

# Assessment of the Prognosis of Chronic Kidney Disease in People Living with HIV, Co-Morbid Hypertension and Diabetes Mellitus in Two Clinics in Maseru

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## Abstract

**Background:** Chronic kidney disease (CKD) has recently posed a significant public health concern in lower-middle-income countries, including Lesotho. Despite comorbidities such as diabetes mellitus (DM), hypertension (HTN), and Human Immunodeficiency Virus (HIV) worsening the condition, the combined impact on Chronic kidney disease prognosis is not well understood in Lesotho.

**Objective:** The study aimed to assess the prognosis of chronic kidney disease in individuals living with Human Immunodeficiency Virus, co-morbid hypertension, and diabetes mellitus, in two clinics in Maseru.

**Method:** This retrospective cross-sectional study was conducted at the Lesotho Defence Force (LDF) and Domiciliary clinics using medical records in adult patients living with HIV, comorbid hypertension and/or diabetes mellitus. The data was analysed with IBM SPSS version 20. The descriptive data were presented as frequencies and percentages, while the continuous data were presented as means and standard deviations.

**Results:** At the LDF clinic, 53.1% of the patients were female, and 46.9% were male. Patients living with HIV were diagnosed with CKD stage 2, those with HIV and HTN had CKD stage 3a, and those with HIV, HTN, and DM had CKD stage 3b. At the Domiciliary clinic, 56.7% of the were female, and 43.1% (56) were male. Patients with HIV and HTN had CKD 2, and CKD 3a for patients with all three comorbidities.

**Conclusion:** Both CKD-EPI and MDRD methods showed minimal differences in eGFR. The CKD-EPI formula in HIV-comorbid hypertensive and/or diabetic patients defines stage 3 renal failure earlier. HIV, HTN, and DM were the major risk factors for poor CKD prognosis, often leading to kidney failure.

**Keywords:** Comorbidity; Prognosis; Chronic Kidney Disease; CKD-EPI; MDRD

## Introduction

Chronic kidney disease (CKD) is the abnormality of kidney structure or function (defined by markers of kidney injury or decreased GFR) present for more than three months with health implications [1]. Kidneys can get damaged in several ways, often through physical injury or diseases like diabetes mellitus (DM) and hypertension (HTN). This is usually associated with a reduction in glomerular filtration rate (GFR) [2]. CKD has been recognised as a leading public health problem worldwide [3]. The global estimated prevalence of CKD is 13.4% [4], with a prevalence of 36.1% amongst those living with HIV and other comorbidities [5]. The burden of CKD is rising worldwide, with the fastest growth occurring in low-income countries like Lesotho [6]. In addition to poorly controlled DM and HTN, human immunodeficiency virus (HIV) plays an essential role in the epidemiology of CKD [7].

Chronic kidney disease due to DM and HTN affects nearly 5-7% of the world population [8]. The Modification of Diet in Renal Disease (MDRD) and the Chronic Kidney Disease Epidemiology Collaboration (CKD-EPI) equations are two commonly used equations for estimating GFR to evaluate the severity of CKD [9]. The MDRD equation estimates GFR using variables like serum creatinine, age, gender and race. The CKD-EPI equation was developed as an improvement over the MDRD equation [9]. It is aimed to provide more accurate estimates of GFR, especially in patients with higher GFR levels and across diverse populations [9].

Chronic Kidney Disease is the healthcare burden in Lesotho, and this results in patients' morbidity, mortality and increased healthcare costs [6]. Primary healthcare facilities in Lesotho, including the major ones in Maseru, assess or manage hypertension (HTN), diabetes mellitus (DM), and HIV; however, none of these primary healthcare facilities screen for chronic kidney disease (CKD) progression. To date, the progression of CKD and its staging remains unknown. The number of patients living with CKD, HIV, co-morbid HTN and DM seems to be increasing [6]. These comorbidities independently are proven to increase the development and progression of chronic kidney disease, but the interaction between all these conditions on the prognosis of CKD remains poorly understood.

Evidence suggests that the increasing prevalence of CKD, which progresses to kidney failure (KF), increases healthcare resource utilisation [10]. CKD co-morbid HIV leads to a low quality of life in affected individuals with limited and reduced ability to perform their daily duties [11]. Understanding the prognosis of CKD in individuals with these comorbidities is essential due to the potential for a significant disease burden and healthcare impact. Improved understanding of CKD prognosis in this specific patient population can inform healthcare policies and resource allocation.

## Materials and Methods

This study was a retrospective cross-sectional study which was conducted among outpatients living with HIV, comorbid hypertension and DM who had attended Lesotho Defence Force (LDF) and Domiciliary clinics. These two clinics are the major primary healthcare facilities in Maseru, which manage major risk factors to CKD, including HTN, DM and HIV, whilst keeping the laboratory results for HIV patients. The study population in two health facilities include people living with HIV alone and/or comorbid HTN and DM who attend services in these clinics between January 1<sup>st</sup> 2022, and April 30<sup>th</sup> 2024. All files for men and women 18 years and older who had either HIV alone, HIV comorbid HTN and/or DM with at least two measurements of biomarkers (i.e. serum creatinine and BUN) were included in the study. The data collection tool recorded the average of the two most recent serum creatinine and BUN values. Incomplete files without serum creatinine and patient files before 1<sup>st</sup> January 2022 were excluded from the study.

The quantitative data were collected using a structured questionnaire adapted from similar studies comparing the estimated glomerular filtration rate based on the Modified

Diet in Renal Disease (MDRD) and the Chronic Kidney Disease Epidemiology Collaboration (CKD-EPI) formulas [8-10]. These ensure that all the validated questionnaires and methodologies used to measure the study's objectives were valid and reliable.

The data was collected using a validated survey questionnaire adapted from similar studies [12-15] and modified to achieve the objectives of the current study. The information extracted from the patient's files includes the patient demographic information (such as age, gender, body mass index), laboratory biomarkers, including creatinine, urea and Blood urea nitrogen (BUN) and serum creatinine was used to calculate the eGFR based on the Modified Diet in Renal Disease (MDRD) and the Chronic Kidney Disease Epidemiology Collaboration (CKD-EPI) formulas, which were used to classify the patient's CKD staging.

The study was approved by the National University of Lesotho International Review Board (NUL-IRB) and the Ministry of Health Research Ethics Committee (MOH-REC) (ID 58-2024). Confidentiality was ensured throughout the study. For anonymity and confidentiality, the patients were allocated serial numbers linking them to the files for record keeping.

Data was entered into a Microsoft Excel spreadsheet and analysed with the IBM SPSS statistical package (version 20). The patient's data was captured on Microsoft 365 Excel®, and the patient's demographic data, which included categorical variables, was analysed with descriptive statistics and presented as frequency and percentage per total, while the continuous variables were presented as a mean ± standard deviation (SD). The data were subjected to the Shapiro-Wilk test for normality. The chi-square was performed to assess the relationship between the independent categorical data, whereas Spearman's correlation (non-parametric bivariate test) was performed to assess the factors that can influence the eGFR. The baseline male and female eGFR were calculated using CKD-EPI and MDRD equations as below.

$$\text{MDRD equation} = 186 \times \left( \text{plasma Cr in } \frac{\text{umol}}{\text{L}} \times 0.011312 \right) - 1.154 \times \text{age} - 0.203 \times (1.210 \text{ if black}) \times (0.742 \text{ if female})$$

$$\text{CKD-EPI} = 141 \times \min\left(\frac{\text{Cr}}{k}, 1\right) \alpha \times \max\left(\frac{\text{Cr}}{k}, 1\right) \times 0.993 \text{age} \times 1.018 \text{ if female} \\ \times 1.159 \text{ if black : where } k = 0.7 \text{ for females, } 0.9 \text{ for males,} \\ \alpha = -0.329 \text{ for females, } -0.411 \text{ for males}$$

Where plasma Cr = plasma creatinine (umol/l)<sup>3</sup>.

## Results

A total of 212 medical records were analysed, comprising 82 from the LDF clinic and 130 from the Domiciliary clinic. Among LDF records, 43.9% (n = 36) were females, and 56.1% (n=46) were males. In the Domiciliary Clinic, 56.9% (n=74) were females, while 43.1% (n=56) were males. The median age was 45.00 years [interquartile range (IQR) 35.00-52.00] at the LDF clinic, whereas at the Domiciliary clinic, the median 41.50 [interquartile range (IQR) 33.75-50.50]. At the LDF clinic, 48.3% (n= 38) had HIV only,

25.6% (n=21) had both HIV and HTN, whereas 28.0% (n=23) had HIV, HTN and DM (p=0.062). At Domiciliary, 60.0% (n=78) had HIV, 33.8% (n=44) had HTN and HIV, while the ones with HIV, HTN and DM were 6.2% (n=8), (p=0.933) (Table 1). The mean BMI for patients were (29.47 ± 4.00kg/m<sup>2</sup>, p=0.077) at the LDF clinic and (26.03±6.39kg/m<sup>2</sup>, p=0.115) at the Domiciliary clinic (Table 1). At the LDF clinic, the baseline average mean serum creatinine was 130.56±22.69umol/l, results were independent of age (p=0.055), whereas at the Domiciliary clinic, the baseline average mean serum creatinine was 84.09±27.67umol/l, and results significantly

depend on age (p=0.011) (Table 1). The baseline average mean eGFR based on CKD-EPI was 54.96±13.59ml/min/1.73m<sup>2</sup>, and results significantly depend on age p<0.000), whereas for MDRD the baseline average mean was 47.92±11.15ml/min/1.73m<sup>2</sup> (p=0.104) (Table 1). At the Domiciliary clinic, the baseline average mean eGFR based on CKD-EPI was 91.95±22.63ml/min/1.73m<sup>2</sup> and results significantly depend on age p=0.025), whereas for MDRD the baseline average mean was 97.62±26.66ml/min/1.73m<sup>2</sup> (p=0.045) (Table 1).

**Table 1:** Demographic and clinical characteristics of 212 HIV positive patients at LDF and Domiciliary clinics receiving ART treatment between January 2022 and April 2024.

HTN -Hypertension; HIV-Human Immunodeficiency Virus; DM-Diabetes Mellitus; eGFR-estimated glomerular filtration rate; CKD-EPI-Chronic Kidney Disease Epidemiology Collaboration; MDRD- Modification of Diet in Renal Disease; BMI-Body mass index; BUN-Blood urea nitrogen m- Meters; m<sup>2</sup>-Meters squared Kg-Kilogram; mg/l-Milligrams per litre;umol/l-micromoles per litre; ARVs -Antiretrovirals; TDF/3TC/DTG-Tenofovir/lamivudine/Dolutegravir; TDF/3TC/EFV Tenofovir/lamivudine/Efavirenz; LPVr/AZT/EFV-Lopinavir/zidovudine/Efavirenz; ACEIs- Angiotensin converting enzyme inhibitors; ARBs-Angiotensin receptor blockers BB-Beta blockers; CCBs-Calcium channel blockers.

Variables	LDF Clinic N=82 (%)	Chi-Square	P-Value	Domiciliary Clinic N=130 (%)	Chi-Square	P-Value
Age (in years)	45 [35-52]	-	-	41.5 [33.8-50.5]	-	
<b>Gender</b>						
Male	46 (56.1)	35.44	0.400	74 (56.9)	31.46	0.858
Female	36 (43.9)			56 (43.1)		
<b>Comorbidity</b>						
HIV + HTN	21 (25.6)	86.81	0.062	44 (33.8)	137.72	0.933
HIV + DM	0			0		
HIV only	38 (46.3)			78 (60.0)		
HIV + HTN +DM	23 (28.0)			8 (6.2)		
BMI	29.47±4.00	874.28	0.077	26.03±6.39	3918.31	0.115
Height (m)	1.64±0.08	861.51	0.131	1.61±0.90	1805.61	0.089
Weight (Kg)	79.15±12.26	1938.73	0.131	66.87±15.62	4714.41	0.198
Baseline mean creatinine (umol/l)	130.56±22.69	1968.80	0.055	84.09±27.67	2791.94	0.011
BUN (mg/L)	1.48±0.257	1766.53	0.043	0.95±3132	2697.69	0.016
Baseline mean eGFR (CKD-EPI) (ml/min/1.73m <sup>2</sup> )	54.96±13.59	1470.9	0.000	91.95±22.63	2767.81	0.025
eGFR (MDRD) (ml/min/1.73m <sup>2</sup> )	47.92±11.15	2536.5	0.104	97.62±26.66	5089.50	0.045
<b>Drugs groups</b>						
ARV regimens						
TDF/3TC/DTG	82 (100)	-	-	111 (85.4)	-	-
TDF/3TC/EFV	0	-	-	18 (13.8)	-	-
LPVr/AZT/EFV	0	-	-	1 (0.8)	-	-
<b>Antihypertensive</b>						
Diuretics	44 (53.7)	-	-	49 (37.7)	-	-
ACEIs	19 (23.2)	-	-	23 (17.7)	-	-
ARBs	9 (11.0)	-	-	6 (4.6)	-	-
Spiranolactone	19 (11.0)	-	-	0	-	-
BB	0	-	-	5 (3.8)	-	-
CCBs	17 (20.7)	-	-	30 (23.1)	-	-
<b>Prophylaxis</b>						
Statins	25 (30.5)	-	-	3 (2.3)	-	-

Antiplatelets	34 (41.5)	-	-	21 (16.2)	-	-
Antidiabetics						
Biguanides	23 (28.0)	-	-	8 (6.2)		
Sulfonyl urea's	21 (25.6)	-	-	2 (1.5)	-	-
Insulin	8 (9.8)	-	-	1 (0.8)	-	-

Our results showed that all HIV positive (n=82, 100%) patients at LDF were placed on TDF/3TC/DTG-based regimen, whereas 85.4% (n=111) of the patients at the Domiciliary clinic were placed TDF/3TC/DTG-based regimen, and 13.8% (n=18) of the patients at Domiciliary clinic were placed on TDF/3TC/EFV based regimen (Table 1). As shown in Table 1, the diuretics were the most used antihypertensives for the treatment of HTN in patients at the LDF clinic (n= 44, 53.7%) versus HTN patients' Domiciliary clinic (n=49, 37.7%). The biguanides were mostly used in the management of DM among patients at the LDF clinic (n=23, 28.0%) versus a few (n=8, 6.2%) of the patients at the Domiciliary clinic (Table 1).

According to Table 2 below, when using CKD-EPI to compute eGFR, none of the patients had eGFR values  $\geq 90$ ml/min/1.73m<sup>2</sup> at LDF, whereas at Domiciliary, 60.7% (n=79) had eGFR values  $\geq 90$ ml/min/1.73m<sup>2</sup> which correspond to stage 1. Based on the CKD-EPI, 40.2% (n=33) of the patients at the LDF clinic and 30.8% (n=40) of the patients at the Domiciliary clinic had eGFR values 60-89ml/min/1.73m<sup>2</sup>, which corresponds to CKD stage 2 (Table 2).

As seen in Table 2, based on CKD-EPI, 28.1% (n=23) of patients at LDF and 4.6%(n=6) of the patients at Domiciliary had eGFR values 45-59ml/min/1.73m<sup>2</sup>, which correspond to stage 3a. Based on the CKD-EPI, 30.5% (n=25) of the patients at the LDF clinic and 2.3% (n=3) of the patients at the Domiciliary clinic had eGFR values, 30-44ml/min/1.73m<sup>2</sup>, which correspond to stage 3b (Table 2). As seen in Table 2, using CKD-EPI, 1.22% (n=1) of the patients at LDF and 1.5 % (n=2) of the patients at Domiciliary clinic had eGFR values, 15-29ml/min/1.73m<sup>2</sup>, which correspond to stage 4. When using the MDRD, 63.8% (n=83) of the patients at Domiciliary had eGFR values greater than or equal to 90ml/min/1.73m<sup>2</sup> (Table 2). As seen in Table 2, the number of patients who had eGFR values 60-89ml/min/1.73m<sup>2</sup> was twice at the Domiciliary clinic (n=36, 27.7%) versus the number of patients (n=15, 18.3%) at the LDF clinic. The majority (n=35, 42.7%) of the patients at LDF had eGFR ml/min/1.73m<sup>2</sup> is 6.2% compared to a few (n=8, 6.2%) of the patients at the Domiciliary clinic (Table 2). The majority (n= 29, 35.4%) of the patients LDF clinic had eGFR values 30-44ml/min/1.73m<sup>2</sup> compared to a few (n=2, 1.5%) (Table 2).

**Table 2:** Comparisons of Clinical CKD staging based on CKD-EPI and MDRD eGFR in Patients at LDF (N=82) and Domiciliary clinics (N=130).

eGFR values	LDF CLINIC (N = 82)		DOMICILIARY CLINIC (N=130)	
	CKD-EPI N (%)	MDRD N (%)	CKD-EPI N (%)	MDRD N (%)
Stage 1 (> 90)	0	0	79 (60.8)	83 (63.8)
Stage 2 (60 - 89)	33 (40.2)	15 (18.3)	40 (30.8)	36 (27.7)
Stage 3a (45 - 59)	23 (28.1)	35 (42.7)	6 (4.6)	8 (6.2)
Stage 3b (30 - 44)	25 (30.5)	29 (35.4)	3 (2.3)	2 (1.5)
Stage 4 (15 - 29)	1 (1.2)	3 (3.7)	2 (1.5)	1 (0.8)
Stage 5 ( $\leq 15$ )	0	0	0	0

As shown in Table 3, looking in female patients at LDF clinic, the Spearman's correlation shows a significantly negative correlation between age (r=-0.837, p<0.000), weight (r=-0.834, p<0.000), BMI (r= -0.760, p<0.000) and creatinine (r=-0.964, p<0.000) versus eGFR determined with the CKD-EPI formula. Our results demonstrated a significant negative correlation between age (r=-0.820, p<0.000), weight (r=-0.836, p<0.000), BMI (r=-0.780, p<0.000) and creatinine (r=-0.979, p<0.000) versus eGFR determined with the MDRD formula. According to the male patients at LDF clinic, our results demonstrated a significant negative correlation between age (r=-0.828, p<0.000), weight (r=-0.600, p<0.000), BMI (r=-0.634, p<0.000) and creatinine (r=-0.893, p<0.000) versus eGFR determined with the CKD-EPI formula (Table 3). Our results demonstrated a significant negative correlation between age (r=-0.813, p<0.000), weight (r=-0.611, p<0.000), BMI (r=-0.642, p<0.000) and creatinine (r=-0.895, p<0.000) versus

eGFR determined with the MDRD formula (Table 3).

In the Domiciliary clinic, according to the female patients, the Spearman's correlation shows a significantly negative correlation between age (r=-0.647, p<0.000), and creatinine (r=-0.948, p<0.000) versus eGFR determined with the CKD-EPI formula (Table 3). Our results demonstrated a significant negative correlation between age (r=-0.556, p<0.000) and creatinine (r=-0.974, p<0.000) compared to eGFR determined using the MDRD formula (Table 3). According to the male patients, the Spearman's correlation shows a significantly negative correlation between age (r=-0.465, p<0.000), weight (r=-0.343, p=0.010) and creatinine (r=-0.913, p<0.000) versus eGFR determined with the CKD-EPI formula (Table 3). Our results demonstrated a significant negative correlation between age (r=-0.343, p=0.010), weight (r=-0.324, p=0.015) and creatinine (r=-0.973, p<0.000) versus eGFR determined with the MDRD formula (Table 3).

**Table 3:** Shows the Spearman's correlation (bivariate analysis) of CKD-EPI and MDRD eGFR based on age, weight, BMI and creatinine in HIV co-morbid HTN and DM patients at LDF and Domiciliary clinics.

N= number of participants; r= Correlation Coefficient; CKD-EPI-Chronic Kidney Disease Epidemiology Collaboration; MDRD- Modification of Diet in Renal Disease

Variable	Spearman's	Lesotho Defence Force Clinic				Domiciliary Clinic			
		Female (N=36)		Males (N=46)		Female (N=74)		Male (N=56)	
		CKD-EPI	MDRD	CKD-EPI	MDRD	CKD-EPI	MDRD	CKD-EPI	MDRD
AGE (Years)	(r)	-0.837**	-0.820**	-0.828**	-0.813**	-0.647**	-0.556**	-0.465**	-0.343**
	(p-value)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.010
Weight (Kg)	(r)	-0.834**	-0.836**	-0.600**	-0.611**	-0.015	-0.005	-0.343**	-0.324*
	(p-value)	0.000	0.000	0.000	0.000	0.898	0.967	0.010	0.015
BMI (Kg/m <sup>2</sup> )	(r)	-0.760**	-0.780**	-0.634**	-0.642**	-0.004	0.004	-0.243	-0.258
	(p-value)	0.000	0.000	0.000	0.000	0.976	0.972	0.072	0.055
Creatinine (umol/l)	(r)	-0.964**	-0.979**	-0.893**	-0.895**	-0.948**	-0.974**	-0.913**	-0.973**
	(p-value)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

## Discussion

The study revealed that in Lesotho, the prevalence of CKD is higher in women compared to men. In 2016, a meta-analysis of 51 studies reporting sex-specific CKD prevalence found a mean prevalence of CKD of 14.6% in females and 12.8% in males, corresponding to a female: male prevalence ratio of 1.14 [16]. More recently, the 2017 Global Burden of Disease (GBD) study reported that the global age-standardised prevalence of CKD was 1.29 times higher in females than in males. It is generally accepted that, for any given age, the prevalence of milder forms of CKD (KIDGO Stage 1-3) is higher in females, while the opposite is true for kidney failure (KIDGO Stage 5) [16]. A recent review on the role of sex and gender in CKD have highlighted a complex interplay of biological, behavioural, cultural and socio-economic factors that may contribute to observed disparities [17].

Although TDF is implicated in causing nephrotoxicity, the likelihood of CKD progression is minimal due to monotherapy as compared to polypharmacy exhibited in other comorbidities. Similar to our results, one study revealed that people taking more than 3 drugs, which are predominantly excreted by the kidneys, have a heightened likelihood of developing CKD later in life, regardless of the diseases being treated, than those taking a single drug [18].

The equations for estimating GFR include plasma creatinine concentration, which is endogenously produced from skeletal muscle. For this reason, females who have less muscle mass than males would have lower plasma creatinine concentrations and consequently lower eGFR, which our study demonstrated [19].

Studies comparing the CKD-EPI equation with MDRD indicate that CKD-EPI yields more accurate results in estimating GFR and recommend the use of this equation in clinical practice [20]. Although both formulas were mainly developed in patients with CKD, different population data were also taken into account in the CKD-EPI equation [20]. Matsushita et al. compared creatinine clearance, MDRD, and CKD-EPI formulas in one of their studies [20]. When the cases were analysed according to gender, there was

a significant difference between GFR values in women. Whereas there was a statistically significant difference between creatinine clearance and MDRD, there was no significant difference between CKD-EPI with creatinine clearance [21].

The prevalence of CKD is 11.5% among individuals 70 years old with stage III and above CKD in Lesotho [6]. The increasing incidence of diseases, such as hypertension, obesity, and DM, constitutes a risk for CKD in our country and makes the early diagnosis and follow-up of CKD more important. The increase in the elderly population in our country and the decrease in renal function with ageing are indicators of an increase in the prevalence of CKD in the coming years.

For this reason, we believe that we have shown the importance of calculating GFR to make a more accurate assessment since creatinine values alone in the early diagnosis and management of CKD in elderly patients are not enough. Furthermore, the study showed that at the LDF clinic, the average eGFR using CKD-EPI for patients with HIV only is 66.53±8.02ml/min/1.73m<sup>2</sup>, while the average eGFR using CKD-EPI of patients living with HIV and HTN is 47.10±6.89ml/min/1.73m<sup>2</sup> and that of patients living with HIV, HTN and DM is 43.04±9.53ml/min/1.73m<sup>2</sup>. These eGFR values calculated using CKD-EPI correspond to stage 2, stage 3a and stage 3b, respectively, in these patient populations. On the other hand, the average eGFR using MDRD for patients living with HIV only is 57.17±6.80ml/min/1.73m<sup>2</sup>, while for people living with HIV and HTN is 41.40±5.98ml/min/1.73m<sup>2</sup> and for those living with HIV, HTN and DM is 39.36±9.03ml/min/1.73m<sup>2</sup>. These eGFR values obtained using MDRD correspond to stage 3a for people living with HIV only, 3b for HIV and HTN and also 3b for those living with HIV, HTN and DM. This shows a slight difference between CKD-EPI and MDRD.

The study also revealed the importance of taking baseline creatinine levels when patients are introduced to ART. This is of paramount importance in monitoring CKD and ultimately results in a better prognosis [22]. Again, it was noted that the majority of patients were obese and overweight; therefore, it is crucial to

highlight the importance of weight management in this patient population. Patients should be mindful of their diet and ensure at least 30 minutes of regular exercise of any kind. The bivariate analysis demonstrated a statistically significant negative correlation between age, weight, body mass index and creatinine versus eGFR determined with both CKD-EPI and MDRD. Both formulas incorporate age and creatinine, which are inversely proportional to the estimated glomerular filtration rate.

The research team acknowledge the following limitations, which may have affected the findings and interpretations: Two facilities were assessed, and the conclusions made cannot be generalized to give the overall CKD in Lesotho primary health facilities. Additionally, incomplete data had to be excluded in the analysis, which reduced the sample size, and may have affected the conclusiveness of the data and was therefore taken into consideration.

## Conclusion

HIV, HTN and DM are major risk factors for the prognosis of CKD in two healthcare facilities in Maseru. The majority of the patients with these comorbidities were diagnosed with CKD stage 3. Early detection of CKD and proper management of these comorbidities may decrease the progression to kidney failure. MDRD and CKD-EPI equations can significantly be employed in the determination of the patients at risk of CKD in HIV patients with other comorbidities at affordable cost.

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## Declarations

### Funding

The study was partially funded by the Lesotho National Manpower Development Secretariat (NMDS) as student project fee. Other costs of the study was self-funded by the authors.

### Competing interests

All authors declare no conflict of interest.

### Ethical approval

Approval by the National University of Lesotho International Review Board (NUL-IRB) and Ministry of Health Research Ethics Committee (MOH-REC) (ID 58-2024). The authors obtained consent to publish from the MOH of Lesotho and two clinics.

### Declaration of patients consent

The informed consent waiver was obtained in the present study since the study used secondary data and was retrospective.

### Use of Artificial Intelligence (AI)

Assisted Technology for Manuscript Preparation: The author (s) confirm that the Zotero reference manager, grammar checker

were the only used AT tools during the manuscripts. However, none of the Assisted Technology were used for writing the manuscripts and no images were manipulated with the application of AI.

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