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Epidemiology, Clinical Characteristics, and Outcomes of 4546 Adult Admissions to High-Dependency and ICUs in Kenya: A Multicenter Registry-Based Observational Study

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OBJECTIVES: To describe clinical, management, and outcome features of critically ill patients admitted to ICUs and high-dependency units (HDUs) in Kenya.

DESIGN: Prospective registry-based observational study.

SETTING: Three HDUs and eight ICUs in Kenya.

PATIENTS: Consecutive adult patients admitted between January 2021 and June 2022.

INTERVENTIONS: None.

MEASUREMENTS AND MAIN RESULTS: Data were entered in a cloud-based platform using a common data model. Study endpoints included case-mix variables, management features, and patient-centered outcomes. Patients with COVID-19 were reported separately. Of the 3892 of 4546 patients without COVID-19, 2445 patients (62.8%) were from HDUs, and 1447 patients (37.2%) were from ICUs. Patients had a median age of 53 years (interquartile range [IQR] 38–68), with HDU patients being older but with a lower severity (Acute Physiology and Chronic Health Evaluation II 6 [3–9] in HDUs vs. 12 [7–17] in ICUs; $p < 0.001$). One in four patients was postoperative with 604 (63.4%) receiving emergency surgery. Readmission rate was 4.8%. Hypertension and diabetes were prevalent comorbidities, with a 4.0% HIV/AIDS rate. Invasive mechanical ventilation was applied in 3.4% in HDUs versus 47.6% in ICUs ($p < 0.001$), with a duration of 7 days (IQR 3–21). There was a similar use of renal replacement therapy (4.0% vs. 4.7%; $p < 0.001$). Vasopressor use was infrequent while half of patients received antibiotics. Average length of stay was 2 days (IQR 1–5). Crude HDU mortality rate was 6.5% in HDUs versus 30.5% in the ICUs ($p < 0.001$). Of the 654 COVID-19 admissions, most were admitted in ICUs (72.3%) with a 33.2% mortality.

CONCLUSIONS: We provide the first multicenter observational cohort study from an African ICU National Registry. Distinct management features and outcomes characterize HDU from ICU patients.

KEYWORDS: high-dependency unit; intensive care unit; Kenya; outcomes; registry

In synchrony with the increasing global burden of critically ill patients (1), critical care services in Kenya are rapidly evolving as an established healthcare service. The availability of both high-dependency units (HDUs) and ICUs is increasing in Kenya and other African countries (2, 3). As of 2020, there were 54 critical care units in public, private, and faith-based healthcare facilities spread out over 22 of 47 counties in Kenya (4, 5).

Understanding of demographics, management patterns, and outcomes of patients accessing critical care units is pivotal for service evaluation and quality

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KEY POINTS

Question: What are the clinical characteristics and outcomes of critically ill patients admitted to critical care units in Kenya?

Findings: We leveraged the novel Kenya Critical Care Registry that uses a cloud-based platform and common data model to report contemporary data on more than 4000 admissions to high-dependency units and ICUs in the country.

Meanings: Epidemiology, clinical characteristics, and outcomes of adult admissions to high-dependency and ICUs in Kenya's large dataset are key in defining the context-specific epidemiology and outcomes. This information is pivotal for clinical trial equipoise assessment, sample size estimations, and national critical care resources forecasting.

improvement, government resource planning, and clinical trials sample size and equipoise assessments. This importance was accrued during the COVID-19 global pandemic (6). Few single-center studies assessed outcomes of patients in Kenyan ICUs, reporting high mortality and variable performance of existing prognostic score systems (7, 8). A recent study landscaped the organization, staffing, and resources of both public and private critical care units in Kenya (6). We still lack large multicenter studies describing patient epidemiologic characteristics, patterns of management, and patient-centered outcomes.

Patients in Kenya access different types of critical care units with varying levels of structural organization, organ support capabilities, resources, and staffing patterns. Although terminology varies, several classification systems exist to frame services provided by HDUs versus ICUs (9). Usually, HDUs care for less sick patients, provide support for only one organ failure, and have a lower nurse-to-patient ratio as compared with full-feature ICUs.

To facilitate real-time patient-level data collection enabling critical care service evaluation and identification of targets for quality improvement initiatives, the Kenyan Critical Care Registry was launched in December 2020 by the Critical Care Society of Kenya (CCSK) with the Collaboration for research, implementation, and training in Critical Care in Asia and Africa Network and Mahidol Oxford Research Unit (10). The registry currently involves 11 units spread across 6 hospitals in 5 counties in Kenya. As with other national ICU registries worldwide, it also provides benchmarking services, opportunities for service forecasting, and allocation of resources (11–14).

In this multicenter registry-based observational study, we sought to describe patient epidemiologic characteristics, patterns of management, and outcomes of critically ill patients referred to critical care units in Kenya. We also aimed to define variations in these features between HDU and ICU patients.

MATERIALS AND METHODS

Study Design and Ethics Approval

Epidemiology, clinical characteristics, and outcomes of adult admissions to high-dependency and ICUs in Kenya (EPOK) was a multicenter registry-based prospective observational study. Data were collected from the Kenya Critical Care Registry housed under the CCSK. Primary ethics approval for the registry deployment was sought from the Aga Khan University Institutional Ethics Review Committee (reference number 2019/IERC-89 approved on November 26, 2020) and for the present study (approval for "Baseline Kenya Critical Care Registry output" with reference number 2021/IERC-125 on September 28, 2021). The National Commission for Science, Technology, and Innovation (NACOSTI) license was obtained (reference number 16058). Site approvals from NACOSTI-accredited ethical committees and/or administrative clearance were obtained from participating institutions before registry initiation. A waiver of informed consent was obtained. The study was registered on Clinicaltrials.gov (reference number NCT05456217). Preliminary results were previously reported in abstract form (15). The study is reported following the Strengthening of the Reporting of Observational Studies in Epidemiology statement guidelines and checklists (**Supplemental Table 1**, http://links.lww.com/CCX/B294) (16).

Participants

Consecutive patients of 18 years or older admitted to HDUs and ICUs from January 2021 to June 2022 within 11 Kenya Critical Care Registry network units were enrolled. Patient follow-up lasted until HDU or ICU discharge.

Study Endpoints

Descriptive endpoints included case-mix variables such as information on demographic characteristics like age, years, sex at birth, comorbidities, reasons for admission, source of admission, and surgical status. The Acute Physiology and Chronic Health Evaluation (APACHE)-II score was used to describe severity of illness, with a range from 0 to 71. Management features included organ support measures namely use of invasive mechanical ventilation (IMV), noninvasive ventilation, high-flow nasal therapy (HFNT), use of vasoactive medication, sedatives, and renal replacement therapy. Antibiotic prescriptions during the first 24 hours of patient care were also reported. Patient-centered outcomes included duration of IMV, length of stay, and crude mortality.

Registry Structure

A preestablished critical care minimum dataset (**Supplemental Table 2**, http://links.lww.com/CCX/B294) was used in all centers participating in the study. Details of the registry structure, quality assurance, and data safety are available in **Supplementary Material (page 2)** (http://links.lww.com/CCX/B294) and previously published work (17). The registry data flow is schematized in **Supplemental Figure 1** (http://links.lww.com/CCX/B294).

Statistical Analysis Plan

For this descriptive study, no formal sample size calculation was performed. All patients admitted to participating critical care units from the registry onset to June 2022 were included. The main grouping variable was the type of unit of admission (HDU vs. ICU). Patients with a diagnosis of COVID-19 were described as a preestablished patient subgroup.

Continuous variables were presented as medians (interquartile range [IQR]) and categorical variables as numbers and percentages. Continuous data were tested for normality using the Shapiro-Wilk normality tests. Mann-Whitney and Chi-square tests were used for comparisons of continuous and nominal data, respectively. The APACHE-II score was calculated for all patients as originally described (18). Missing values in the variables required for APACHE-II score calculation were handled through imputation using the normal distribution method. For missing data in categorical variables, we reported denominators and adjusted proportions accordingly. The association between the grouping variable (admission to HDU or ICU) and mortality as a time-to-event was analyzed with a Cox regression model, reporting the hazard ratio with 95% CI. All analyses were performed using a two-sided superiority hypothesis test, with a significance level of 0.05. No corrections were performed for multiple comparisons across descriptive outcomes. Analyses were performed using software R (version 4.0.2, R Core Team, 2016, Vienna, Austria).

RESULTS

Patient Cohort and Geographic Distribution

A total of 4546 patients were recruited in the Kenya Critical Care Registry from January 2021 to June 2022, with a rising number of monthly encounters in time (**Supplemental Fig. 2**, http://links.lww.com/CCX/B294). Patient enrollment flowchart is shown in **Figure 1**. There was an imbalance in geographical distribution of patients with a wider representation of patients from the southern part of the country and the capital city Nairobi (**Fig. 2**). The amount of missing data was low (Supplemental Table 2, http://links.lww.com/CCX/B294). Of the 3892 patients admitted for a reason different from severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection, 2445 (62.8%) patients were admitted to HDUs and 1447 (37.2%) to ICUs. A total of 654 patients (14.4%) were confirmed positive for SARS-CoV-2 infection, with 27.6% being admitted to HDUs while 72.3% were ICU admissions.

Units Characteristics

A total of six mixed ICUs, two COVID ICUs, and three HDUs participated in the study from six different hospitals. The units differed in terms of organizational, staffing, and availability of resources (**Supplemental Table 3**, http://links.lww.com/CCX/B294). All units apart from one HDU had functional mechanical ventilators. A functional blood gas apparatus was missing in five units.

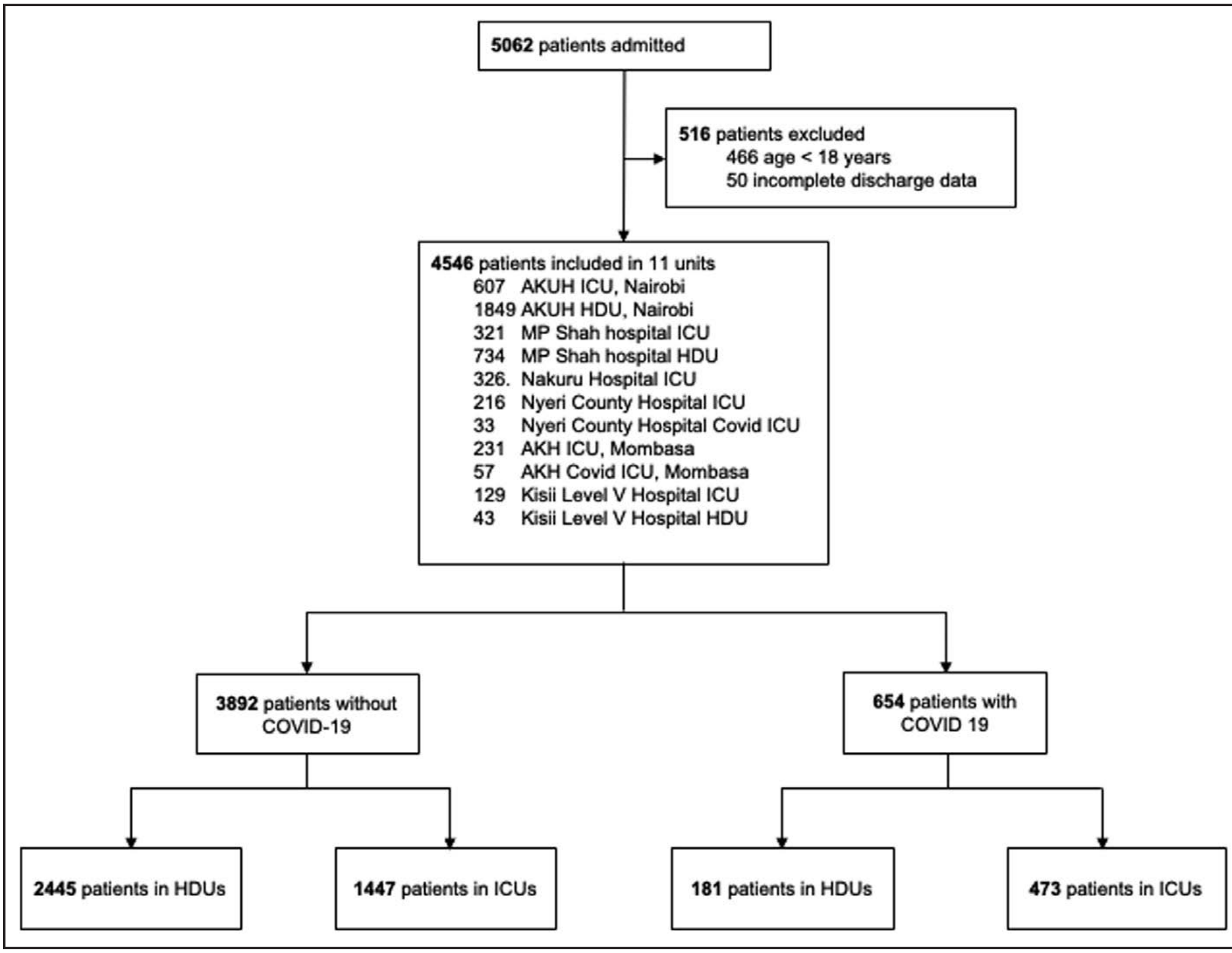

Figure 1. Patient flowchart. HDU = high-dependency units.

Case-Mix and Severity of Illness

Demographic characteristics, reasons of admissions, and reported comorbidities of patients admitted for reasons other than COVID-19, are summarized in **Table 1**. Median age was 53 (38–68) years, with HDUs admitting older patients (55 [40–70] yr) compared with ICUs (49 [34–64] yr; $p < 0.001$). Overall, 42% of patients were female with a similar sex at birth distribution between the units. Main diagnostic categories were respiratory, neurologic, and cardiovascular. One of four patients was admitted following a surgical operation with 63.4% being emergency procedures. Hypertension and diabetes mellitus were highly prevalent, with HIV prevalence reported at 4.0% (**Supplemental Table 4**, http://links.lww.com/CCX/B294). Patients in HDUs had more frequent comorbidities as compared with ICUs.

The severity of illness at admission measured by the APACHE-II score was lower in HDUs (6 [3–9] vs. 12 [7–17] in ICUs; $p < 0.001$). Overall, 4.7% of patients were unconscious at admission, less frequently in HDUs (0.7% vs. 11.6% in ICUs; $p < 0.001$). Overall, blood gas analysis information was available in half of patients (49.8%), and less frequently in ICU patients (**Supplemental Table 5**, http://links.lww.com/CCX/B294).

Management Features During First 24 hours

Only 3.4% of HDU patients were invasively ventilated versus 47.6% in the ICU ($p < 0.001$; **Table 2**). HFNT and noninvasive ventilation were seldom used in both HDUs and ICUs despite being available in half of the hospitals. Sedation was used less frequently in HDUs as compared with ICUs (2.7% vs. 26.9%, $p < 0.001$). Overall, vasopressor

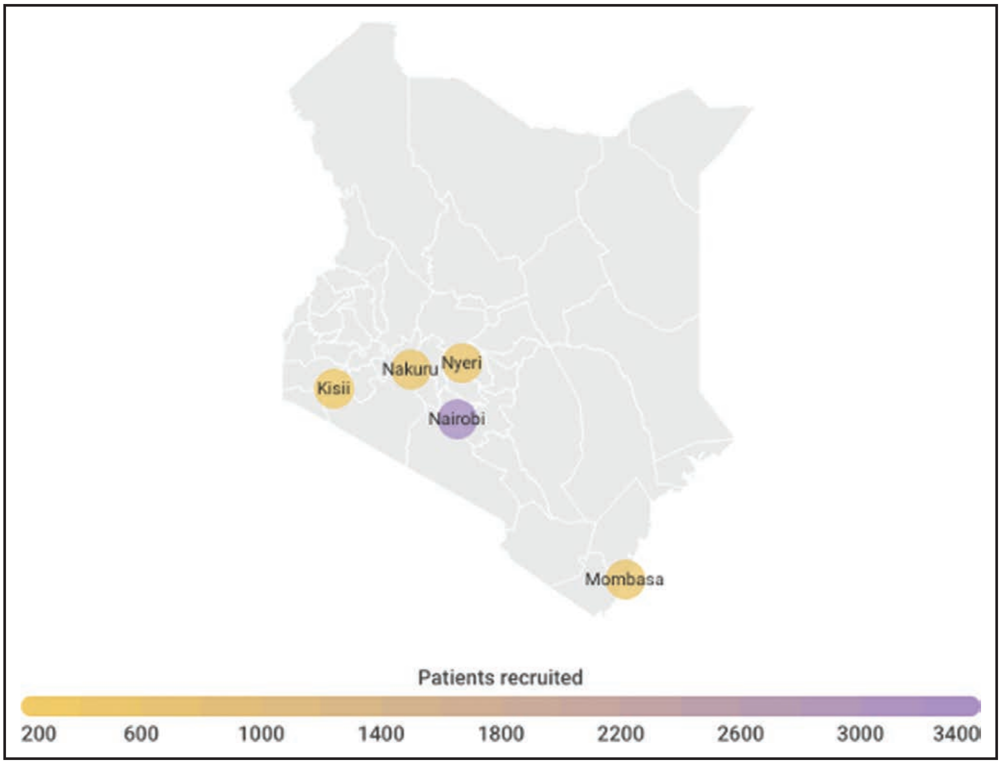

Figure 2. Geographical distribution of recruited patients in Kenya, stratified by county.

use rate in the first 24 hours was 5.4% with a lower use in HDUs (2.7% vs. 10.2%) in ICUs ($p < 0.001$). Renal replacement therapy (RRT) was used in 4.2% of patients, similarly in HDUs and ICUs. One of two admitted patients received antimicrobial therapy during the first 24 hours of admission—less frequently in HDUs ($p < 0.001$).

Patient Outcomes

Patient outcomes are summarized in Table 2. Crude mortality stratified by age, sex, comorbidities, ICU/HDU admission status, and IMV is shown in **Figure 3**. Mortality increased linearly with rising APACHE-II levels (**Fig. 4**), with probability of survival in time being higher in HDUs compared with ICUs. HR for death in ICU compared with HDU was 3.7 (95% CI, 3.1–4.5; $p < 0.001$). Duration of IMV for intubated patients was 7 days (3–21). Median length of stay in critical care was 2 days (1–5), being shorter in the HDU as compared with ICUs (2 [1–4] vs. 3 [1–6] days; $p < 0.001$). One of 20 patients (5.3%) received a tracheostomy during ICU stay.

COVID-19 Patients Subset

COVID-19 admissions were less frequent in HDUs as compared with ICUs. Peaks of admissions for COVID-19 were observed in March, July, and November 2021. The median age was 62 years (IQR 49–72). Most admissions came from inpatient facilities (44.8%) and the emergency department (39%; **Supplemental Table 6**, http://links.lww.com/CCX/B294). The most common comorbidity was hypertension. Most patients were conscious (77.7%; **Supplemental Table 7**, http://links.lww.com/CCX/B294) and spontaneously breathing at admission (70.3%), with 14.7% of patients requiring invasive ventilation (2.8% in HDUs vs. 19.2% in ICUs, $p < 0.001$). Use of sedatives, vasopressors, and RRT was similar to patients without COVID-19 (**Supplemental Table 8**, http://links.lww.com/CCX/B294). Overall, 62.7% of patients received antibiotics at admission (36.5% in HDUs vs. 72.7% in ICUs, $p < 0.001$). The overall mortality rate was 33% (21.0% in HDUs vs. 37.8% in ICUs, $p < 0.001$ (**Supplemental Table 9**, http://links.lww.com/CCX/B294).

DISCUSSION

This report describes demographic, clinical features, and outcomes of a large cohort of patients admitted to critical care units in Kenya. These data are key in defining context-specific epidemiology, forecasting the need for critical care resources, as well as informing hospital preparedness activities. These findings will also contribute to future planning of clinical trials in terms of equipoise establishment and sample size calculations.

More than half of the patients in the Kenyan Registry were HDU admissions. This is a novel finding, highlighting the role of intermediate units in caring for critically ill patients with a low to medium degree of severity. Although several research groups are attempting to establish minimum levels of critical care in Africa (19, 20), exact guidelines, admission

TABLE 1.
Demographic Characteristics, Severity Level, Reason, and Sources of Admission of Patients (Excluding COVID-19 Patients)

Variables	All Patients (n = 3892)	Patients in HDU (n = 2445)	Patients in ICU (n = 1447)	p
Demographics				
Age, yr	53 (38–68)	55 (40–70)	49 (34–64)	0.000[a]
Sex, female	1633 (42.0)	1058 (43.3)	575 (39.7)	0.071
Acute Physiology and Chronic Health Evaluation II score	8 (4–13)	6 (3–9)	12 (7–17)	0.000[a]
Reason of admission to ICU[a]				0.000[a]
Cardiovascular	1145 (29.4)	704 (28.8)	441 (30.5)	
Neurologic	1149 (29.5)	618 (25.3)	531 (36.7)	
Respiratory	837 (21.5)	440 (18)	397 (27.4)	
Gastrointestinal	827 (21.2)	508 (20.8)	319 (22)	
Genitourinary	463(11.9)	225 (9.2)	238 (16.4)	
Metabolic/endocrine	349 (9)	246 (10.1)	103 (7.1)	
Trauma	335 (8.6)	107 (4.4)	228 (15.8)	
Hematology	150 (3.9)	104 (4.3)	46 (3.2)	
Musculoskeletal/skin	146 (3.8)	77 (3.1)	69 (4.8)	
Transplant	8 (0.2)	5 (0.2)	3 (0.2)	
ICU admission source				0.000[a]
Same hospital				
ED	2028/3862 (52.5)	1501/2420(62.0)	527/1442 (36.5)	
Ward	848/3862 (22.0)	474/2420 (19.6)	374/1442 (25.9)	
Operating theater	550/3862 (14.2)	222/2420 (9.2)	328/1442 (22.7)	
ICU/HDU	259/3862 (6.7)	181/2420(7.5)	78/1442 (5.4)	
Other hospital				
ED	39/3862 (1.0)	5/2420 (0.2)	34/1442 (2.4)	
Ward	69/3862 (1.8)	4/2420 (0.2)	65/1442 (4.5)	
Operating theater	13/3862 (0.3)	0/2420 (0.0)	13/1442 (0.9)	
ICU/HDU	25/3862 (0.6)	9/2420 (0.4)	16/1442 (1.1)	
Operating theater, unclassified	31/3862 (0.8)	24/2420 (1.0)	7/1442 (0.5)	
Readmissions	185/3892 (4.8)	123/2445 (5.0)	62/1447 (4.3)	0.314
Admission type				
Operative	952/3892 (24.5)	495/2445 (20.2)	457/1447 (31.6)	0.000[a]
Nonoperative	2940/3892 (75.5)	1950/2445 (79.8)	990/1447 (68.4)	
Emergency surgery for operative	604/952 (63.4)	286/495 (57.8)	318/457 (69.6)	0.000[a]

ED = emergency department, HDU = high-dependency unit.

[a]Classification based on Acute Physiology and Chronic Health Evaluation IV coding.

Data are presented as frequency (%) or median (interquartile range).

TABLE 2.
Management Features and Patient Outcomes (Excluding COVID-19 Patients)

Variables	All Patients (*n* = 3892)	Patients in HDU (*n* = 2445)	Patients in ICU (*n* = 1447)	*p*
Management				
Ventilation status at admission				0.000[a]
Spontaneous	3047/3869 (78.8)	2332/2444 (95.4)	715/1425 (50.2)	
High-flow nasal cannula	3/3869 (0.1)	0/2444 (0)	3/1425 (0.2)	
Noninvasive ventilation	48/3869 (1.2)	30/2444 (1.2)	18/1425 (1.3)	
Invasive ventilation	771/3869 (19.9)	82/2444 (3.4)	689/1425 (48.4)	
Therapeutics				
Use of sedatives	423/3889 (10.9)	34/2444 (1.4)	389/1425 (27.3)	0.000[a]
Use of vasopressors	210/3889 (5.4)	65/2444 (2.7)	145/1425 (10.2)	0.000[a]
Renal replacement therapy	165/3889 (4.2)	97/2444 (4.0)	68/1425 (4.8)	0.267
Antimicrobial use	1936/3889 (49.7)	941/2444 (38.5)	995/1425 (69.8)	0.000[a]
Outcomes				
Mortality at ICU discharge	601/3892 (15.4)	160/2445 (6.5)	441/1447(30.5)	0.000[a]
Discharge destination for survivors				
Ward	2682/3291 (81.5)	1956/2285 (85.6)	726/1006 (72.2)	0.000[a]
ICU	128/3291 (3.9)	92/2285 (4.0)	36/1006 (3.6)	
Home	211/3291 (6.4)	186/2285 (8.1)	25/1006 (2.5)	
HDU	151/3291 (4.6)	3/2285 (0.1)	148/1006 (14.7)	
Other hospitals	55/3291 (1.7)	21/2285 (0.9)	34/1006 (3.4)	
Transfer for specialist care	13/3291 (0.4)	5/2285 (0.2)	8/1006 (0.8)	
Other reasons	51/3291 (1.5)	22/2285 (1.0)	29/1006 (2.9)	
Left against medical advice[a]	20/3291 (0.6)	14/2285 (0.6)	6/1006 (0.4)	0.000[a]
Discharge upon patient request[b]	39/3291 (1.2)	15/2285 (0.7)	24/1006 (2.4)	0.000[a]
Other outcomes				
Length of stay, d	2 (1–5)	2 (1–4)	3 (1–6)	0.000[a]
Duration of mechanical ventilation, d (*n* = 606)	8 (3–21)	NA[c]	8 (3–21)	NA[c]
Tracheostomy	32/606 (5.3)	NA[c]	32/606 (5.3)	NA[c]

HDU = high-dependency unit, NA = not applicable.

[a]Defined as the patient leaving the ICU against the advice of their medical team.

[b]Defined as the decision to discharge from ICU made by a patient or family and facilitated by the clinical team (e.g., transfer to another hospital at patient's request).

[c]Daily registry data not available in HDU.

Data are presented as frequency (%) or median (interquartile range).

criteria, and quality indicators for HDUs are still lacking. Registry-based studies focusing on HDU patients' characteristics were performed especially in Japan, focusing on pneumonia, COVID-19, and surgical patients (21, 22). Single-center studies are available from African HDUs, but focused on organizational characteristics, cost-effectiveness, and specific subpopulations such as obstetrics (2, 3, 23). EPOK's findings pinpointing extensive clinical and outcome features provide the first patient-level multicenter data specifically assessing this group of patients against the group admitted to ICUs.

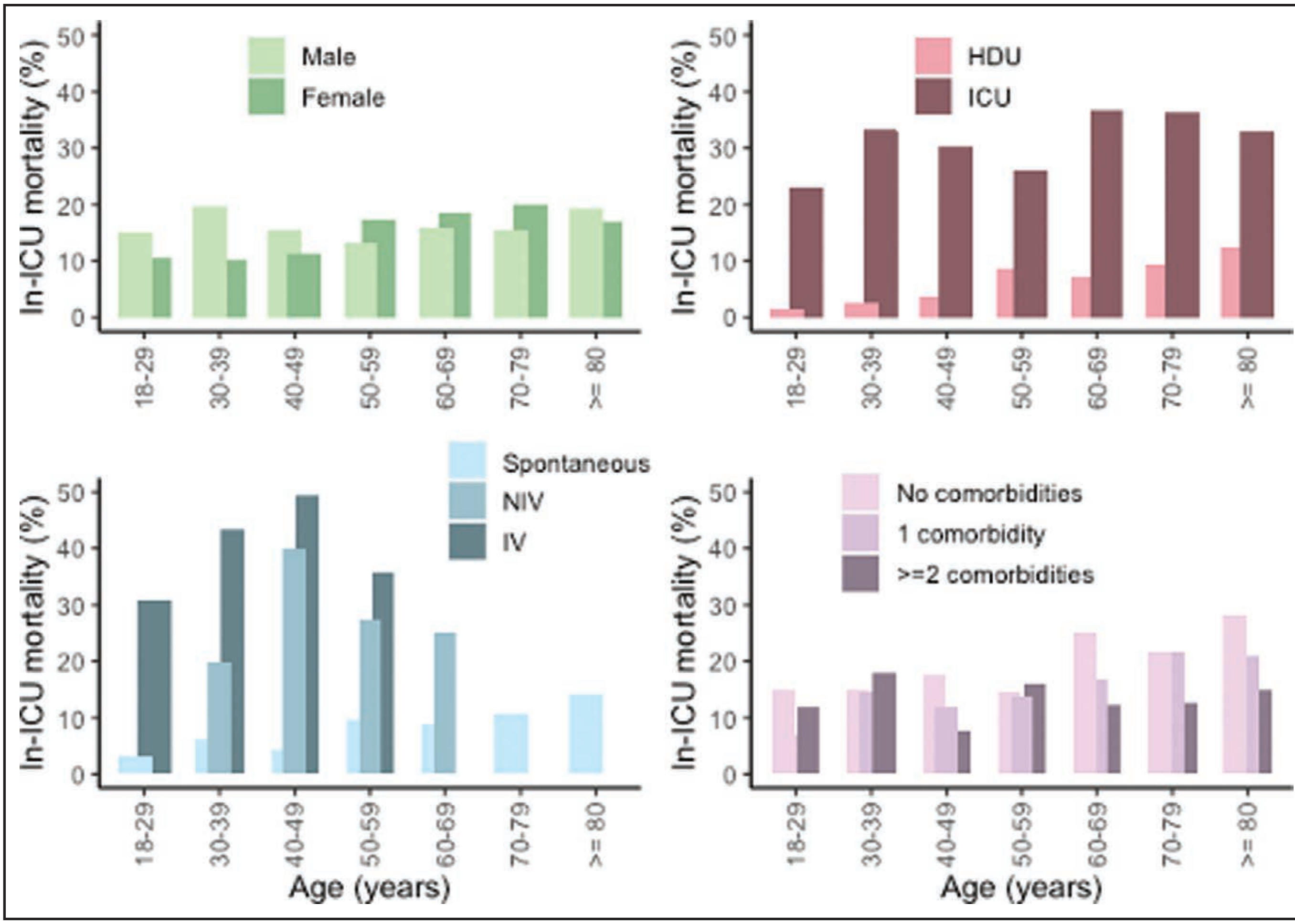

Figure 3. Crude ICU mortality stratified by age, sex, comorbidities, ICU/high-dependency unit (HDU) admission status, and invasive mechanical ventilation for patients admitted to critical care units in Kenya (excluding COVID-19 patients). Data are from patients with a defined ICU discharge outcome; proportions of patients were calculated based on complete case data for sex, comorbidities, ICU/high-dependency unit (HDU) admission status, and invasive ventilation (IV) variables. NIV = noninvasive ventilation.

Our findings on case-mix and epidemiologic characteristics are in line with previous reports from Kenya and other African countries (7, 8). The age of critically ill patients in Kenya was relatively low, with overall half of patients being between 38 and 68 years of age, with even younger patients accessing ICUs. Of note, we could not show a clear linear increase in mortality with age. Six of 10 patients had one or more comorbidities with a spectrum of chronic conditions including hypertension, diabetes, chronic kidney disease, and neoplastic disorders. A quarter of patients arrived in the critical care unit after surgery, in line with other international observational studies (24–27), although less than reported in Uganda (28) and Malawi (29). In fact, critical care registries such as the one deployed for this study were deemed important to tackle the high perioperative mortality in Africa (30).

The findings on organ support in patients accessing Kenyan HDUs and ICUs present some peculiarities. There was a comparable use of non-IMV in HDUs as ICUs, while IMV clearly remains an ICU feature. Of note, the use of renal replacement therapy was equal in HDUs compared with ICUs, emphasizing the important role that intermediate-level units play in renal organ support. Patients in ICUs received similar rates of mechanical ventilation and RRT as compared to another registry-based cohort in Brazil, but consistently less cardiovascular support (11). The rate of cardiovascular support was also lower compared with cohorts from India (13), and from previous studies in Kenya (7, 8). Whether this represents underreporting or actual underuse of cardiovascular support remains to be elucidated. With regards to respiratory support, we observed that HFNT is still rarely used in both HDUs and ICUs, despite efforts to increasing noninvasive ventilation support occurring during the pandemic. Whether patients not receiving invasive ventilation should be admitted to ICUs is a debated issue in other national

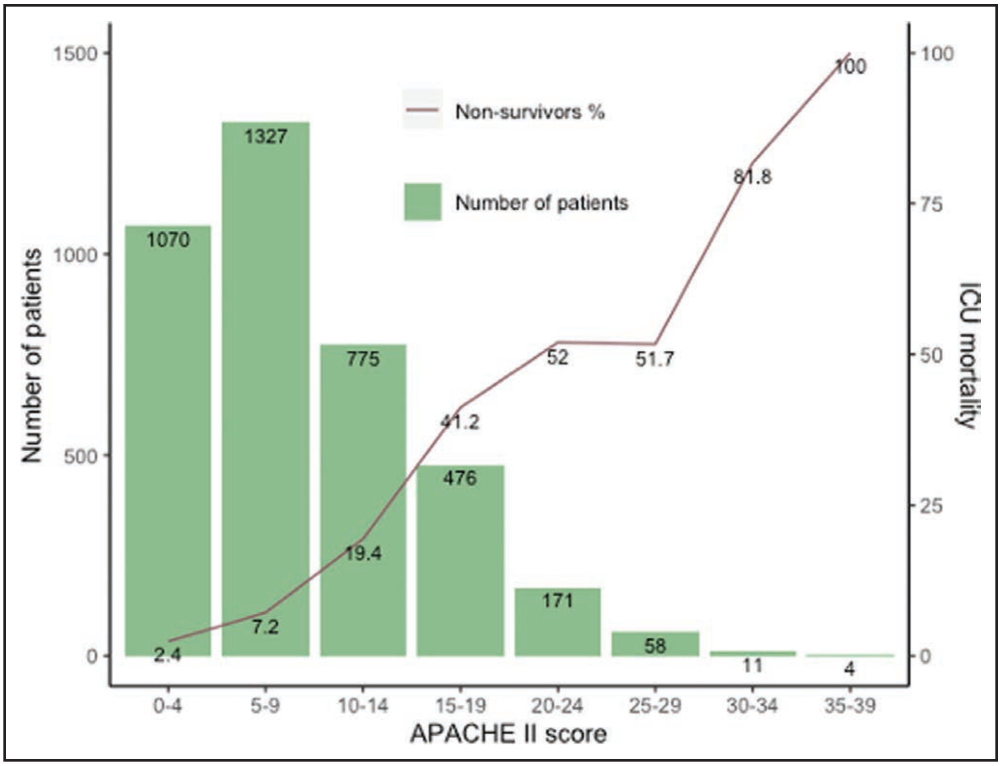

Figure 4. Distribution of Acute Physiology and Chronic Health Evaluation (APACHE)-II scores and ICU mortality rates (excluding COVID-19 patients).

This is considerably higher than what was observed in middle-income countries in Asia (25). Subsequent analysis will be needed to define modifiable factors for mortality in Kenya, both in ventilated and nonventilated subgroups.

The proportion of COVID-19 admissions (14%) was comparable to other countries during the pandemic period. The SARS-CoV-2 vaccination program was initiated in March 2021 and there was a large unvaccinated vulnerable geriatric population at the beginning of the EPOK study. SARS-CoV-2 admissions were mainly internal referrals, or from hospitals without critical care services. Patients' age and comorbidities were in line with findings from the African COVID-19 Critical Care Outcomes Study (ACCCOS) cohort (33). Length of stay was also similar around a median of 6–7 days. Crude mortality is difficult to compare as ACCCOS reported 30-day mortality (48%), whereas EPOK reported death at ICU discharge. A multinational registry-based study concluded that the pandemic particularly affected the outcomes of non-COVID patients in low and middle income countries, but we could not corroborate this hypothesis in our data (34).

registries (31). Scaling up HFNT use or zooming in on the use of cardiovascular support represent potential targets of quality improvement initiatives focusing on adoption and fidelity of interventions.

Outcomes of critically ill patients in our cohort seem to show an improving trend compared with past reports. A previous single-center report in 2018 including 450 ICU patients reported a mortality above 50% (8), while in our study it is just above 30% for the ICU cohort. The 2018 study included patients who were more frequently ventilated or received other organ support measures, limiting the meaningfulness of direct comparisons (8). EPOK's ICU mortality is comparable to a more recent study looking at outcomes of one single well-resourced ICU in Kenya (7). However, the observed ICU mortality exceeding 30% in a mixed ICU population is higher than previously found in a large multicenter point prevalence study in India that had comparable APACHE-II scores at admission (24) or from registry-based evaluations from Brazil (11) and India (13). A recent analysis focusing on mechanically ventilated patients in Ethiopia reported an ICU mortality of 49%, identifying as relevant risk factors being diabetic, having a glasgow coma scale less than 8, and nighttime admissions (32).

The EPOK study has several limitations. First, only one-fifth of critical care units in Kenya were represented in the study, although the mix allowed for both private and public centers with a geographic distribution that mirrors the one found in a recent landscaping ICU survey (6). Second, willingness of participating units to join a national registry could have led to selection bias toward inclusion of units with better resources or outcomes. The HDU cohort was unbalanced toward one high-resourced HDU in Nairobi. Similar to other registry-based studies, access to patients' data was restricted to data collectors and site leads, and no formal source data verification was performed. In addition, we lacked data on several key domains such as entry criteria in the units, complications occurring during ICU stay, granular data on ventilation and hemodynamic variables, long-term mortality as well as institutional policies on end-of-life and palliative care. The study was performed amid COVID-19 surges, thus admission patterns in the non-COVID units may have differed from the norm.

CONCLUSIONS

EPOK's findings extend our knowledge on demographics, clinical features, and short-term outcomes of patients being admitted to critical care units in Kenya. The defined timeframe within which data was gathered limited the effect of practice changes over time while allowing to account for seasonal case-mix variations and inclusion of the COVID-19 patient subgroup. These data establish a basis for sample size calculations for future critical care trials in Kenya and provide context-specific information on quality improvement targets and contemporary service evaluation from a representative sample of public and private units in the country.

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A waiver of informed patient consent was obtained for the Kenya Critical Care Registry.

The datasets used and analyzed during the current study are available on motivated request. For further information and access to the data, contact the Critical Care Asia Africa data access committee (DAC@nicslk.com) quote the article, your institution and provide return correspondence information.

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