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Twelve Month outcome analysis of a South African Intensive Care Unit.

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Declaration

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Signed

Signed by candidate

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Table of Contents

Cover page	i
Declaration	ii
Acknowledgements	ii
Chapter 1 – Publication ready Manuscript	1
Abstract	2
Keywords	2
Acknowledgements	3
Conflict of interest	3
Author contributions	3
Funding	3
Acronyms and abbreviations	4
Background	5
Methods	6
Results	7
Discussion	8
Limitations	10
Conclusion	11
References	12
Tables and Figures	15
Appendices	
Appendix 1: UCT HREC approval for the study	22
Appendix 2: South African Medical Journal Instructions to authors	23

Chapter 1: Publication-ready manuscript

Twelve Month outcome analysis of a South African Intensive Care Unit.

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Abstract

Background: The description of outcomes after admission to Critical Care Units in Africa is sparse, reporting mortality rates between 23.6% and 53.6%. South African data, thus far, show in-ICU mortality rates between 9% and 19.7%. To our knowledge, no evaluation of ICU outcomes has ever been performed on a population group in the Western Cape Province.

Objectives: To describe patients admitted to an 8-bed ICU unit over one calendar year with regards to demographics and outcomes situated in Groote Schuur Hospital with regard to in-ICU and 1-year mortality rates.

Methods: This is a retrospective descriptive review of adult patients (>18 years old) from 1 January 2019 to 31 December 2019. Data were collected on age, sex, primary admission diagnosis, length of stay and mortality.

Results: A total of 338 patients were included; 61.2% (n=207) with a primary medical diagnosis and 38.2% (n=129) with a non-medical diagnosis. Trauma accounted for 13.6% of all admissions. The burden of known HIV infection as a comorbidity was 16.9% (n=57). The overall in-ICU mortality was 25.7% (n=87), and the one-year mortality was 18.0% (n=25), but with a significant loss to follow-up of 33.1%.

Conclusion: The overall in-ICU mortality was 25.7%. A large proportion of patients admitted had a trauma diagnosis, despite it historically accepting mostly medical and complicated obstetric patients.

Keywords: ICU; mortality; Africa; outcomes

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Conflict of interest

No actual, perceived or potential conflicts of interest are known to the authors, and we have no personal or financial incentives to declare that are in any way related to the content/topic of this manuscript.

Author contributions

DE, MM and JP conceived of the study. DE and MM collected the data. DE, MM and JP wrote the first draft. All authors (DE, MM, JP, IJ) reviewed the data and provided input into the different versions. All authors read and approved the final version.

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Acronyms and abbreviations

HIC	High-income countries
CCU	Critical care unit
ICU	Intensive care unit
UMIC	Upper-middle-income countries
KZN	KwaZulu Natal
HRQOL	Health-related quality of life
GSH	Groote Schuur Hospital
COVID-19	Coronavirus disease of 2019
M&M	Morbidity and mortality
NDoH	National Department of Health
LOS	Length of stay
APACHE II	Acute Physiology and Chronic Health Evaluation II score
SOFA	Sequential Organ Failure Assessment score
SAPS 3	Simplified Acute Physiology Score 3
ISS	Injury Severity Score
IQR	Interquartile range
HIV	Human immunodeficiency virus
CD4	Cluster of differentiation 4
AIDS	Acquired immunodeficiency syndrome
UNAIDS	The Joint United Nations Programme on HIV and AIDS
TB	Tuberculosis
OAD	Obstructive airways disease
ERCP	Endoscopic retrograde cholangiopancreatography
ENT	Ear, nose and throat surgery
OMFS	Oral, maxillofacial surgery

Background

In contrast to the extensive literature arising from high-income countries (HIC), the description of outcomes after admission to Critical Care Units (CCUs) in Africa is sparse. This is explained, in part, by the lack of resources and overburdened healthcare personnel^[1]. According to the World Bank, no African country is classified as a HIC^[2].

Previously published studies, in combined medical and surgical Intensive Care Units (ICU) from Africa, describe mortality rates of between 23.6% and 53.6%^[3-7]. These, however, only describe survival up to ICU discharge.

According to data from the World Bank, South Africa is classified as an upper-middle-income country (UMIC) and, compared to its neighbours and the rest of the continent, is relatively wealthy^[8]. However, the healthcare sector in South Africa is resource-poor, with a reported 6 ICU beds per 100 000 population as compared to HICs with an estimated 12.8 beds per 100 000^[9, 10]. The government-funded healthcare system is more constrained than the private healthcare system^[11]. To date, the South African data on morbidity and mortality in critically ill patients varies widely due to the heterogeneity of population groups studied and the limited availability of resources in the government-funded healthcare sector. The absence of a national database and widespread electronic record keeping, in particular, makes it difficult to combine data in a review^[12-14].

With respect to data from South Africa, in 1985, Hira et al. described the outcomes of 156 critically ill patients admitted over a 6-week period to the ICU at the Baragwanath Hospital, Gauteng. They reported an ICU mortality rate of 9% and an in-hospital mortality rate of 10.3%; longer-term outcomes were not reported^[12]. More recently, 4 South African studies have published data from government-funded hospitals in the provinces of KwaZulu Natal (KZN) and the Eastern Cape: Wise et al. (2017) included 228 patients from 11 ICUs from 6 hospitals over a 1-month period and reported an in-ICU mortality rate of 19.7%, with a 30-day mortality rate of 33.9%^[13]. Anesi et al. (2018) described 2 630 patients admitted over a 3-year period to 2 ICUs. In this cohort, the in-ICU mortality rate was 15%, but longer-term outcomes were not reported^[14]. In 2022, Freercks et al. reported on outcomes for medical ICU patients from a prospectively collected 2017 dataset; 712 patients were evaluated, with an in-ICU mortality rate of 11.1% and an in-hospital mortality rate of 21.5%^[15]. South African data on longer-term outcomes were published by Van der Merwe et al. in 2022, describing 1-year outcome data for long-stay medical and surgical intensive care patients in the Eastern Cape. Their cohort included patients who received mechanical ventilation for >6 days. The in-hospital mortality rate was 42.9%, and the 1-year mortality rate was 57.4%; survivors had a high incidence of poor health-related quality of life (HRQOL) at 12 months post-discharge^[16].

Groote Schuur Hospital (GSH) is a government-funded, tertiary-level teaching hospital and is affiliated with the University of Cape Town. At the time of this study, GSH had a capacity of 991 beds, serving the Western part of the Cape Metropole and other areas determined by Provincial referral policy. The 25 ICU beds at GSH are under the governance of the Division of Critical Care and function as closed ICUs with high-intensity staffing models.

Prior to the Coronavirus disease of 2019 (COVID-19) pandemic, there was little published mortality data for patients admitted to ICUs in the Western Cape of South Africa. The aim of

this study was to describe mortality data for patients admitted to an ICU at GSH in the Western Cape.

Methods

This is a retrospective descriptive review of adult patients (>18 years) admitted to a single ICU with a total of 8 beds, from 1 January 2019 to 31 December 2019. The study is designed to provide data on ICU outcomes, specifically, in-ICU mortality and mortality 1 year after discharge from ICU, and to document the disease burden in this patient group.

Historically, the ICU under review admitted only medical patients and obstetric patients with complex disease. However, since forming an amalgamated Division of Critical Care in October 2003, surgical and trauma patients may also be accommodated in this unit should the need arise due to bed pressure across the ICU platform. Nevertheless, the unit under review remains the primary referral unit for critically ill medical and obstetric patients. During the study period, the combined critical care division comprised 25 ICU beds (8 medical, 8 surgical, 6 cardiothoracic and 3 source isolation beds).

At the time of data collection, an electronic database had not been established in the combined ICUs at GSH. For the purpose of this study, the nursing admission book served as the primary source of admission data. The nursing admission book documents limited information: patient's name, date of birth, hospital identification number, referral ward or hospital, date and time of admission, and date, time and location of discharge from ICU or death. These data are contemporaneously collected by the admitting nurse at the time of admission and at the time of ICU discharge or death. In order to minimise missing data, additional information was obtained from discharge and death summaries, statistics from morbidity and mortality meetings (M&M), digital radiological records, and the Clinicom™ electronic hospital information system used at GSH and by the Western Cape Department of Health [14].

With the amendment to the Births and Deaths Registration Act No. 51 of 1992 in 2014, the National Department of Health (NDoH) is no longer able to access identified information recorded by doctors on the death notification form (DHA-1663). This information can only be accessed by a Statistics South Africa official [17]. This makes it impossible for local health sub-districts to capture mortality data for statistical use. We could not utilise a central database to determine the date of death for those patients who were lost to follow-up.

Data were collected on in-ICU and 1-year mortality as well as age, sex, primary admission diagnosis, relevant laboratory results, and ICU length of stay (LOS). Information regarding the severity of disease and ICU mortality prediction (e.g. Acute Physiology and Chronic Health Evaluation (APACHE II), Sequential Organ Failure Assessment (SOFA) score, Simplified Acute Physiology Score 3 (SAPS 3), Injury Severity Score (ISS)) were not available. Patients younger than 18 years old were not included in the analysis. Patients readmitted to ICU during the same hospital admission were deemed to have failed discharge from ICU and had data captured for the index admission only. Any patient with subsequent readmission to ICU after discharge to home or a step-down healthcare facility had data captured for both admissions.

Data were entered into a Microsoft Excel® Spreadsheet, which was password protected. Only investigators had access to this spreadsheet. Computers used to collect and analyse data were equipped with updated anti-virus, spyware, firewall and ransomware security measures.

Statistical analysis was conducted in STATA Version 17.0® (StataCorp LP, College Station, Texas). Descriptive statistics were used to summarise patient data, namely frequency and percentage for categorical data with mean and standard deviation or median and interquartile ranges for continuous data. Where applicable, the Mann-Whitey U/Wilcoxon rank sum test and χ^2 or Fisher's exact tests were used to determine significance. Kaplan-Meier estimates were used to generate cumulative risks. Where applicable, an adjusted threshold of 0.002 was used to define statistical significance (using the Bonferroni method).

Ethics approval was granted from the University of Cape Town's Faculty of Health Sciences Human Research Ethics Committee, Cape Town (Ref 759/2022).

Results

Three hundred and fifty-nine (359) admission episodes were logged during the study period. Fifteen patients were < 18 years old and were excluded. Six patients failed discharge from ICU and their second admission was excluded. As depicted in Fig. 1, 338 patients were included in the study cohort. ICU bed occupancy for the period was calculated at 84.6%.

Females accounted for 47.9% of the cohort. The median age at admission was 41.9 years old (Interquartile range (IQR) 31.1 - 55.4). The youngest patient was 18.7 years old, and the eldest 84.4 years. As shown in Fig. 2, the median age for survivors was 39.4 years and for non-survivors 46.5, which proved to be statistically significant (Two Sample T Test $p=0.0072$). Additional demographic details are included in Table 1.

A primary medical diagnosis accounted for 61.2% ($n=207$) of admissions, whilst 38.2% ($n=129$) were non-medical. No documented diagnosis was recorded for 0.6% ($n=2$). Of the non-medical patients, 12 were referred from the obstetric unit, which accounted for 3.6% of the total admissions.

Indications for admission to ICU are summarised in Table 2. In patients admitted with a primary medical diagnosis, pneumonia was the commonest (13.0%; $n=44$); followed by toxin ingestion (10.1%; $n=34$) and exacerbation of obstructive airways disease (7.7%; $n=26$).

Of all patients admitted to ICU with a surgical diagnosis, 89.9% ($n=116$) were deemed unplanned admissions. The majority of all surgical admissions was due to trauma, accounting for 35.7% ($n=46$) of all surgical admissions and 13.6% of the total cohort. Routine admission after major surgery accounted for 6.5% ($n=22$) of the total cohort, and patients with a surgical cause for sepsis 5.6% ($n=22$). Table 3 elaborates further on the indication for surgical admission and admitting subspeciality. In this study, unplanned surgical / trauma admissions had a mortality rate of 28.4% compared to elective surgical cases, with only a 7.7% mortality rate ($p=0.094$).

We found no statistically significant association between the reason for admission and the risk of in-ICU death, except for surgical cause for sepsis ($p=0.001$). Sepsis other than pneumonia approaches significance ($p=0.003$), but due to our adjusted threshold, this is not considered significant.

Comorbidities were present in 58.3% (n=197) of the cohort and 45.0% had 2 or more. Chronic lung disease was the most common non-communicable disease (n=59; 17.4%), followed by hypertension (n=58; 17.2%) and diabetes mellitus (n=37; 10.9%). There was a statistically significant association between pre-existing hypertension and in-ICU death (p=0.008). The presence of 2 or more comorbidities was also statistically significantly associated with in-ICU death (p=0.014).

Of all patients admitted, 16.9% (n=57) were known to be infected with Human Immunodeficiency Virus (HIV). A CD4 count was available in 49% of these, with a median CD4 count of 177 cells/mm³ (IQR=75-352). No reliable information on the use of antiretroviral therapy was available. There was no statistically significant relation between HIV status and death in ICU (p=0.659).

The median LOS was 4 days (IQR 2-7 days). The LOS between ICU survivors and non-survivors (7.15 and 6.60, respectively) was not statistically different, as confirmed with a two-sample T-Test for equal variances (p=0.6).

The overall in-ICU mortality rate was 25.7% (n=87). Medical patients had a mortality rate of 25.6%, and patients with a surgical indication for admission 26.4%. There were no statistically significant differences between these groups (p=0.944) (Table 4). For surgical patients, the mortality rate for planned and unplanned admissions were 7.7% and 28.4%, respectively (p=0.094). The overall one-year survival rate was 82.0%, with a loss to follow-up rate of 33.1% (n=112). A visual representation of survival, as depicted by a Kaplan-Meier survival plot, can be seen in Fig. 3.

Discussion

This study assesses the outcomes of a single ICU in a tertiary hospital.

Of the 338 patients included in our analysis, the in-ICU mortality is 25.7%. This is notably more than the analysis by Anesi et al., conducted in KZN where two ICUs each had an in-ICU mortality rate of 14.1% and 15.6%^[14]. The Eastern Cape outcome study by Freercks et al., focused on medical patients admitted to the ICU and reported an in-ICU mortality rate of only 11.1% and an in-hospital mortality rate of 21.5%^[15]. The South African Surgical Outcomes Study (SASOS) from 2014 reported an overall mortality of 22.4% in all patients undergoing non-cardiac surgery who were admitted to critical care units in the post-operative period^[18]. In our cohort, patients with a medical indication for admission had a mortality rate of 25.6%, similar to those with a surgical indication at 26.4% (p=0.944). Freercks et al. report similar in-hospital mortality rates for medical and surgical emergency admissions (21.5% and 24.4%, respectively, p=0.372) but do not mention in-ICU mortality rates for surgical emergencies^[15]. It is difficult to meaningfully compare the mortality rates in the current study to previous studies from South Africa as data on patient severity of illness scores or ICU mortality prediction (e.g. APACHE II, SOFA, SAPS 3, ISS) is not available.

We report a 1-year mortality rate of 18.0% with a loss to follow-up rate of 33.1% overall. Van der Merwe et al. conducted an outcome study focussing on HRQOL after one year and found a 57.4% mortality rate^[16]. This study, however, selected those ventilated for more than

6 days and is not comparable to our cohort. In HICs, one-year mortality rates of 16 - 44% have been reported [19-21].

Our cohort had a relatively young patient population of 41.9 years old (IQR 31.1-54.4). This is comparable to other African studies with a mean age of 32.8 years [5] and South African studies with reported mean ages of 38.0 - 40.2 [13, 15], however, it is much lower than that for cohorts in HICs (67; IQR 57-75)[19]. We speculate that this difference between UMICs and HICs is multifactorial and would include, but is not limited to, the burden of HIV and Acquired immunodeficiency syndrome (AIDS), high incidence of trauma, poor socioeconomic circumstances, and a lower life expectancy. According to the United Nations, life expectancy at birth in South Africa was estimated at 65.4 years in 2017, whilst Europe and North America had life expectancies of 75.3 and 76.7 years, respectively[22].

We report a statistically significant difference between the median age for in-ICU survivors vs non-survivors (39.4 vs 46.5, $p=0.0072$). Despite being statistically significant, the small difference in age is not of clinical relevance. Although hypertension was a statistically significant predictor of mortality, this is a comorbidity with a high prevalence and is more common with advancing age[23]. This finding is more likely indicative of an association rather than causation. Those admitted with a surgical cause for sepsis also showed a statistically significant difference between those who survived ($n=8$, 42.1%) and those that did not survive ($n=11$, 57.9%)($p=0.001$).

Our ICU LOS of 4 days (IQR 2-7) is similar to that reported by Wise et al. (3 days (IQR 1 - 6)). The LOS of medical and non-medical patients in our study (4 days (IQR 2-8) and 3 days (IQR 2 – 6) respectively) is similar to that reported by Freercks et al. for their medical and surgical patients at 3 (IQR 2-8) and 3 (IQR 1-7), respectively.

The seroprevalence rate of HIV infection (16.9%) in this study is in keeping with data from The Joint United Nations Programme on HIV and AIDS (UNAIDS) in 2019 which cites the prevalence of HIV in South Africa as 18.6% [24]. However, this is significantly higher than a previous study published by Mkoko et al., in 2017 (9.6%) from data collected from the combined medical and surgical ICUs at GSH[25]. Our study only included patients from one of the ICUs at GSH, which may account for this discrepancy. Patients were tested for HIV infection at the discretion of the attending clinician. Mkoko, however, reported that 61% of their cohort had an unknown HIV status, which makes an estimation of true prevalence impossible. Wise et al. report an HIV prevalence of 19.3%, but considering a higher background prevalence of HIV in KZN (33.5% in 2001), this is an unsurprising finding[26]. From the paper by Freercks et al., in patients with a known HIV status, we can estimate a 32% HIV prevalence in their ICU cohort of mixed surgical and medical patients, although only 58.3% had an available HIV test result[15]. Nevertheless, the South African burden of HIV disease is incredibly high when compared to the global prevalence of 0.7% of adults aged 15–49 years[27]. No reliable information on the use of antiretroviral therapy was available for our analysis.

The Western Cape of South Africa has an extremely high burden of tuberculosis (TB), estimated at 681 cases per 100 000[28]. In our cohort, 15 patients (4.4%) had pulmonary TB, diagnosed either before or during admission. Two of these had planned admissions for lobectomy for extensive drug-resistant TB. This low incidence may be explained by the stringent triage criteria in use in the ICUs at GSH, usually excluding patients with

advanced/disseminated TB with a likely poor prognosis. Some local publications report an ICU mortality rate for patients ventilated for pulmonary TB of 44%^[29].

TB and HIV coinfection is likely to place a great disease burden on ICUs in the Western Cape and may contribute to a poorer outcome compared to HICs. Five patients (1.5%) had TB and HIV coinfection in our cohort, of which 2 (40%) did not survive to one-year post-ICU discharge.

Admissions due to toxin exposure were lower in our study compared to a critical care unit in the Eastern Cape (10.2% vs 15.3% respectively)^[15]. A Kenyan study reported 10.2% of patients being admitted with drug/alcohol intoxication^[5]. Some of the peripheral hospitals in the GSH drainage area have access to high-care units and often admit patients with toxin exposure who require a short duration of organ support, which may explain the lower incidence in our unit.

Despite the ICU in this study being the referral ICU for all medical and complex obstetric patients, 117 patients (34.6%) were admitted with a non-medical/obstetric indication. Of the total patients admitted, 13.6% were for trauma; this is an extremely high proportion, given that all surgical and trauma admissions are initially referred to another ICU ward at GSH. Admission of surgical or trauma patients to the study ICU only occurs once the surgical ICUs have reached capacity and impact bed availability for critically ill medical patients from within the hospital and the outlying drainage areas. Due to the high incidence of trauma in South Africa, unplanned admissions inevitably place a large burden on available ICU beds.

Limitations

Given that GSH uses a largely paper-based system, we tried to minimise missing data by crosschecking 4 alternative sources (discharge summaries, death summaries, digital radiological records and data from the monthly M&M meetings, as obtained from ClinicomTM).

South Africa does not have a national critical care electronic database, and institution-specific databases are not widely used in the government-funded healthcare sector. Data quality may be limited due to our retrospective collection method.

This study may not be generalisable as it is a single-centre study, only evaluating one ICU ward that historically admits patients with a medical, or complicated obstetric, diagnosis. The results, therefore, are unlikely to reflect the national disease profile of ICU patients. In addition, our findings may not be comparable to other African countries, as South Africa is classified as a UMIC and is relatively well-resourced regarding the provision of critical care beds^[9].

Another limitation in our study is that prior to 2020, the unit we evaluated had not reliably collected data on APACHE II, SAPS 3, SOFA and ISS, which limits the ability to compare subgroups regarding the severity of illness.

We acknowledge that mortality data is a crude outcome measure and does not reflect limitations in HRQOL in survivors of critical illness. It is nevertheless an important measure in quality and outcomes of care and may give some insight into the treatment burden and success rates.

Conclusion

We report a retrospective descriptive review from an ICU unit situated in Groote Schuur Hospital in the Western Cape. In this cohort, the overall in-ICU mortality was 26.2% and 1-year mortality 18.0%. We found no statistically significant predictor of mortality other than age and hypertension. A large proportion of patients admitted had a trauma diagnosis. We recognise a significant need for a local, as well as a national, electronic registry to gain insight into the South African critical care context using prospective data collection. Auditing of outcomes is important for future allocation and prioritising of resources, particularly in a resource-constrained environment.

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Tables and figures

Table 1: Demographics and comorbidities				
	Total, n (%)	ICU Survivors, n (%)	ICU Non-survivors, n (%)	p value (<0.05 considered significant)
All patients included	338 (100.0)	251 (74.3)	87 (25.7)	
Median age on admission (IQR)	41.9 (31.1-55.4)	39.4 (30.2-51.7)	46.5 (36.4-57.7)	0.0072
Female	162 (47.9)	115 (71.0)	47 (29.0)	0.187
Male	176 (52.1)	136 (77.2)	40 (22.7)	
Selected Comorbidities*				
Chronic lung disease	59/338 (17.4)	23/251 (9.16)	10/87 (30.3)	0.528
Hypertension	58/338 (17.2)	35/251 (13.9)	23/87 (26.4)	0.008
HIV	57/338 (16.9)	41/251 (16.3)	16/87 (18.4)	0.659
Diabetes (unspecified)	37/338 (10.9)	25/251 (10.0)	12/87 (13.8)	0.324
2 or more comorbidities	152 (45.0)	103 (67.8)	49 (32.2)	0.014
IQR = interquartile range; * Four most prevalent comorbidities				

Table 2: Indication for admission to ICU				
	Total, n (column %)	ICU Survivors, n (row %)	ICU Non-survivors, n (row %)	p value (<0.002 considered significant)
All patients	338 (100.0)	251 (74.3)	87 (25.7)	
Medical diagnosis	207 (61.2)	154 (74.4)	53 (25.6)	
Pneumonia	44 (13.0)	27 (61.4)	17 (38.6)	0.036
Toxin ingestion*	34 (10.1)	30 (88.2)	4 (11.8)	0.061 [§]
Exacerbation of OAD [‡]	26 (7.7)	24 (92.3)	2 (7.7)	0.033 [§]
Sepsis-related (other than Pneumonia) [†]	26 (7.7)	13 (50.0)	13 (50.0)	0.003
Neurological diagnosis	17 (5.0)	14 (82.4)	3 (17.6)	0.434 [§]
Status epilepticus	11 (3.3)	10 (90.9)	1 (9.1)	0.301 [§]
Pulmonary oedema	11 (3.3)	10 (90.9)	1 (9.1)	0.301 [§]
Acute renal failure	6 (1.8)	6 (100.0)	0 (0.0)	0.345 [§]
Cardiomyopathy	5 (1.5)	2 (40.0)	3 (60.0)	0.110 [§]
Pulmonary embolism	4 (1.2)	1 (25.0)	3 (75.0)	0.054 [§]
Angioedema	3 (0.9)	3 (100.0)	0 (0.0)	0.572 [§]
Haemoptysis	3 (0.9)	1 (33.3)	2 (66.7)	0.164 [§]
Near drowning	3 (0.9)	3 (100.0)	0 (0.0)	0.572 [§]
Aspiration pneumonitis/pneumonia	2 (0.6)	2 (100.0)	0 (0.0)	1.000 [§]
Other	12 (3.6)	8 (66.7)	4 (33.3)	0.514 [§]
Surgical diagnosis	129 (38.2)	95 (73.6)	34 (26.4)	
Trauma	46 (13.6)	37 (80.4)	9 (19.6)	0.303
Routine admission after major surgery	22 (6.5)	18 (81.8)	4 (18.2)	0.614 [§]
Surgical cause for sepsis	19 (5.6)	8 (42.1)	11 (57.9)	0.001
Miscellaneous perioperative complications	15 (4.4)	13 (86.7)	2 (13.3)	0.371 [§]
Pancreatitis	7 (2.1)	4 (51.7)	3 (42.9)	0.379 [§]
Burns	5 (1.5)	5 (100.0)	0 (0.0)	0.333 [§]
Threatened airway	6 (1.8)	6 (100.0)	0 (0.0)	0.345 [§]
Post operative haemorrhage	4 (1.2)	2 (50.0)	2 (50.0)	0.274 [§]
ERCP related pancreatitis	3 (0.9)	2 (66.7)	1 (33.3)	1.000 [§]
Other	2 (0.6)	0 (0.0)	2 (100.0)	0.066 [§]
No diagnosis	2 (0.6)	2 (100.0)	0 (0.0)	

ICU = intensive care unit; OAD = Obstructive airways disease; ERCP = Endoscopic retrograde cholangiopancreatography
* Includes iatrogenic drug toxicity and intentional/ non-intentional drug overdose
[†] All medical causes for sepsis, excluding pneumonia and aspiration pneumonia
[‡] Includes asthma, chronic obstructive airways disease, undifferentiated obstructive airways disease
[§] Fishers exact test

Table 3. Distribution by surgical discipline			
	Total, n (column %)	Planned, n (row %)	Unplanned, n (row %)
Mortality rate (%)	34 (26.4)	1 (7.7)	33 (28.4)
Surgical admissions	129 (38.2)	13 (10.1)	116 (89.9)
Trauma surgery	46 (35.7)	(0.0)	46 (100.00)
General surgery	29 (22.5)	(0.0)	47 (100.0)
Obstetric surgery	12 (9.3)	0 (0.0)	12 (100.0)
Hepatobiliary surgery	8 (6.2)	2 (25.0)	5 (75.0)
Cardiothoracic surgery	7 (5.4)	5 (71.4)	2 (28.6)
ENT/OMFS	7 (5.4)	2 (28.6)	5 (71.4)
Colorectal surgery	6 (4.7)	2 (33.3)	4 (66.7)
Urological surgery	4 (3.1)	(0.0)	4 (100.0)
Neurosurgery	2 (1.6)	1 (50.0)	1 (50.0)
Upper gastrointestinal surgery	2 (1.6)	0 (0.0)	2 (100.0)
Transplant surgery	2 (1.6)	0 (0.0)	2 (100.0)
Orthopaedic surgery	1 (0.8)	0 (0.0)	1 (100.0)
Gynaecological surgery	1 (0.8)	0 (0.0)	1 (100.0)
Endocrine surgery	1 (0.8)	0 (0.0)	1 (100.0)
Vascular surgery	1 (0.8)	0 (0.0)	1 (100.0)
ENT: Ear, nose and throat surgery: OMFS: Oral, maxillofacial surgery			

Table 4. Outcome related to reason for admission					
	All patients included	Medical reason for admission	Surgical reason for admission	No diagnosis	p value (<0.05 considered significant)
ICU Survivors, n (column %)	251 (74.3)	154 (74.4)	95 (73.6)	0 (0.0)	0.094
ICU Non-survivors, n (column %)	87 (25.7)	53 (25.6)	34 (26.4)	2 (100.0)	
Total, n (row %)	338 (100.0)	207 (61.2)	129 (38.2)	2 (0.6)	

Figures:

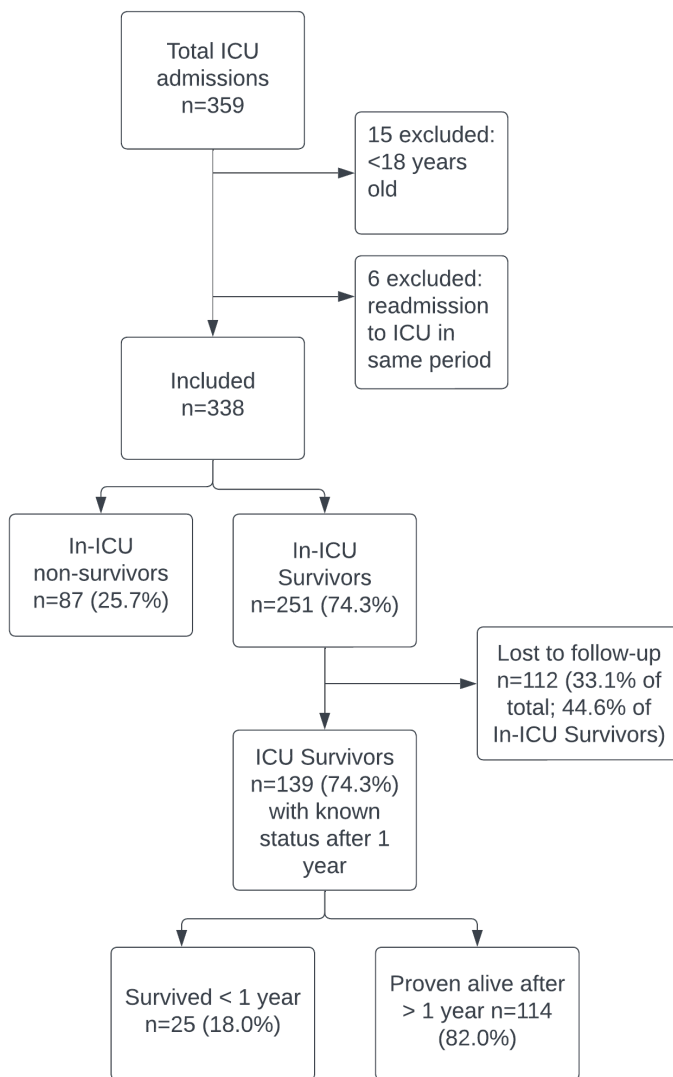


Figure 1: Diagram of patients included in the analysis and outcomes.

Violin plot: Age on admission by ICU Survival

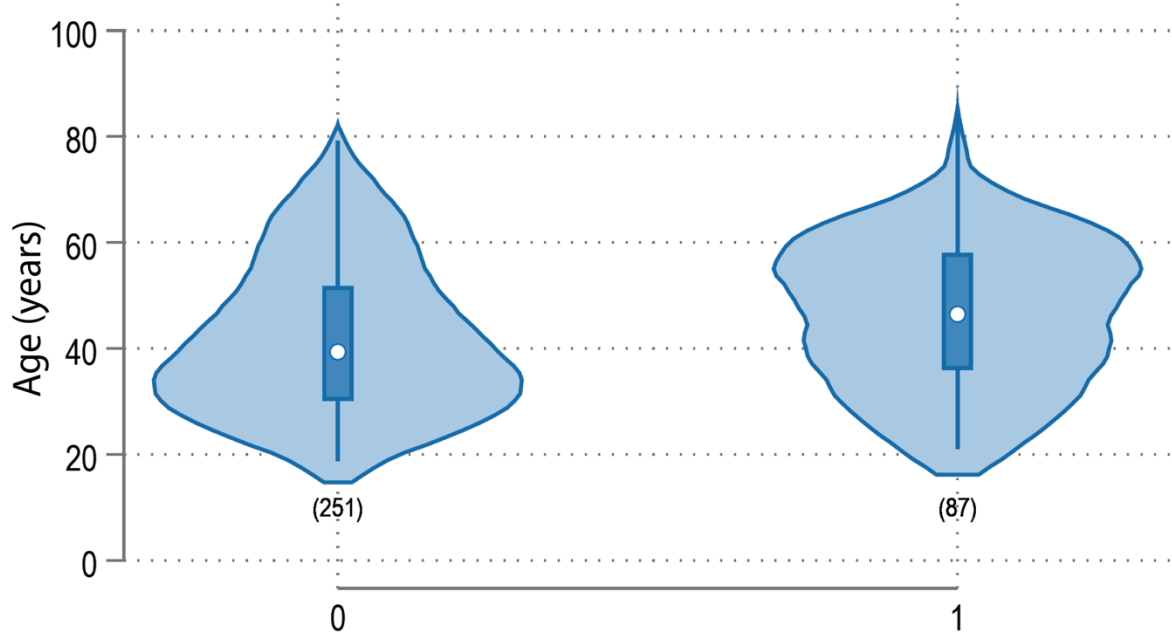


Figure 2: Age on admission vs Intensive Care Unit survival (Violin chart)

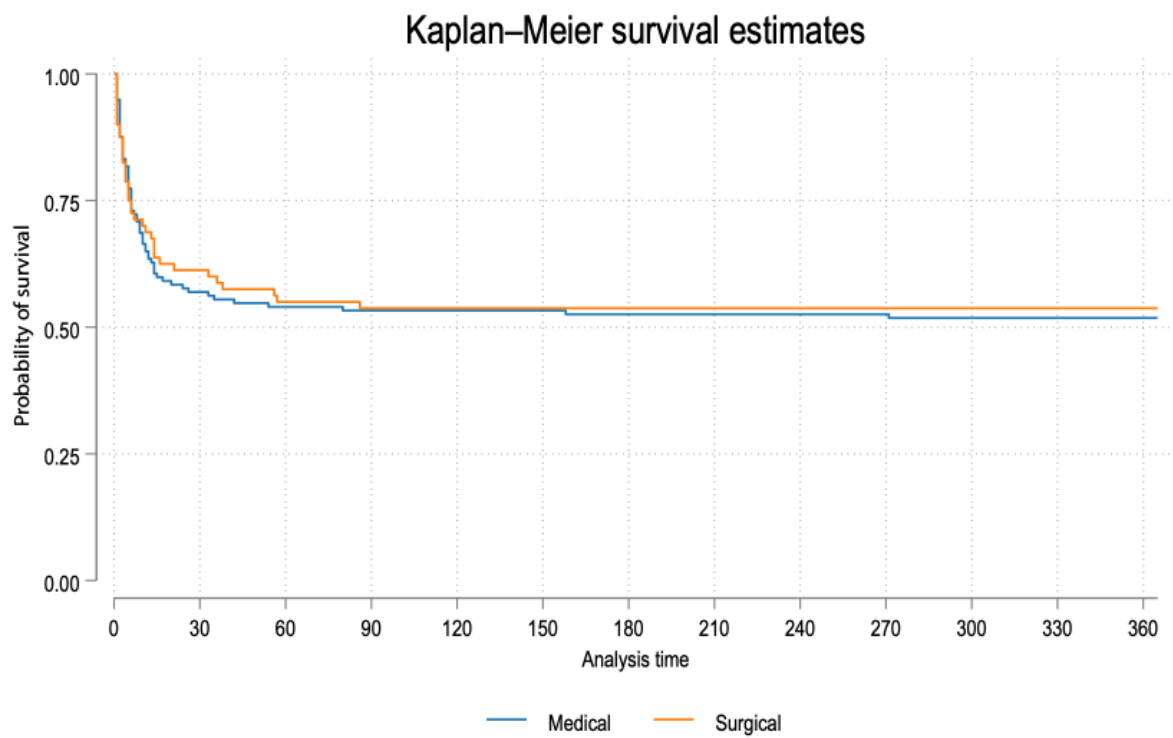


Figure 3: Kaplan-Meier plot, comparing the 1 year survival of medical to surgical patients.

Appendix 1: Human Research Ethics Approval



UNIVERSITY OF CAPE TOWN
Faculty of Health Sciences
Human Research Ethics Committee



Room 45 E-52-E-Floor- Old Main Building
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22 November 2022

HREC REF: 759/2022

Dr J Piercy

Division of Critical Care
Department of Anaesthesia and Perioperative Medicine
Ward C-27, ICU NGSH
Email: jenna.piercy@uct.ac.za
Student: ERWDAN002@myuct.ac.za

Dear Dr Piercy

**PROJECT TITLE: PRE-PANDEMIC SURVIVAL ANALYSIS OF A SOUTH AFRICAN MEDICAL ICU-
5MASTERS CANDIDATE-DR DANIEL ERWEE)**

Thank you for submitting your study to the Faculty of Health Sciences Human Research Ethics Committee (HREC) for review.

It is a pleasure to inform you that the HREC has **formally approved** the above-mentioned study.

Approval is granted for one year until the 30 November 2023.

Please submit a progress form, using the standardised Annual Report Form if the study continues beyond the approval period. Please submit a Standard Closure form if the study is completed within the approval period.

(Forms can be found on our website: www.health.uct.ac.za/fhs/research/humanethics/forms)

The HREC acknowledge that the student: Dr Daniel Erwee will also be involved in this study.

Please quote the HREC REF 759/2022 in all your correspondence.

Please note that the ongoing ethical conduct of the study remains the responsibility of the principal investigator.

Please note that for all studies approved by the HREC, the principal investigator **must** obtain appropriate institutional approval, where necessary, before the research may occur.

Yours sincerely


PROFESSOR M BLOCKMAN
CHAIRPERSON, FACULTY OF HEALTH SCIENCES HUMAN RESEARCH ETHICS COMMITTEE

Hrec ref: 759 2022

Appendix 2: South African Medical Journal Instructions to Authors

The dissertation is written in accordance with guidelines set out for the South African Medical Journal. The latest updated guidelines are available at:

<http://www.samj.org.za/index.php/samj/about/submissions#authorGuidelines>