

# The Characteristics, Management and Outcome of Patients Receiving Acute Dialysis in Swaziland (Eswatini)

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## Abstract

**Background:** Eswatini, a land-locked country in Southern Africa with a population of about 1.4 million, is one of the few countries in Africa where dialysis is available as part of the country's health plan. This is the first study of the pattern of kidney disease amongst patients receiving acute dialysis in the country.

**Methods:** This was a retrospective folder review of patients who were dialysed at Eswatini's three institutions where dialysis is offered. Patients dialysed acutely from the 1<sup>st</sup> of June 2015 to the 31<sup>st</sup> of May 2016 were included. A data collection form was used to collect information on patient demographics (de-identified), co-morbidities, reason for referral for dialysis, place of referral, basic investigations, and outcome in terms of renal recovery, need for chronic dialysis and 30 day mortality. The study was approved by the National Health Research Review Board, the Ethics committee of Eswatini. A waiver of consent was granted as patient information was de-identified. Data from the data collection forms was entered into Microsoft Excel and RStudio software for analysis by the principal investigators.

**Preliminary Results:** A total number of 219 patients received acute dialysis over the study period. Ages ranged from 9 months to 84 years. Most underwent acute haemodialysis with only 4 undergoing acute peritoneal dialysis. The majority (131) 59.8% were male. Co-morbidities included HIV in 124 (56.6%), hypertension in 118 (54.1%), diabetes in 48 (21.9%), and urinary tract obstruction in 13 (5.9%). A total of 87 (39.7%) patients had received Tenofovir Disoproxil Fumarate for treatment of HIV. Of the patients with available data, those achieving partial or full renal recovery within 30 days totaled 42 (19.2%), and 88 (40.2%) went onto chronic dialysis. There were 31 deaths (out 189 identified folders) (16.4%) within 30 days.

**Conclusions:** Dialysis requiring patients in Eswatini include the young and old. The most notable risk factors are hypertension and HIV, as well as recent use of Tenofovir Disoproxil Fumarate. A large proportion of patients present with advanced kidney disease that requires ongoing renal replacement therapy. Improved management of the identified risk factors for acute and chronic kidney disease may reduce the number of patients requiring dialysis in Eswatini.

**Keywords:** Dialysis; Renal recovery; Mortality

## Introduction

Kidney disease may occur due to various conditions that cause acute or chronic kidney damage. The result is the disturbance of some or all of the functions of the kidneys, including electrolyte, acid-base, and fluid balance. It is a very serious illness that can lead to several complications including death if not treated. Epidemiological studies have clearly demonstrated the association between both acute and chronic kidney disease and increased mortality risk [1,2].

Acute kidney injury is defined by deterioration of kidney function involving either an increase in serum creatinine by more than one and a half times from baseline within 7 days, an increase in serum creatinine by 26.4 µmol/l within a 48 hour period, or a decrease in urine output by at least 0.5 ml/kg/hour over 6 hours [3]. It is staged according to severity from 1 to 3 [3].

Chronic kidney disease is present if a patient has had kidney abnormalities for at least 3 months, involving either the structure of the kidneys, such as scarring, a urine abnormality such as the presence

of abnormal amounts of protein, or a decrease in the glomerular filtration rate of the kidneys [4]. It is staged according to severity from 1 to 5 [4].

Detection of both acute kidney injury and chronic kidney disease in their early stages may provide the opportunity to institute management that can slow progression to a more severe and life threatening stage [5,6]. However, patients surviving an acute kidney injury episode have been shown to remain at increased future risk of developing chronic kidney disease, thus contributing to the burden of chronic kidney disease in a population [7].

Although some causes of acute and chronic kidney disease are not preventable such as genetic or autoimmune causes, many potential causes can be avoided by educating the public and health workers. Potentially preventable causes of acute kidney injury described in Africa include dehydration, sepsis and herbal toxins [8,9]. Modifiable causes of chronic kidney disease that are reported in Sub-Saharan Africa include diabetes, hypertension, and HIV [10].

In Eswatini acute and chronic haemodialysis and peritoneal dialysis are offered to patients. Acute peritoneal dialysis is offered to the paediatric age group as well as to patients at the National TB Hospital, treated for drug resistant tuberculosis, who are unable to access the three dialysis centres because of infection control precautions. Haemodialysis is offered at Mbabane Government hospital (the main referral hospital), Raleigh Fitkin Memorial Hospital and Hlathikhulu Government Hospital only.

All three hospitals have laboratories and radiology departments. The Kidney Disease Improving Global Outcomes (KDIGO) group has listed some basic investigations in the management of patients presenting with acute kidney failure [5]. These include laboratory tests (serum creatinine, blood urea nitrogen, and electrolytes), urine analysis (dipstick, microscopy and electrolytes), and abdominal imaging (ultrasonography and computed tomography as indicated) [5].

The treatment of kidney failure with dialysis carries high economic costs, with estimates in South Africa at about ZAR200, 000-00 per patient per year [11].

In view of the personal and national costs of kidney disease, it is vital that measures be taken to sensitise the public and medical staff to this condition, as well as to emphasise the need for its prevention and early detection.

Knowledge of the pattern and outcome of kidney disease in the country can help inform public policy at the national level and improve staff training and public awareness campaigns.

This study was designed to address the gap in the body of knowledge on kidney disease in Eswatini, and to provide useful information for policy makers.

## Methods

### Study design

A descriptive descriptive retrospective design.

### Primary aim

To determine the 30 day mortality rate amongst patients who received acute dialysis from the 1<sup>st</sup> of June 2015 to the 31<sup>st</sup> of May 2016.

### Secondary aim

To study the demographics, causes of kidney failure, management and renal outcomes of the population group studied.

### Setting and study population

The study included all patients referred for acute dialysis at each of the country's three facilities that offer dialysis. The population of Eswatini of about 1,4 million people is subdivided into four regions, namely Hhohho with a subpopulation of 270000, Manzini with 319530, Shiselweni with 217000 and Lubombo with 202000 [12,13]. HIV/AIDS and tuberculosis affect a significant proportion of the population [12]. There is also a documented rise in non-communicable diseases in the country [14].

The three dialysis centres servicing Eswatini are located in three of the country's regions, namely Hhohho (Mbabane Government Hospital, the main Referral Hospital, with dialysis services since 2001), Manzini (Raleigh Fitkin Memorial Hospital with dialysis services since 2011), and Shiselweni (Hlathikhulu Government Hospital with dialysis services since 2013).

### Dialysis Protocol

Acute dialysis was commenced on patients with kidney failure presenting with uraemic features, metabolic acidosis, refractory hyperkalaemia or pulmonary oedema.

### Data collection

The study investigators collected data from the unit registers and patient files and recorded it on the data collection form.

### Data analysis

Information from the data collection forms was entered into Microsoft Excel and RStudio software for analysis by the principal investigators. Due to missing data, only very basic statistical analyses were performed such as mean age and percentage proportions.

### Ethical Considerations

The study was approved by the Eswatini Ethics committee, the National Health Research Review Board. Permission for the study was also sought from the administration boards of the individual hospitals and from the Ministry of Health. A waiver of consent was granted for the study as patient data was de-identified to respect confidentiality.

## Results

### Demographics

A total of 219 patients received acute dialysis between the 1<sup>st</sup> of June 2015 and the 31<sup>st</sup> of May 2016, at the three institutions providing dialysis in Eswatini. Of these, 131 were male (59.8%) and 88 were female (40.2%). The mean age for all the patients was 48.6 years. The mean age of males at 51.6 years was slightly higher than that of females which was 44.8 years. Most patients were treated with haemodialysis with only 4 treated with acute peritoneal dialysis.

### Renal outcomes

Only 189 of the 219 study patients (86.3%) had data on 30 day mortality, and out of these 189 patients, 31 were recorded as dead within 30 days (16.4%). The total going on to chronic dialysis was 88 out of the total of 219 patients (40.2%). Among the 118 patients with data for renal recovery, a total of 42 achieved complete or partial renal recovery (35.6%). A total of 15 out of the 177 patients with data

(18.5%) self-discharged and were then lost to follow up within the study period (Table 1).

### Comorbid diseases

The leading comorbidity amongst all the patients was HIV at 57.1%, followed by Hypertension at 54.1% (Table 2).

### Causative factors and associations leading to the need for acute dialysis

The commonest pathophysiological factor leading to the need for acute dialysis was pre-renal at 49.7%. This was followed by the finding that 42.2% of the patients with non-missing data were on Tenofovir Disoproxil Fumarate (TDF) at the time of detection of their kidney failure (Table 3). There were 13 out of 158 (8.2%) patients with underlying urinary tract obstruction and 24 out of 156 (15.4%) had a recent history of ingesting herbal medication.

### Patients receiving the basic set of investigations

Only 102 (46.6%) of the patients studied received the complete recommended basic set of investigations for patients presenting with kidney failure (Figure 1).

### Discussion

This is the first study to attempt to describe the population of people receiving acute dialysis in Eswatini. As it was a retrospective study, there was a lot of incomplete data, which hampered the ability to analyse the data for associations between certain variables and patient outcomes. However, the basic data that was obtained sheds some light on the population receiving acute dialysis in Eswatini.

The finding that most of the patients receiving dialysis were male was consistent with published data showing that more males receive dialysis than females [15]. This is despite the fact that chronic kidney disease is reported more in females than in males [16].

The overall 30 day mortality rate of 16.4% amongst patients with non-missing data included both patients with acute kidney injury and those who had end stage renal disease. A Cape Town study looking at patients with all stages of acute kidney injury, found a 30 day mortality of 37.6% amongst those who were dialysed [17].

A big concern from the data is the large proportion of patients who went on to require chronic dialysis. This suggests earlier stages of their chronic kidney disease was missed. Standard practice is that patients with chronic kidney disease be detected early and followed up at clinics where steps to slow or even prevent progression to end stage renal disease can be instituted [6].

The two leading comorbidities were HIV and hypertension, with diabetes mellitus only reported in 22.4% of the patients with available data. The high number of patients with HIV reflects the current high prevalence of HIV in Eswatini [18]. The significant proportion of patients with hypertension is supported by data from the country's STEPS Non-communicable Risk Factor Survey conducted in 2014 in which untreated hypertension was detected in 78.9% of the adults studied [19].

Unlike in more developed parts of the world where diabetes mellitus is reported to be a leading cause of chronic kidney disease, together with hypertension, it ranked only third amongst the patients in our data [20]. This may be partly explained by missed diagnosis, due to reduced insulin clearance and gluconeogenesis in the chronically diseased kidneys, leading to deceptively normal blood glucose levels in some patients with diabetic kidney disease [21]. In this study, there

**Table 1:** A total of 15 out of the 177 patients with data (18.5%) self-discharged and were then lost to follow up within the study period.

Renal outcome	Total identified	Total out of all uncensored patients	Total out of all study patients including censored patients
Relapses	2	2/166 (1.2%)	2/219 (0.9%)
Self-discharged	15	15/177 (8.5%)	15/219 (6.8%)
Overall Dead in 30 days	31	31/189 (16.4%)	31/219 (14.2%)
Transfer outs	33	33/177 (18.6%)	33/219 (15.1%)
Renal recovery	42	42/118 (35.6%)	42/219 (19.2%)
Chronic dialysis	88	88/219 (40.2%)	88/219 (40.2%)

**Table 2:** The leading comorbidity amongst all the patients was HIV at 57.1%, followed by Hypertension at 54.1%.

Condition	Total identified	Total out of all uncensored patients	Total out of all study patients including censored patients
Diabetes Mellitus	48	48/214 (22.4%)	48/219 (21.9%)
Hypertension	118	118/218 (54.1%)	118/219 (53.9%)
HIV	124	124/217 (57.1%)	124/219 (56.6%)
HIV on ART	115	115/214 (53.7%)	115/219 (52.5%)

was no provision to look for other diabetes related target organ damage such as diabetic retinopathy. Reports on the leading causes of chronic kidney disease in sub-Saharan Africa, also found that diabetes was not the most common cause [22].

Regarding the causative factors and associations for the need for acute dialysis, pre-renal causes were common. From the data collection sheets, only 44 patients had a clear indication of the cause of acute kidney injury, such as gastroenteritis and septic shock. There were no recorded cases of Haemolytic Uraemic Syndrome. Data from other regions of Africa also report a predominance of pre-renal causes of acute kidney injury such as diarrhoeal diseases [23].

The use of TDF was found in a large proportion of the patients requiring acute dialysis. This study was not designed to detect whether or not TDF was the cause of kidney failure in the patients, and it can therefore only be said to be an association at this stage. However the finding of kidney failure necessitated the removal of this valuable anti-retroviral drug from patients's treatment armamentarium. TDF has been shown to cause both acute and chronic kidney disease in studies [24]. Guidelines exist to identify patients who are most at risk of TDF associated kidney disease [25]. A recommendation from the study is that these guidelines be emphasised at the time of initiation of anti-retroviral therapy. The adoption of guidelines to monitor for TDF associated proximal renal tubular injury, using urine dipsticks, could assist with the early detection and management of affected patients in the country [26].

A recent history of ingesting herbal medication was detected in 15.4% of the patients, which is not an insignificant figure. Many indigenous plants have proven health benefits, however, analysis of these plants to elicit their therapeutic and toxic dose, in order to facilitate safe prescription is essential.

The association of Non-Steroidal Anti-Inflammatory Drug (NSAID) use was detected in 7.1% of the patients. These are drugs that

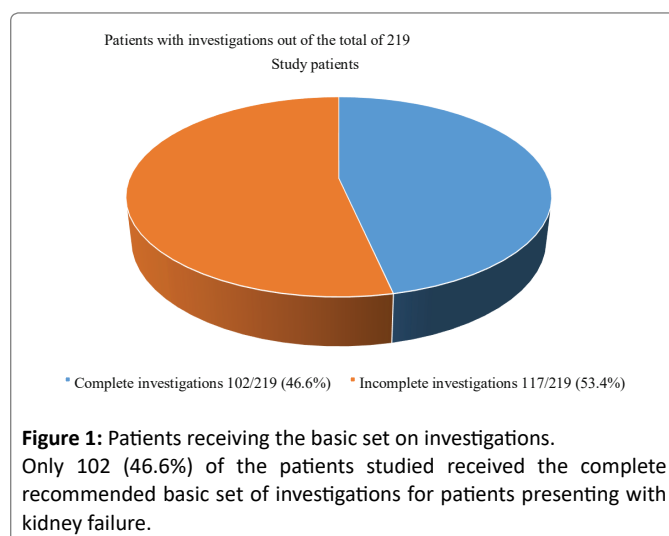
can be easily accessed over the counter in the country. Although their prescription in the short-term may well be necessary, their use needs to be held off in the presence of reduced blood pressure and worsening kidney failure as they may cause or exacerbate kidney failure [27]. The implementation of the Medicine's control Bill in Eswatini should help in preventing people from self-medicating with these drugs. Education of Health workers is key in ensuring safe prescription of non-steroidal anti-inflammatory drugs.

The finding of kidney disease arising from urological tract obstruction underlines the need for increased Urological services in the country. Often early detection and treatment of urinary tract obstruction facilitates treatment that can circumvent the need for dialysis [28].

Only 46.6% of the patients had the full set of recommended basic investigations as outlined by KDIGO for patients presenting with

**Table 3:** The finding that 42.2% of the patients with non-missing data were on Tenofovir Disoproxil Fumarate (TDF) at the time of detection of their kidney failure.

AKI cause/association	Total identified	Total out of all uncensored patients	Total out of all study patients including censored patients
Aminoglycosides	1	1/155 (1.8%)	1/219 (0.5%)
Malaria	1	1/219 (0.5%)	1/219 (0.5%)
Pregnancy	4	4/219 (1.8%)	4/219 (1.8%)
Non steroidal anti-inflammatory drugs	11	11/155 (7.1%)	11/219 (5%)
Urinary tract obstruction	13	13/158 (8.2%)	13/219 (5.9%)
Herbal remedy use	24	24/156 (15.4%)	24/219 (11%)
Pre-renal causes (diarrhoeal illness/gastroenteritis=35; septic shock=7; haemorrhage=1; heart failure=1; unspecified=36)	80	80/161 (49.7%)	80/219 (36.5%)
TDF use	87	87/206 (42.2%)	87/219 (39.7%)



**Figure 1:** Patients receiving the basic set on investigations. Only 102 (46.6%) of the patients studied received the complete recommended basic set of investigations for patients presenting with kidney failure.

kidney failure. Some of these are simple to do, such as urine dipsticks. Basic ultrasonography of the kidneys, ureters and bladder can be taught to medical officers.

### Study limitations

The accuracy of our data results was limited by the incompleteness of patient records in the three institutions. This lack of complete data necessitated the censoring and omission of patients with missing information in the calculations of many of the variables examined in the study. This was done in order to reduce bias in reporting. The only data that was detected from the total number of 219 patients was that for malaria, pregnancy, those with a complete set of investigations and those going on to chronic dialysis.

Due to incomplete data, it was not possible to accurately compare data per institution. Furthermore, it was not possible to ascertain an association between 30 day mortality and gender, HIV status or age.

Although hypertension was one of the leading co-morbidities, the investigations performed were not adequate enough to identify those with hypertension secondary to underlying renal or renovascular disease.

Another limitation is that none of the patients had a kidney biopsy. This is due to resource limitations such as the lack of biopsy needles and fully equipped pathology services. It is hoped that with the advancement of kidney service delivery in the country, kidney biopsies will be performed at Mbabane Government Hospital, the main referral hospital.

### Conclusion

A large proportion of those requiring acute dialysis during the study period were patients with missed chronic kidney disease, who went onto require chronic dialysis.

The leading co-morbidities amongst the patients studied included a communicable disease-HIV and a potentially modifiable non-communicable disease -hypertension.

Many causes of dialysis receiving kidney failure were found to be conditions that can be targeted by population wide education (such as early rehydration for people with diarrhoea and vomiting, avoiding toxic herbal remedies and avoiding self-medicating with non-steroidal anti-inflammatory drugs), as well as screening for conditions that can lead to urinary tract obstruction-such as prostate cancer and cancer of the cervix.

The finding of TDF use in 42.2% of patients dialysed for kidney failure indicates the need for greater adherence to the provided screening tools to detect patients at high risk for TDF induced kidney disease at the time of anti-retroviral therapy initiation. In addition, point of care tests such as a urine dipstick and bedside serum creatinine analysis to enable early detection of TDF induced acute kidney injury are highly recommended.

Although limited by the nature of a prospective observational study, some important insights in to the characteristics of patients requiring acute dialysis in Eswatini have been gained by the study. It is anticipated that the information gathered can be employed by relevant stakeholders to reduce the burden of kidney disease in the country. Follow-up studies of higher quality design would be useful.

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### Conflict of Interest Statement

The Principal Investigator has a Consultancy contract with Fresenius Medical Care, which has a Public Partnership Agreement with the Government of Eswatini at one of the study centres (Mbabane Government Hospital).

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