Organization standards when gender is factored in (73). This lends credence to the severity of renal disease at presentation in our environment and possibly other existing nutritional deficiencies and/ or co-morbidities which predispose to anaemia. An incidental and mainly physiological observation was higher Hb values in males. This is because males have more androgens (in circulation) which increases erythropoietin, and constrict the renal microvasculature, with resultant increase red cell mass through decreased oxygen delivery (75). Males also have more muscle mass requiring higher oxygen demand, which is met by increasing oxygen carrying capacity through Hb. Other losses during menstruation and parturition add to the low Hb observed in females versus males.

A critical observation was that patients who were demised had a significantly shorter mean duration of admission (about 7 days) compared to those who survived (about 37 days), while those requiring chronic dialysis had an even longer duration before discharge (47 days) (Table 2). The shorter admission durations for those who demised likely reflect

the severe nature of their condition, which led to early mortality, whereas survivors generally required longer care, which was further extended when chronic dialysis was required (Table 2). Although prolonged hospitalization facilitates comprehensive monitoring and management of renal function, fluid balance, and co-morbidities, it also increases the risk of complications that can exacerbate AKI. This is supported by the findings of Prowle and colleagues, who suggested that even mild AKI is linked to prolonged recovery from critical illness, underscoring the potential for extended hospitalization to inadvertently worsen renal injury (76). Thus, it can be inferred that the duration of hospitalization may be influenced by other unidentified factors within this study, which could impact renal outcomes.

In the context of HIV, there was significantly lower Hb levels among the HIV-positive group compared to the HIV-negative group (Table 3), though it did not translate into increased mortality, and is likely due to anaemia of chronic disease, related to HIV-infection (77, 78). Other considerations are the role of certain antiretroviral therapy which predispose to anaemia (zidovudine), and some opportunistic infections such as Parvovirus B-19, which were not explored during the study. No published data among AKI patients could be found, but Venturas and colleagues discovered statistically significant lower Hb levels among their HIV-positive COVID-19-infected cohort, and a few of their study participants had CKD (79). Jackson et al. demonstrated the same as well, among deep vein thrombosis (DVT) patients with versus without HIV infection in their study (80).

From the comparative analysis done on the final laboratory data of participants, an interesting finding was a significantly lower potassium level in HIV-positive patients compared to the HIV-negative group (Table 4). This may possibly be due to a proximal potassium wasting tubulopathy due to HIV infection or anti-retroviral use (tenofovir) (81). Other contributors to hypokalemia in HIV are HIV/AIDS-related enteropathies or ongoing infectious diarrhoea. We found higher potassium levels among demised patients (Table 4), but our study was not powered to detect whether a lower potassium level provided a survival benefit. High serum potassium occurs in AKI as a result of increased cellular damage in the face of a reduced renal excretion, while metabolic acidosis also causes an intracellular to intravascular shift of this electrolyte. When comparing final

laboratory data between the demised and alive groups, higher potassium, phosphate, urea, and creatinine were all significantly (p values <0.05) higher in demised patients (Table 4), providing evidence that certain electrolyte abnormalities in AKI are associated with increased mortality. Such findings are consistent with other international results (2, 6). The extended duration of dialysis among survivors in our study likely provided an additional clearance benefit, resulting in lower levels of the aforementioned electrolytes. The higher levels of potassium and phosphate in poorer outcomes in our study are congruent with increased cellular damage in the face of a reduced renal clearance seen in AKI. We also found significantly lower sodium and chloride levels in the demised group versus survivors (Table 4), perhaps suggesting these patients were in a fluid overloaded state with dilutional effect on these electrolytes, either from the AKI itself or post aggressive fluid resuscitation of patients, or from excessive diuretic therapy (71). Additional factors, such as the heightened risk of cerebral edema and dialysis disequilibrium syndrome associated with hyponatremia, may also contribute to increased mortality in patients with AKI. Furthermore, the significantly lower chloride levels in the patients needing chronic dialysis may represent an artefact introduced by the dialysis itself or perhaps as a consequence of diuretic use (71).

It was also noted that patients who required chronic dialysis and those who demised had higher urea and creatinine than those alive and off dialysis from the final laboratory data presented in Table 4. This may mean that early dialysis may possibly, have assisted in preventing death but this negates earlier documentation and is beyond the scope of this work (42, 76). Elevated urea and creatinine levels were noted in the poor outcome groups, indicating progression toward chronic kidney disease (CKD). This finding aligns with the report by Brookes and other literature, which demonstrate that increasing serum urea and creatinine concentrations are proportionate to declining renal function (72).

In summary, from this study, and in application to local context, renal outcomes in AKI patients from whatever aetiology are not affected by demography or HIV status. Patients with longer treatment durations may have a greater chance of survival. However, clinicians should pay attention to identifying patients with high levels of potassium, phosphate, urea, and creatinine in blood, as these are at risk of adverse outcomes. Findings of low sodium and chloride should trigger a review of patient fluid and diuretic

management as well, to avoid worsening renal outcome. Measures to correct these electrolyte abnormalities early may be beneficial in reducing overall morbidity and mortality in the AKI population in resource poor settings where availability of chronic dialysis remains a luxury.

6.1 Limitations

Our data collection and findings were limited by the retrospective nature of this study, and the exclusion of some patients due to critical missing data, therefore presenting information and selective biases. Further, the validity of some findings was riddled with confounding bias due to unavoidable non-exclusion (such as co-morbidities) prior to data selection, and other unidentified contributors. A significant limitation is also the lack of data on the specific causes of AKI in the study group. Our small sample size could have impacted the stated results as well.

6.2 Conclusion

This study has brought to light several pivotal findings regarding patients requiring acute dialysis for AKI at CHBAH. The typical patient profile emerging from this study is a middle-aged male of African ancestry, with AKI more likely from a medical aetiology. HIV remains a risk factor for renal disease such as AKI in South Africa. The study's renal outcomes reflect global trends, with a significant majority who survived, a fewer subset who progressed to dialysis dependence, and about a third of the studied population had succumbed to the illness. However, no significant differences were noted across the patients, when stratified by HIV status. Higher urea, creatinine, potassium and phosphate, as well as lower sodium and chloride were observed with poor renal outcome.

6.3 Recommendations

Some findings from this study were judged inconclusive due to its small sample size. We, therefore, recommend similar studies with a larger sample size, well-balanced demography and preferably of longitudinal design. The effect of duration of hospital stay and electrolyte abnormalities in AKI need further elucidation as well.

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APPENDIX 1: Data Extraction Form

CHRIS HANI BARAGWANATH HOSPITAL : DATA SHEET									
Study Number					DIAGNOSIS				
Age									
RACE	B	W	C	I					
Dialysis Initiation									
Date of ARV Initiation									
ARV	3TC/FTC		TDF		AZT		D4T		
	ABC		EFV		Aluvia		Other		
Date									
Weight									
Na/K									
Cl/CO									
Ca2									
PO4									
Albumin									
WCC									
Hb									
MCV									
Platelets									
CRP/PCT									
INT/PTT									
TB/CB									
ALT/AST									
ALP/GGT									
LDH/CK									
COMOBIDITIES									
	Duration	Treatment		Complications					
DM									
HPT									
TB History									
Other									
INVESTIGATIONS									
Date									
RVD		CD4		VL		HEP B			HEP C
TPHA		TSH		HbA1C		Cholesterol			
Ferritin		t.sats		PTH					
Autoimmune Serology		ANA		dsDNA		ASOT		ENA	
		C3/C4		ANCA					
UPCR		Urine microscopy:							
Sonar									
Other									
OUTCOME									
Resolution of AKI		Chronic HD		PD		Lost to follow up		Death	

APPENDIX 2: Ethical Clearance 1

 UNIVERSITY OF THE WITWATERSRAND JOHANNESBURG	HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)
---	--

Office of the Deputy Vice-Chancellor (Research and Innovation)

TO: Dr M Smith
School of Clinical Medicine
Department of Medicine
Division of Internal Medicine
Faculty of Health Sciences

E-mail: mpusmith@icloud.com

CC: Supervisor: Drs K Motse and M Mashabane
<Mududuzi.Mashabane@wits.ac.za>
and <HREC-Medical Research Office@wits.ac.za>

FROM: Mr Iain Burns
Human Research Ethics Committee (Medical)
Tel: 011 717 1252
E-mail: Iain.Burns@wits.ac.za

DATE: 2024/10/15

REF: R14/49

PROTOCOL NO: **M240995** (This is your ethics application reference number. Please quote it in all enquiries, oral or written, relating to this study.)

PROJECT TITLE: *Acute kidney injury: a comparative study of the outcomes in HIV positive and HIV negative patients*

Please find attached the Clearance Certificate for the above project. I hope it goes well and that an article in a recognized publication comes out of it. This will reflect well on your professional standing and contribute to Government funding of the University.



MSWorks2000/Iain0007/Clearscan.wps

APPENDIX 3: Ethical Clearance 2

UNIVERSITY OF THE
WITWATERSRAND
JOHANNESBURG



R49 Dr M Smith

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)
CLEARANCE CERTIFICATE NO. M240995

NAME: Dr M Smith **DEGREE:** M Med (Int Med)
(Principal Investigator)

DEPARTMENT: School of Clinical Medicine
Department of Medicine
Division of Internal Medicine
Faculty of Health Sciences

PROJECT TITLE: *Acute kidney injury: a comparative study of the outcomes in HIV positive and HIV negative patients*

DATE CONSIDERED: Ad hoc

DECISION: Approved unconditionally

CONDITIONS: Renewal of M18/07/71 - expired on 2023/08/06

NOTE: If contact information regarding student study participants is required, please contact the Registrar's office - <Nicoleen.Potgieter@wits.ac.za>

SUPERVISOR: Drs K Motse and M Mashabane

APPROVED BY: 
Ms I.J. van Niekerk, Co-Chairperson, HREC (Medical)

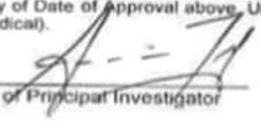
DATE OF APPROVAL: 2024/10/15 **EXPIRY DATE:** 2029/10/14

This Clearance Certificate is valid for 5 years from the date of approval. An extension may be applied for.

DECLARATION OF INVESTIGATORS

To be completed in duplicate and ONE COPY returned to the Research Office secretariat on the 3rd floor, Phillip Tobias Building, Parktown, University of the Witwatersrand, Johannesburg.

I/we fully understand the conditions under which I am/we are authorized to carry out the above-mentioned research and I/we undertake to ensure compliance with these conditions. Should any departure be contemplated from the research protocol as approved, I/we undertake to submit details to the Committee. I agree to submit a yearly progress report in the format available at <https://wits.ac.za/research/researcher-support/research-ethics/ethics-committees/>. This report is due annually, for the duration of the Clearance Certificate, beginning on the first anniversary of Date of Approval above. Unreported changes to the study may invalidate the clearance given by the HREC (Medical).


Signature of Principal Investigator

08/05/2025
Date

APPENDIX 4: Turnitin Report

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by Mpumelelo Smith

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