Scope and mortality of adult medical ICU patients in an Eastern Cape tertiary hospital

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Background. The characteristics and mortality outcomes of patients admitted to South African intensive care units (ICUs) owing to medical conditions are unknown. Available literature is derived from studies based on data from high-income countries.
Objectives. To determine ICU utilisation by medical patients and evaluate the scope of admissions and clinical associations with hospital mortality in ICU patients 12 years and older admitted to an Eastern Cape tertiary ICU, particularly in the subset with HIV disease.
Methods. A retrospective descriptive one-year cohort study. Data were obtained from the LivAKI study database and demographic data, comorbidities, diagnosis, and mortality outcomes and associations were determined.
Results. There were 261 (29.8%) medical ICU admissions. The mean age of the cohort was 40.2 years; 51.7% were female. When compared with the surgical emergencies, the medical subgroup had higher sequential organ failure assessment (SOFA) scores (median score 5 v. 4, respectively) and simplified acute physiology score III (SAPS 3) scores (median 52.7 v. 48.5), a higher incidence of acute respiratory distress syndrome (ARDS) (7.7% v. 2.9%) and required more frequent dialysis (20.3% v. 5.5%). Of the medical admissions, sepsis accounted for 32.4% of admission diagnoses. The HIV seroprevalence rate was 34.0%, of whom 57.4% were on antiretroviral therapy. ICU and hospital mortality rates were 11.1% and 21.5% respectively, while only acute kidney injury (AKI) and sepsis were independently associated with mortality. The HIV-positive subgroup had a higher burden of tuberculosis (TB), higher admission SOFA and SAPS 3 scores and required more organ support.
Conclusion. Among medical patients admitted to ICU, there was a high HIV seroprevalence with low uptake of antiretroviral therapy. Sepsis was the most frequently identified ICU admission diagnosis. Sepsis and AKI (not HIV) were independent predictors of mortality. Co-infection with HIV and TB was associated with increased mortality.
Keywords. ICU; HIV; mortality; Africa; medical.

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Contribution of the study.
The epidemiology and outcomes of adults who are critically ill from medical conditions in South African intensive care units was previously unknown but has been described in this study. The association of sepsis, TB, HIV and acute kidney injury with mortality is discussed.

Despite a growing global demand,[1,2] Intensive care unit (ICU) beds remain a limited resource[3] with rising cost implications.[4] This is especially so in low- and middle-income countries[3, 5] and across the sub-Saharan African (SSA) region where large imbalances in accessing such resources exist.[6] In 2009, the Eastern Cape Province had 252 ICU beds of which only 90 were located in the public sector. This results in a population to ICU bed ratio of 1:75 000 compared with the envisioned 1:10 000 as per the proposed National Health Insurance plan.[7] In view of the limited number of ICU beds, the process of triaging referrals to ICU is accepted practice in South Africa (SA).[8] Part of this process is deciding who is likely to benefit most from ICU admission and auditing outcomes for admitted patients.

There is a paucity of studies describing the spectrum and outcomes of medical patients admitted to ICU in southern Africa. SA criteria for admission are largely influenced by studies performed in high-income countries (HIC) which have vastly different demographic and disease patterns.[8] Medical patients admitted to ICU in SA are younger, with an average age between 40 and 45 years[9,10] and HIV remains a major burden, with an estimated 8.2 million people with HIV in SA alone.[11] HIV-infected people are at higher risk for critical illness and therefore place an increased burden on ICUs.[12,13]

Improving our understanding of our cohort of medical critical care admissions and their outcomes is therefore vitally important and may inform clinicians and policymakers as to who will benefit the most from this life-saving resource. Therefore, this study was undertaken to describe the characteristics and outcomes of medical admissions to a multidisciplinary tertiary ICU in SA, to determine poor prognostic markers and to specifically examine the cohort of known HIV-positive patients.

Ethics

The present study was approved by the research ethics and bio-safety committee at Walter Sisulu University, Mthatha (ref. no. 030/2021). The need for individual study participant consent was waived by the Ethics Unit.

Methods

Study design and setting

This was a retrospective cohort study nested in a previous study titled 'Acute Kidney Injury in critically ill patients in an Eastern Cape Tertiary Intensive Care Unit' (LivAKI)[14] which prospectively collected data on all admissions, 12 years and older, to the Livingstone Tertiary Hospital Adult ICU from 1 January 2017 to 31 December 2017. All medical and emergency surgical admissions (inclusive of all trauma-related admissions) were included in this analysis. Exclusion criteria included the following: elective surgical admissions; ICU readmission (only data from patients' first admission were included); inappropriate ICU admissions (death within 6 hours of admission); post-elective surgical procedures; obstetric patients; brain-dead patients admitted to the ICU awaiting organ procurement; and patients who were found to have end-stage kidney disease and who were not eligible for kidney replacement therapy. Patients with data sets with a missing entry regarding hospital mortality were excluded from outcome analysis.

Data collection and management

Demographic data included age, sex, race, employment history prior to hospital admission and details relating to comorbidities. Details regarding admission diagnosis, ICU stay, physiological parameters, complications and comorbidities (including HIV) were noted. Sepsis and septic shock were defined as per the third international consensus definition (Sepsis-3),[15] acute respiratory distress syndrome (ARDS) was defined by the Berlin 2012 consensus criteria[16] and acute kidney injury (AKI) was defined as per the Kidney Disease Improving Global Outcomes (KDIGO) group.[17]

Statistical analysis

Study data were collected and managed using the Research Electronic Data Capture (REDCap) tool hosted at the University of Cape Town[18] and analysed with R version 4.1.2 (R Core team, Austria). Descriptive statistics were used to summarise the medical cohort, as well as the HIV-positive subgroup. Medical and surgical emergency admissions were compared. Continuous data were tested for normality using Pearson's chi-squared test. Normally distributed data are reported as means with standard deviations (SDs) and skewed data as medians with interquartile ranges (IQRs). Discrete data are presented as numbers (percentages). The student's *t*-test and Mann-Whitney *U* test were used to compare continuous data and the chi-squared and Fisher's exact tests were used for discrete data, as appropriate. Multivariable logistic-regression models were used to determine associations between mortality and patient characteristics of the medical group, and for those with known HIV-positive status. Variables with an alpha level <0.1 by univariable analysis, as well as other potential predictors for mortality (age, sex, hypertension, active malignancy and admission SAPS 3 score) were included in the model. The standardised mortality rate was calculated and the level of significance was 5%.

Results

During the study period, 875 patients were admitted. Medical patients accounted for 29.8% of the cohort (*n*=261). As depicted in Fig. 1, 163 patients were excluded for various reasons while 5 patients were lost to follow-up owing to inter-hospital transfer.

The demographic and clinical characteristics of all emergency admissions are summarised in Table 1. In the medical cohort, the prevalence of epilepsy, active tuberculosis and chronic kidney disease was more than three-fold higher than the surgical cohort ($p<0.001$ for all), while hypertension, diabetes mellitus and chronic kidney disease were the most frequent comorbidities. HIV status was known in 76.6% of the medical admissions and 34.0% of those patients were HIV-positive. Antiretroviral therapy (ART) uptake was low in both subgroups. The medical subgroup had a higher degree of illness compared with non-medical patients, as indicated by significantly higher SAPS 3 scores, admission SOFA scores, increased acute dialysis requirements and more frequent diagnosis of ARDS. Non-medical patients were more likely to receive vasopressor support and to be mechanically ventilated.

Common admission diagnoses in the medical subgroup are summarised in Table 2. Infectious diseases accounted for 32.4% of ICU

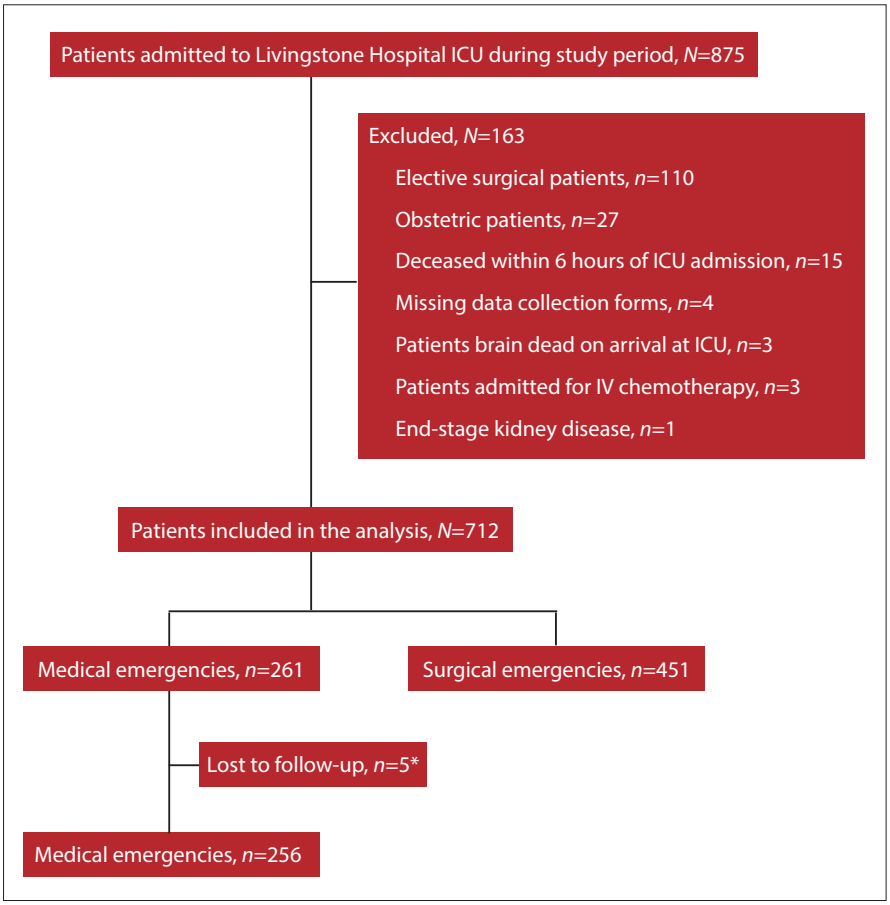

*Fig. 1. Patients included in the analysis. (ICU = intensive care unit; IV = intravenous.) (*A total of 163 patients were excluded for various reasons while 5 patients were lost to follow-up owing to inter-hospital transfer.)*

Table 1. Baseline characteristics of all emergency admissions

Variable	Medical patients (*n*=261), *n* (%)*	Surgical patients (*n*=451), *n* (%)*	*p*-value
Demographics			
Age (years), mean (SD)	40.2 (16.2)	42.0 (16.9)	0.148
Gender, male	126 (48.3)	322 (71.4)	<0.001
Comorbidities			
Diabetes	42 (16.1)	60 (13.3)	0.362
Epilepsy	31 (11.9)	5 (1.1)	<0.001
Active malignancy	3 (1.1)	6 (1.3)	1.000
Active tuberculosis	30 (11.5)	16 (3.5)	<0.001
Immunosuppressive treatment	20 (7.7)	14 (3.1)	0.010
Chronic kidney disease	34 (13.0)	14 (4.0)	<0.001
Hypertension	92 (35.2)	107 (23.7)	0.001
Ischaemic heart disease	6 (2.3)	18 (4.0)	0.322
HIV known status	*n*=200	*n*=215	
Positive, *n* (%)	68 (34.0)	65 (30.2)	0.474
Premorbid CD4 cell count (cells/μL), median (IQR)	306 (113 - 462)	271 (188 - 378)	0.705
Receiving ART			
Yes	39 (57.4)	42 (64.6)	0.496
Unknown	3 (4.4)	2 (3.1)	0.771
Illness severity scores			
Admission SOFA score, median (IQR)	5 (2 - 7)	4 (2 - 6)	0.002
SAPS 3 score, mean (SD)	52.7 (13.5)	48.5 (16.1)	<0.001
SAPS 3 predicted mortality rate, median % (IQR)	18.9 (8.0 - 37.6)	14.5 (4.5 - 33.5)	<0.001
ICU length of stay			
Days, median (IQR)	3 (2 - 8)	3 (1 - 7)	0.420
Days ≥7	83 (31.8)	115 (25.5)	0.085
Mechanical ventilation	141 (54.0)	284 (63.0)	0.023
Ventilator (days), median (IQR)	3 (1 - 8)	3 (1 - 6)	
Requiring vasopressors	59 (22.6)	136 (30.2)	0.037
ARDS	20 (7.7)	13 (2.9)	0.006
Sepsis	91 (34.9)	150 (33.3)	0.723
Dialysed	53 (20.3)	25 (5.5)	<0.001
AKI	163 (62.5)	279 (61.9)	0.094

SD = standard deviation; IQR = interquartile range; ART = antiretroviral treatment; SOFA = sequential organ failure assessment; SAPS = Simplified acute physiology score; ARDS = acute respiratory distress syndrome; AKI = acute kidney injury.

admissions, with community acquired pneumonia, meningitis, tuberculosis and malaria being the main causes. Drug toxicity owing to deliberate self-harm was the second most common cause for admission (15.3%).

ICU mortality and predictors of hospital mortality in medical patients

The ICU and hospital mortality for the medical patients was 11.1% and 21.5%, respectively. By comparison, the hospital mortality for surgical emergency admissions was 24.4% (p=0.372). The standardised mortality rate for medical patients was 0.827 (95% confidence interval (CI) 0.664 - 1.030). Demographic and clinical characteristics of survivors and non-survivors are compared in Table 3. In those with known HIV status, HIV-positive patients had a significantly higher mortality compared with HIV-negative patients (29.4% v. 16.7%, respectively; p=0.036). The mortality risk was not different between those tested and not tested for HIV (21.1% v. 23.9%, respectively; p=0.817). HIV-positive non-survivors had a lower mean premorbid CD4 cell count. Other significant associations with increased mortality risk included increased age, higher admission SOFA and SAPS scores, prolonged ICU stay, sepsis, AKI, the need for mechanical ventilation, vasopressor support and dialysis.

Multivariable analysis indicated that only sepsis (odds ratio (OR) 2.91; 95% CI 1.25 - 6.87) and AKI (OR 3.14; 95% CI 1.12 - 10.30) were significantly associated with hospital mortality (Table 4). Furthermore, there was a trend of increased mortality among older patients (OR 1.02; p=0.058) and patients requiring vasopressor therapy (OR 2.34; p=0.066). HIV status was not independently associated with a higher mortality (p=0.167).

Medical subgroup comparison by HIV status

The prevalence of active tuberculosis in patients with HIV was 20.6% and 10.6% in those without HIV (p=0.087) as seen in Table 5. As indicated by higher admission SOFA and SAPS 3 illness severity scores, the HIV-positive subgroup had a higher severity of illness than those who were HIV-negative. The HIV-positive patients also had a higher incidence of sepsis and requirement for dialysis. There was no difference in the length of hospital stay, vasopressor use and ventilatory requirements between the two subgroups.

Sepsis, the presence of active tuberculosis and vasopressor requirements were associated with higher mortality in patients with HIV, as depicted in Table 6. The mortality of HIV-positive patients co-infected with TB was 57.1%.

Table 2. Main admission diagnoses in medical patients

Diagnoses	Patients, *n* (%)
Pneumonia	43 (16.5)
Intentional drug overdose	40 (15.3)
Meningitis	16 (6.1)
AKI	15 (5.7)
Diabetic emergencies	15 (5.7)
Status epilepticus	13 (5.0)
TTP	12 (4.6)
Tuberculosis	10 (3.8)
Hypertensive crises	9 (3.4)
Status asthmaticus	9 (3.4)
Pulmonary embolism	8 (3.1)
Pancreatitis	6 (2.3)
Malaria	6 (2.3)
Interstitial lung disease	6 (2.3)
COPD exacerbation	5 (1.9)
Guillain-Barré syndrome	5 (1.9)
Mitral stenosis	5 (1.9)
Myocardial infarction	4 (1.5)
Urosepsis	4 (1.5)
Hypokalaemia	3 (1.1)
Hyponatraemia	3 (1.1)
Septic shock, unclear source	3 (1.1)
Soft-tissue infection	3 (1.1)
Angioedema	2 (0.8)
Other	16 (6.1)

AKI = acute kidney injury; TTP = thrombotic thrombocytopenic purpura; COPD = chronic obstructive pulmonary disease.

Discussion

This study describes the case mix and outcomes of 256 adult medical patients admitted to the ICU of a tertiary hospital in a contemporary SA population. The study cohort was young (42.1 years) compared with the ICU patients in HICs[19-21] and demonstrated a high HIV seroprevalence rate. Infectious diseases were major contributors to ICU admission. Diagnosis of sepsis during any stage of the patient's admission and the presence of AKI were independent markers of mortality among medical patients, however, HIV-positive status was not.

The finding of a relatively young medical cohort was similar to ICU cohorts described in reports from other low- and middle-income countries, where the average age ranged between 31 and 47 years.[22-25] The most common reason for ICU admission among medical patients was infection, including community acquired pneumonia, meningitis, malaria and tuberculosis, followed by drug toxicity. The number of malaria cases over the course of the study period was notable as the centre is not situated in a malaria area. A high burden of intentional overdose was also evident.

The ICU and in-hospital mortality rates in our cohort study were 11.1% and 21.5%, respectively. The hospital mortality rate was not significantly different from that predicted by the SAPS 3 score. The mortality rate was comparable to a study conducted in KwaZulu-Natal that reported a hospital mortality rate of 17.5%.[26] Numerous other studies in Africa have reported higher mortality rates among critically ill medical patients: 30.5% in Egypt;[27] 40% in Malawi;[28] 41.4% in Tanzania; [29] and 43.7% in Uganda.[24] This variation may be a result of differences in the availability of resources across the various SSA countries.[30] As expected, the non-survivors in our study had higher illness severity scores and required more interventions such as vasopressor infusions, mechanical ventilation and dialysis. Furthermore, non-survivors had a high prevalence of sepsis (69%) as the likely underlying driver of morbidity and mortality as seen in local[31,32] and international studies.[33-35] The present study did not distinguish between sepsis on admission and nosocomial sepsis. However, the finding that the presence of sepsis was independently associated with mortality, emphasises the importance of preventing ICU-acquired infections by implementing prevention bundles and infection-control measures. Similar to international studies,[36,37] AKI was an independent marker of mortality and guidelines for the prevention for AKI in ICU patients[38] should be promoted in order to improve outcomes.

The HIV seropositivity rate in the study population was 34%. This was considerably higher than the 21% prevalence reported in a recent Eastern Cape study[39] and the 22.6% prevalence reported in a recent ICU study in Johannesburg.[32] Of the medical patients, 76.6% were tested for HIV, which was higher than the 39.0% in a recent report from Cape Town.[40] We found the uptake of ART to be low in our cohort, with only 57.4% of those with HIV on ART at admission. Other African studies have also demonstrated low rates of ART utilisation (range 48% - 54%) in patients admitted to the respective ICUs.[23,40] Notably, this falls well behind the ambitious 90-90-90 treatment target by the UNAIDS which aimed to have 90% of people diagnosed with HIV on ART by 2020.[41]

While HIV was associated with a higher mortality rate, it was not independently associated with mortality on multivariable analysis. This can be explained by the fact that the HIV-positive patients had a higher severity of disease (as indicated by higher SAPS 3 and SOFA scores), more frequent sepsis and higher requirements for dialysis. While earlier studies associated HIV infection with increased mortality in the ICU,[9,42] equivalent ICU outcomes for those with and without HIV have been demonstrated in the ART era after adjustment for disease severity.[23,43]

The prevalence of active tuberculosis among the medical cohort was 11.7%, which was somewhat lower than the 15.8% reported in a recent SA study.[32] Active tuberculosis was associated with mortality in patients with HIV. The high mortality rate in co-infected patients (57.1%) may partly be explained by the high number of patients who were ART-naïve. Prior studies of HIV and TB co-infected patients in ICUs have also demonstrated high mortality rates, ranging between 32.5% and 78.3%, respectively, with mechanical ventilation,[44,45] a high admission SOFA score,[46] a higher SAPS score[47] and AKI[44,48] as predictors of mortality.

Study strengths and limitations

The present study had a number of strengths. It was based on one of the largest complete ICU data sets in SSA, with a cohort of 875 admissions (including 261 medical admissions) over a 1-year period and encompassing a wide referral base. Secondly, owing to the use of a prospective data collection process, the results are unlikely to be biased. In addition to ICU mortality, hospital mortality was also reported. Limitations of the study include the fact that this was a single-centre study and was therefore subject to local ICU admission criteria and ICU practices. In view of this, the findings may not necessarily be generalisable. Secondly, 23.4% of our patients did not have an HIV test and this may result in the over- or underestimation of the HIV incidence in our cohort. However, the mortality rate was not different between the groups, suggesting a low risk of selection bias in initiating testing.

Table 3. Comparison of medical survivors v. non-survivors

Variable	All medical patients (*n*=256), *n* (%)*	Non-survivors (*n*=55), *n* (%)*	Survivors (*n*=201), *n* (%)*	*p*-value
Demographics				
Age (years), mean (SD)	39.9 (15.9)	46.0 (17.1)	38.3 (15.1)	0.003
Gender, male	122 (48.3)	26 (47.3)	97 (48.3)	1.000
Comorbidities				
Diabetes	42 (16.4)	7 (12.7)	35 (17.4)	0.531
Epilepsy	31 (12.1)	6 (10.9)	25 (12.4)	0.940
Active malignancy	3 (1.2)	2 (3.6)	1 (0.5)	0.226
Active tuberculosis	30 (11.7)	10 (18.2)	20 (10.0)	0.148
Immunosuppressive treatment	19 (7.4)	3 (5.5)	16 (8.0)	0.735
Chronic kidney disease	33 (12.9)	4 (7.3)	29 (14.4)	0.240
Hypertension	90 (35.2)	20 (36.4)	70 (34.8)	0.958
Ischaemic heart disease	5 (2.0)	3 (5.5)	2 (1.0)	0.117
HIV status				
Tested	198 (78.1)	41 (74.5)	157 (78.6)	0.584
Positive	68 (34.3)	20 (48.8)	48 (30.6)	0.045
On ART	39 (57.4)	9 (45.0)	30 (62.5)	0.289
Not on ART	26 (38.2)	10 (50.0)	16 (33.3)	0.310
ART use unknown	3 (4.4)	1 (5.0)	2 (4.5)	0.163
Negative	130 (66)	21 (51.2)	109 (69.4)	0.045
Premorbid CD4 cell count (cells/μL), median (IQR)†	306 (113 - 462)	85 (52 - 136)	331 (184 - 503)	0.031
Illness severity scores				
Admission SOFA score, median (IQR)	5 (2 - 7)	7 (5 - 10)	4 (2 - 6)	<0.001
SAPS 3 score, mean (SD)	52.8 (13.5)	63.7 (13.7)	49.8 (11.8)	<0.001
ICU length of stay				
ICU days, median (IQR)	4 (2 - 8)	6 (3 - 11)	3 (2 - 7)	0.010
ICU days ≥7	83 (32.4)	26 (47.3)	57 (28.4)	0.013
Mechanical ventilation	139 (54.3)	44 (80.0)	95 (47.3)	<0.001
Ventilator (days), median (IQR)	3 (1 - 8)	5 (2 - 10)	3 (1 - 7)	0.037
Requiring vasopressors	59 (23.0)	32 (58.2)	27 (13.4)	<0.001
ARDS	20 (7.7)	6 (10.9)	14 (7.0)	0.495
Sepsis	91 (35.5)	38 (69.1)	53 (26.4)	<0.001
Septic shock	43 (16.8)	25 (45.5)	18 (9.0)	<0.001
Dialysed	52 (20.3)	22 (40.0)	30 (14.9)	<0.001
AKI	160 (62.5)	50 (90.9)	110 (54.7)	<0.001

SD = standard deviation; IQR = interquartile range; ART = antiretroviral treatment; SOFA = sequential organ failure assessment; SAPS = simplified acute physiology score; ARDS = acute respiratory distress syndrome; AKI = acute kidney injury.
*Unless otherwise specified.
†Premorbid CD4 count only available in 4 and 17 HIV-positive non-survivors and survivors, respectively.

Table 4. Associations with mortality in medical cohort

	Adjusted OR	95% CI	*p*-value
Age (years)	1.02	1.00 - 1 .05	0.058
Ischaemic heart disease	6.68	0.69 - 74.96	0.101
Admission SOFA score	1.03	0.80 - 1.19	0.742
SAPS 3 score	1.03	0.99 - 1.07	0.131
ICU length of stay (days)	0.98	0.94 - 1.02	0.432
Mechanical ventilation	2.34	0.90 - 6.43	0.086
Use of vasopressors	2.34	0.94 - 5.8	0.066
Sepsis	2.91	1.25 - 6.87	0.014
AKI	3.14	1.12 - 10.3	0.040
HIV-positive status	1.87	0.00 - 1.53	0.167

OR = odds ratio; CI = confidence interval; SOFA = sequential organ failure assessment; SAPS = simplified acute physiology score; AKI = acute kidney injury.

Conclusion

This study contributes to the body of literature by describing the epidemiology and mortality of critically ill medical adults in an SA hospital. Infectious diseases remain a major cause of ICU admission and the presence of sepsis and AKI were independent markers of mortality. A high HIV seroprevalence with a low uptake of ART were found in this cohort. However, despite low ART uptake, HIV-positive status was not independently associated with mortality.

Table 5. Comparison between HIV-positive and HIV-negative subgroups

Variable	All patients (*N*=200), *n* (%)*	Positive (*n*=68), *n* (%)*	Negative (*n*=132), *n* (%)*	*p*-value
Demographics				
Age (years), mean (SD)	38.7 (14.5)	37.7 (10.9)	39.2 (16)	0.434
Gender, male	104 (52)	35 (51.5)	69 (52.3)	1
Co-morbidities				
Diabetes	28 (14)	5 (7.4)	23 (17.4)	0.084
Epilepsy	27 (13.5)	13 (19.1)	14 (10.6)	0.147
Active malignancy	2 (1)	0 (0)	2 (1.5)	–
Active tuberculosis	28 (14)	14 (20.6)	14 (10.6)	0.087
Immunosuppressive treatment	17 (8.5)	9 (13.2)	8 (6.1)	0.145
Chronic kidney disease	23 (11.5)	6 (8.8)	17 (12.9)	0.537
Hypertension	63 (31.5)	14 (20.6)	49 (37.1)	0.026
Ischaemic heart disease	1 (0.5)	0	1 (0.8)	–
Illness severity scores				
SOFA score, median (IQR)	5 (3 - 7)	5 (4 - 8)	4 (2 - 6)	0.005
SAPS 3 score, mean (SD)	52.8 (13.2)	57.1 (14)	50.6 (12.2)	0.001
ICU length of stay				
Days, median (IQR)	4 (2 - 9)	4 (2 - 9)	4 (2 - 8)	0.653
Days ≥7	72 (36.0)	28 (41.2)	44 (33.3)	0.348
Mechanical ventilation	110 (55)	35 (51.5)	75 (56.8)	0.569
Ventilator days, median (IQR)	4 (2 - 10)	4 (2 - 9)	4 (2 - 10.5)	0.674
Requiring vasopressors	43 (21.5)	19 (27.9)	24 (18.2)	0.159
ARDS	17 (8.5)	4 (5.9)	13 (9.8)	0.493
Sepsis	74 (37.0)	33 (48.5)	41 (31.1)	0.023
Dialysed	46 (23.0)	23 (33.8)	23 (17.4)	0.015
AKI	129 (64.5)	50 (73.5)	79 (59.8)	0.079

SD = standard deviation; SOFA = sequential organ failure assessment; IQR = interquartile range; SAPS = simplified acute physiology score; ARDS = acute respiratory distress syndrome; AKI = acute kidney injury.
*Unless otherwise specified.

Table 6. Comparison of HIV-positive medical survivors with non-survivors

Variable	All HIV-positive medical patients (*N*=68), *n* (%)*	Non-survivors (*n*=20), *n* (%)*	Survivors (*n*=48), *n* (%)*	*p*-value
Demographics				
Age (years), mean (SD)	37.7 (10.9)	40.9 (10.3)	36.4 (10.9)	0.116
Gender, male	35 (51.5)	9 (45.0)	26 (54.2)	0.672
Comorbidities				
Diabetes	5 (7.4)	1 (5.0)	4 (8.3)	1.000
Epilepsy	13 (19.1)	5 (25.0)	8 (16.7)	0.647
Active malignancy	0	0	0	–
Active tuberculosis	14 (20.6)	8 (40.0)	6 (12.5)	0.026
Immunosuppressive treatment	9 (13.2)	2 (10.0)	7 (14.6)	0.908
Chronic kidney disease	6 (8.8)	1 (5.0)	5 (10.4)	0.804
Hypertension	14 (20.6)	4 (20.0)	10 (20.8)	1.000
Ischaemic heart disease	0	0	0	–
Illness severity scores				
SOFA score, median (IQR)	5 (4-8)	7 (5.8-10.2)	5 (4-7)	0.002
SAPS 3 score, mean (SD)	57.1 (14)	67.2 (12.6)	52.9 (12.4)	<0.001
ICU length of stay				
Days, median (IQR)	4 (2 - 9)	3.5 (1.8 - 8.2)	4 (2 - 10)	0.409
Days ≥7	28 (41.2)	8 (40.0)	20 (41.7)	1.000
Mechanical ventilation	35 (51.5)	14 (70.0)	21 (43.8)	0.088
Ventilator (days), median (IQR)	4 (2 - 9)	4.5 (1.2 - 9)	4 (2 - 9)	0.852
Requiring vasopressors	19 (27.9)	10 (50.0)	9 (18.8)	0.020
ARDS	4 (5.9)	2 (10.0)	2 (4.2)	0.714
Sepsis	33 (48.5)	16 (80.0)	17 (35.4)	0.002
Dialysed	23 (33.8)	10 (50.0)	13 (27.1)	0.124
AKI	50 (73.5)	18 (90.0)	32 (66.7)	0.092

SD = standard deviation; SOFA = sequential organ failure assessment; IQR = interquartile range; SAPS = simplified acute physiology score; ARDS = acute respiratory distress syndrome; AKI = acute kidney injury.
*Unless otherwise specified.

Active tuberculosis, sepsis and vasopressor support were associated with mortality in HIV-positive patients. While HIV status did not predict ICU outcome *per se*, the premorbid CD4 cell count, frailty and presence of comorbidities such as tuberculosis, should be considered when assessing HIV-positive patients for ICU in a resource-limited setting. In SA, multicentre studies of medical ICU patients are needed to shed light on ways to improve outcomes and the establishment of critical care registries may be an important step to address this concern.

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Author contributions. NG wrote the protocol, interpreted the data and wrote the first draft, supervised by EvdM and RF. RA collected the data and designed the original study. SP performed statistical analysis. RF wrote the final draft and all authors assisted with and approved the final manuscript.

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Conflicts of interest. None.

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