



# Clinical Profile and Outcome of Critically ill adult patient's presenting to an Urban Emergency Department in Sub Saharan Africa: A Prospective Cohort Study in Tanzania

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## Abstract

**Background:** Management of critically ill patients is a worldwide challenge but the complexity is even greater in low resource countries due to patient delay in seeking care, limited diagnostic and treatment options and lack of in-route care to appropriate health care facilities. Timely patient evaluation, resuscitation and continuous care of critically ill patients from the Emergency Medicine Department (EMD) to Intensive Care Unit (ICU) can reduce poor patient outcome. This study aim to describe the clinical profile and 24 hours outcome of critically ill adult patients presenting to the EMD of Muhimbili National Hospital (MNH)

**Methods:** This was a prospective, descriptive cohort study of non-trauma critically ill adult patients presenting to the EMD of MNH from April to October, 2018. Patients were considered critically ill if they had a Triage Early Warning Score (TEWS) of greater than 7 (RED) or had a critical intervention performed. A structured case report form were used to document demographics, clinical presentation, diagnostic evaluation, treatment at EMD, disposition and 24hours hospital outcome.

**Results:** During the study period, 7597 patients attended the EMD and 527 (5.4%), met criteria for being critically ill. Among them 274 (52%) were male and the overall median age was 35 [IQR 25-44] years. The majority (477, 90.5%) of critically ill patients were disposed to general ward, and 19 (4.4%) died within 24hours; 50 (9.5%) were admitted to ICU and 5 (10%) died within 24hours. Among those patients that died within 24hours, majority has pre-existing CKD (10.8%) followed by diabetes (8.1%). HIV/AIDS and Hypertension were 5.2% and 5.1% respectively.

**Conclusion:** In this ED in Sub Saharan Africa, only minority of critically ill patient with indications for ICU admission are admitted to ICU. The overall 24-hours survival rate is high among those admitted to general ward than those in ICU. Further studies need to evaluate the reasons mortality in ICU compared to general ward.

**Keywords:** Critical illness; Outcome; ICU care

## BACKGROUND

Critical illness is a worldwide challenge because of the high mortality rate [6,8] and need for early and aggressive treatment. Delay in diagnosis or therapy can result in multiple organ failure and death [9]. Timely patient evaluation, resuscitation, stabilization and continuous care of critically ill patients, starting in the ED and then continuing in the ICU or general ward under

the care of a reliable team, can reduce the incidence of poor patient outcome [4,13].

The challenges posed by critically ill patients are even greater in low resource countries [14] such as sub-Saharan Africa, due to patient delay in seeking care, lack of diagnostic and treatment facilities (particularly at the local level) [15,8], limited treatment options, and delays along the referral chain to more advanced care. Over one-third of the Tanzanian population lives in poverty, a condition which is associated with communicable diseases and poor health-care seeking behaviour [9]. HIV/AIDS carries a high disease burden in patient presenting with critical illness followed by malaria, respiratory infection and sepsis of any infectious cause. Other critical illnesses are neurological, cardiovascular, renal, endocrine, poisoning and malignancy in origin.

Despite efforts by the Tanzania government, Emergency Medicine Association of Tanzania and non-governmental organizations to improve the health system, few health facilities in the country have acute intake areas [15] staffed by emergency Specialists and well-trained nurses able to provide resuscitation and stabilization of patients. Even after stabilization, most critically ill patients require cardiac, respiratory and fluid

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monitoring, but it is difficult to monitor this group of patients in these low resource areas due to the lack of appropriate resources, such as intensive care units, specialists, and equipment.

Emergency medicine is a relatively new specialty in Tanzania and other sub-Saharan countries. Tanzania currently has only two full capacity emergency departments, both in Dares Salaam [15], and only one emergency medicine residency training program. These EDs are intended to improve quality of care for acutely ill patients. However, even these EDs are subject to resource constraints, including lack of ventilators, and frequent absence of appropriate medications. Moreover, availability of ICU beds is limited. The impact of care in these departments for critically ill patients has not been studied. The first twenty-four hours of care in the hospital after an ED visit are most likely to reflect the quality of care given by the ED. This study aims at describing the burden of critical illness, characterize risk and protective factors, clinical progress and short-term (24-hour) outcome of patients presenting to the ED with critical illness.

### Study design

This was a prospective observational cohort study of adult patients with critical illness presenting to the Emergency Medicine Department of Muhimbili National Hospital between April, 2018 and October, 2018.

### Study setting

The study was conducted at Muhimbili National Hospital, located in Ilala district, Dar es Salaam, Tanzania. This is the largest tertiary referral hospital, research centre and the main university teaching hospital in Tanzania, which serves patients referred from all parts of the country. It is a 1500 bed facility, attending 1000 to 1200 outpatients and 1000 to 1200 inpatients per week. The Muhimbili National Hospital emergency department opened 9 years ago, being the first full capacity emergency medicine department in the country and the primary site for the only emergency medicine training program in Tanzania. It is staffed by locally trained emergency specialists, and residents in an emergency medicine and operates 24 hours attending an average of 150 to 200 critically ill patients a day.

### Participants

All adult patients ( $\geq 18$ ) who were critically ill, defined as either: patients who score 7 and above using triage early warning score (TEWS) or receive critical intervention while in EMD. (Intubation, CPR, central line, chest tube, and airway management).

### Study procedures

A structured data collection form with discrete fields was used to extract required information from providers, relatives and patient's chart during the ED visit.

### Outcomes

The primary outcome was 24-hour hospital mortality of critically ill patients calculated as deaths within 24 hours (including ED deaths) divided by the total number of all critically

ill patients seen at the ED during the study period. Secondary outcomes: Risk factors associated with mortality were calculated using chi-square test to compare proportions of patients with and without the risk factors when the variable was categorical.

### Ethical approval

Ethical clearance to carry out this study was obtained from the Research and Publications Committee of MUHAS and permission to conduct this study at MNH was obtained from MNH research committee. Each patient was assigned a unique study number, which was entered on their form.

### Data analysis

The data obtained was transferred from REDCap data collection forms into an Excel file (Microsoft corporation, Redmond, WA, USA) and imported and analysed using Stata (version 13, Stata Corp LP, Texas, USA). Characteristics of the patient population were described using descriptive statistics. For continuous variables, means and standard deviation or medians and IQ, depending on whether the data is normally distributed. These variables include age, illness, vital signs, comorbidities, and referral status. Categorical variables will be presented using proportions, and include sex, proportion receiving critical care interventions, disposition and mortality. Risks for mortality were determined using relative risk, with significance of  $p \leq .05$ .

## RESULTS

During the study period 7597 patients attended the EMD and 527 (6.9%), met criteria for being critically ill (432 had TEWS  $> 7$  and 95 had critical interventions at EMD). Of those enrolled, 50 (9.5%) were admitted to ICU and 462 (90.5%) general wards with overall mortality of 39(7.2%) (Figure 1).

### Demographic characteristics of critically ill adult patient above 18 years

Among 527 critically ill patients, the overall median age was 35 [IQR 25-44] years and 274 (52%) were male. Approximately half 266 (49.5%) were transfers from another, outlying hospital. Hypertension, diabetes and HIV were the most common comorbidities (Table 1).

### Clinical characteristics of critically ill adult patient

Difficulty breathing 206(40.7%) was the most frequent presenting complaint, followed by altered mental status 128(25%) and convulsion 24 (4.7%). On initial presentation, hypertension was present in 340(64.5%) and hypotension in 63 (12%). Nearly half 262 (49.7%) were tachycardic (Table 2).

### Emergency management of critically ill adult patient

Most patients 449 (85.2) received IVF, 215 (40.8%) received antibiotics and 48(9.1%) received blood transfusion. Among critical procedures, intubation 19 (3.6%) was the most frequently performed, followed by CPAP 15(3%), and CPR 8 (1.5%) **Table 3**

### The disposition and outcomes of critically ill adult patients during the study period

Among all critically ill patients, 15 (2.8%) died in the ED. The majority of the remaining patients 462 (87.7%) were admitted to

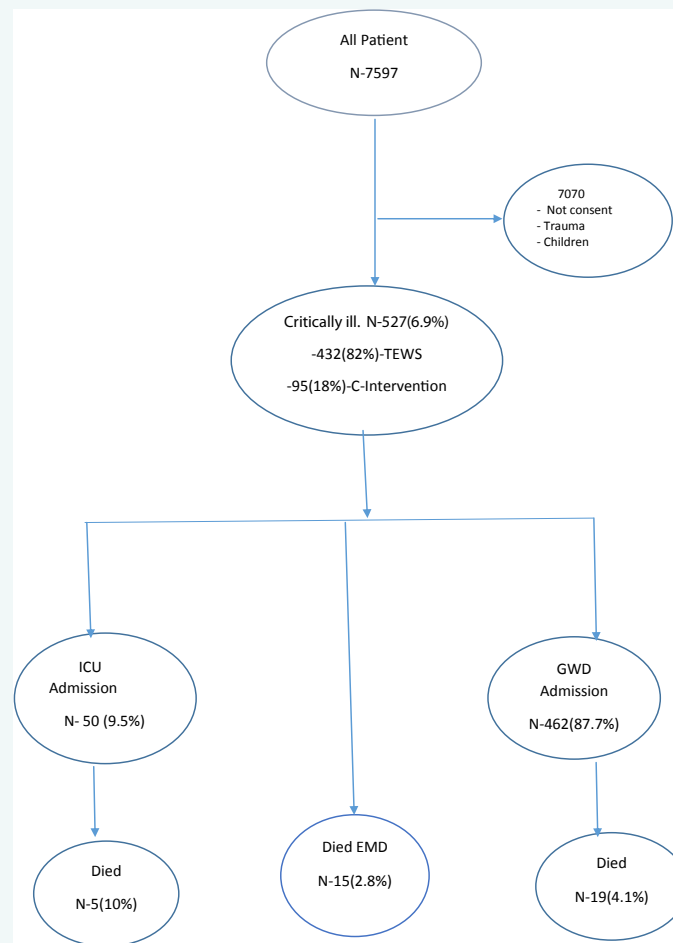


Figure 1 Critically ill adult patient's prospective descriptive cohort study flow chart.

Demographics	Number	%
<b>Sex</b>	274	52
Male		
<b>Age group</b>		
18-59	299	56.7
>60	228	43.3
<b>Referral status</b>		
Self-referral	266	50.5
Hospital referral	261	49.5
<b>Comorbidities</b>		
Hypertension	178	33.8
Diabetic Mellitus	86	16.3
Dilated Cardiomyopathy	59	0.9
HIV	58	11.0
CKD	37	7.0
Malignancy	23	4.4
Heart Failure		

the general ward and 50 went to the ICU. Overall 39 patients died within 24 hours, for a mortality rate of 7.2%. 15 (2.8%) died in the ED, 5 (10%) died in the ICU, and 19 (4.0%) died in the ward (Table 4).

### Factors associated with 24-hour mortality for adult patients

Among patients with an elevated TEWS, those with bradycardia had a mortality rate of 16.7%; and those with hypotension had a 12.7% mortality rate while for those presenting with altered mental status, the mortality rate was 3.1%. Patients who were tachycardic had a lower risk of death compared to those who were not ( $p = 0.017$ ).

Patients admitted to the ICU had a higher mortality rate than those admitted to the general ward, ( $RR = 1.35$ ) but this was not statistically significant ( $P = 0.50$ ). Patients who had non-invasive ventilation had a 2.8 relative risk of dying compared to all others, while being intubated reduced relative risk, although neither association was statistically significant.

Patients with convulsions had a 0.0001 relative risk of dying which is statistically significant and patients with pre-existing



**Table 2: Clinical characteristics critically ill patient.**

Variable	Frequency (N)	Percentage (%)
<b>Presenting complaints</b>		
Difficult breathing	206	40.7
Altered mental status	128	25.3
Diarrhoea	70	13.1
Vomiting	70	13.9
Fever	69	13.1
Abdominal pain	62	12.3
Cough	45	8.9
Abdominal distension	40	7.9
Chest pain	35	6.9
Convulsions	24	4.7
<b>Physical examination</b>		
<b>Vital Signs</b>		
	N	%
High SBP>140mmHg	340	64.5
Tachycardia (HR>100 /min)	262	49.7
Tachypnea	185	35.1
SpO <sub>2</sub> <90%	93	17.6
Febrile (T >37.5oC)	69	13.1
Bradycardia (HR<60 /min)	12	2.3
Hypotension (SBP <90mmHg)	63	12.0
GCS <14	32	6.1%

**Table 3: EMD Emergency management.**

EMD Management	Number N	Percentage %
Intravenous Fluids	449	85.2
Antibiotics	215	40.8
Oxygen therapy	128	24.3
Intubation	19	3.6
Blood transfusion	48	9.1
Nebulization	19	4.0
CPAP	15	3.0
CPR	8	1.5
Pleural tapping	7	1.3
Ascetic taping	4	0.7
Electrical therapy	3	0.6
Central line	0	0.0

CKD has 0.445 relative risk of dying while patient who has been refereed has 0.090 relative risk of dying (Table 5).

## DISCUSSION

Our study shows the presentation, treatment and outcome of critically ill adult patients attending to our hospital. We have found that of all patients presenting to our ED, during the time period 6.9% met criteria for being critically ill adult patients. The

overall 24 hour mortality rate was 7.2%, and slightly less than half died in the ED. Patients who were admitted to the wards had a better survival rate than those admitted to general ward.

Among critically ill patients, the overall median age were 35 years, , while the mean age for critically ill patients is high in HIC's [7] . This age difference is found in many studies in sub-Saharan Africa because of low economic and poor heath seeking behavior [16]. Non communicable disease shows predominant comorbidities among all conditions, high frequency has been seen in hypertensive heart disease 33.8% and patient with previous coronary artery disease shows low frequency 1 (0.2%). Worldwide cardiac conditions are more common, most of critically ill patient presents with and majority require intensive care and some end up with poor outcome [7,10,17]. And generally cardiac conditions are found in older people in HIC's (> 50).

In our study difficulty breathing was the most frequent presenting problem (40.7%) in patients presenting with critical illness and convulsion was the least frequent (4.7%), but convulsion was significantly associated with mortality compare with other presenting complaints, Previous studies show that convulsion are often a sign of metabolic derangements and multi-organ failure, including the brain suggesting the patient is late in their disease [18].

Also this study looked into the emergency management of which critically ill patients received at EMD and show that majority of patients received IVF 85% and some 9.1% received blood transfusion, these are basic care among of emergency medicine care and potential for better patient outcome. Patients who received non-invasive ventilation had a higher risk of death and those receiving intubation had a lower risk, although neither was statistically significant. Many patients in our ED may have indications for intubation but are unable to receive it, either due to the lack of ventilator or lack of bed in the ICU. This might indicate that with better resources, more patients would receive indicated care. In our ED, patients who underwent cardiopulmonary resuscitation at EMD has higher risk of dying and this can be a reason of higher mortality in ICU than general ward because most of patient in these group were disposed in ICU.

We found that the mortality rate was higher among patients admitted to ICU compared with the wards although the different is not statistically significant. This is different with other studies which shows better survival rate in intensive care unit than

**Table 4: Disposition and Outcome of critically ill patient.**

Disposition	Number	Percentage
Wards	477	88%
ICU/HDU	50	9.2%
Died at EMD	15	2.8%
ICU mortality	5	10%
Ward mortality	19	4.0%
Overall Inpatient mortality*	24	4.5%
24-hour mortality**	39	7.2%



**Table 5:** Relative risk associated with 24-hour mortality for adult patients.

Factor	Overall N-527	Died N-39	Survived N-488	Relative Risk	P value
<b>Relative risk- TEW</b>					
Tachycardia	262 (49.7)	12(5.0)	250(95.0)	0.4495	0.0173
Hypoxia	93(17.6)	9(9.7)	84(90.3)	1.4000	0.3533
Febrile	69(13.1)	3(4.00)	66(96.0)	0.5531	0.3130
Hypotension	63(12.0)	8(12.7)	55(87.1)	1.9007	0.0852
Altered mental status	32(6.1)	1(3.1)	31(96.9)	0.4071	0.3671
Bradycardia	12(2.3)	2(16.7)	10(83.3)	2.3198	0.2055
<b>Critical interventions</b>					
Intubation	19	1(5.3)	18(94.7)	0.7036	0.7214
CPAP	15	3(20.0)	12(80.0)	2.8444	0.0532
CPR	8	1(12.5)	7(87.5)	1.7072	0.5728
<b>Other factors</b>					
Referred	261(49.5)	11(4.2)	250(95.8)	0.5695	0.0908
Age above 60	228(43.3)	10(4.4)	218(95.4)	0.5927	0.1300
Oxygen therapy	128(24.3)	13(10.2)	115(89.8)	1.3724	0.2989
Pre-existing HHD	178(33.8)	9(5.0)	169(95.0)	0.6832	0.2893
Pre- existing DM	86(16.3)	7(8.1)	79(91.9)	0.0999	0.8089
ICU admission	50(9.2)	5(10.0)	45(90.0)	1.3513	0.5048
Pre- existing CKD	37(7.0)	4(10.8)	33(89.2)	1.4608	0.4454
Convulsions	24(4.7)	8(33.3)	16(66.7)	5.4086	0.0001

general ward [6] Of those who were enrolled, only 9.5% were admitted to ICU, which is small percentage compared with patient who in need of ICU care. This is similar to other low and middle income countries where there are a large number of patients who require ICU care but only few are able to receive that opportunity [11,15], But is different from developed countries where more critically ill patient receive ICU care [7,10]. It believed that care which critically ill patient receive in intensive care unit greatly improves their outcome to compare with critically ill patients receive care in general ward [10]. This is due to constant care in ICU, higher staff to patient ratio, close patient monitoring from life support equipment and medication and highly trained doctors and nurses who specialised in caring for critically ill patient, dissipate of all these expected care mortality is high in ICU compare to general ward for our setting. The higher mortality rate in our setting is likely because, due to the limited number of ICU beds, only the very sickest patients are sent to the ICU.

### Study limitation

This was a single centred study which may not be representative of other hospitals in Tanzania or other LIMCs. Patients were followed for 24 hours and so definitive diagnoses associated with mortality could not be used.

### Conclusion

In this ED in Sub Saharan Africa we found that that 24-hours mortality of critically patients is high, with nearly half of patients dying in the ED. Few patients were admitted to the ICU.

### DECLARATIONS

#### Competing interests

The author declare no conflicts of interest

#### Ethical approval and consent to participate

Ethical clearance was obtained from Muhimbili University of Health and Allied Sciences' (MUHAS) Institutional Review Board and permission to collect data was obtained from relevant authorities of both MUHAS and MNH. The study was approved by the Research and Publication authorities at MUHAS. Written informed consent was sought from patients prior to participation in the study.

#### Availability of data and material

The dataset supporting the conclusion of this article is available from the authors on request

#### Funding

This was a non-funded project; the principal investigators used their own funds to support the data collection and logistics

#### Authors' contribution

MKK contributed to conceptualization, data oversee, formal analysis, funding acquisition, methodology, project administration, writing original draft and writing review and editing. HRS was involved in conceptualization, data curation, formal analysis, methodology and supervision as well as revision





writing review and editing of the manuscript. SK contributed to conceptualization, data curation, formal analysis, methodology, supervision, writing review and editing of the manuscript. DK contributed to the conceptualization, revised data analysis, interpretation and the manuscript. UE contributed to the conceptualization, revised data analysis, interpretation and the manuscript. AI contributed to the conceptualization, revised data analysis, interpretation and the manuscript. EJW contributed to the conceptualization, revised data analysis, interpretation and the manuscript. All authors read and approved the final manuscript.

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