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ORIGINAL ARTICLE

The burden on emergency centres to provide care for critically ill patients in Addis Ababa, Ethiopia

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ABSTRACT

Introduction: Given the scarcity of critical care hospital beds in Africa, emergency centres (ECs) are increasingly charged with caring for critically ill patients for extended periods of time. The objective of this study was to improve the understanding of the nature and outcomes of critically ill patients with prolonged treatment times of more than six hours in two ECs in Addis Ababa, Ethiopia.

Methods: This study was conducted over three months in two ECs of urban tertiary care hospitals in Addis Ababa. Structured questionnaires were completed by six emergency and critical care nurses. EC patients were included if they met the Society for Critical Care Medicine (SCCM) intensive care unit (ICU) admission criteria and stayed in the EC for more than 6 h. We collected initial demographic and clinical information, data about the patients' clinical course in the EC, and data regarding the patients' disposition. We used descriptive statistics for analysis.

Results: A total of 291 patients, over the course of three months, had an EC stay that exceeded six hours. The median length of stay for these patients was 48 h (interquartile range: 25–72 h). The most common categories of illness were neurological disease in 87 patients (30%) and cardiovascular disease in 61 patients (21%). The most frequent aetiologies of critical illness were severe head trauma and severe sepsis with multi-organ failure (26 patients, 9% each). A total of 94 patients (32%) died in the EC, while 86 (30%) were discharged directly from the EC without hospital admission.

Discussion: ECs in Addis Ababa face a heavy burden in caring for a large number of critically ill patients over a long period of time, with relatively high mortality rates. These findings should promote supporting emergency centres to strengthen and expand ICU capacity to provide appropriate critical care services.

African relevance

- The demand for critical care is on the increase in Africa.
- Emergency centres in Africa are the main gateways for critically ill patients requiring definitive care.
- Due to resource limitations, emergency centres provide a significant proportion of local critical care.

Introduction

The availability of critical care beds is scarce in developing countries; this is especially true in sub-Saharan Africa [1]. While the availability of intensive care unit (ICU) beds has been progressively growing in Addis Ababa, the growth has not been proportional to population growth and demand [2]. As life expectancy and the burden of non-communicable diseases continue to rise [3], further increases in demand for critical care beds is anticipated.

Patients are admitted to the ICU in numerous ways, but the primary avenues for admission are via emergency centres (EC) and operation rooms. For example, in one study from northwest Tanzania, more than 60% of ICU admissions for traumatic injuries came directly from the emergency centre [4]. Similar reports from resource-rich countries show a significant percentage of EC patients require ongoing critical care until the patient can be transferred to the ICU or is stabilized enough to be admitted to a general ward [5]. Given the shortage of ICU beds, this has the potential to create a backlog of critically ill patients

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who must be cared for in the EC for prolonged periods of time and place a significant burden on EC resources.

Emergency medicine remains a relatively new specialty in Ethiopia and continues to be hampered by a lack of organization and sufficiently trained staff [6]. Similarly, ICU beds remain severely limited and are generally available only in tertiary care teaching hospitals in Ethiopia, reflecting a worldwide shortage [7,8]. Thus, EC professionals are often required to manage the care of critically ill patients for an extended time period.

In Ethiopia, tertiary care ICUs are run rarely by anaesthesiologists, pulmonologists, and critical care specialists. Specific critical care dedicated training has only recently been made available. In ECs there are a growing number of trained doctors in emergency and critical care medicine. ECs are designed to provide care for acute and critically ill patients, but are not specifically equipped and staffed to provide critical care for prolonged periods of time [9]. In recognition of the need for an increased number of emergency and critical care professionals in Ethiopia, facilities started offering special certificate training for medical doctors and masters training for nurses [10].

In this study, we explored the burden on extended stays of ICU patients in two ECs in Addis Ababa, Ethiopia, to provide intensive care for critically ill patients for prolonged periods of time. We aimed to describe the number, clinical characteristics, and outcomes of critically ill patients cared for in ECs for more than six hours. This information is intended to provide more complete data on the burden of critically ill patients in ECs for use by hospital administrators, health care providers, and national policymakers.

Methods

This study was conducted in the ECs of two tertiary care hospitals in Addis Ababa, Ethiopia, Tikur Anbessa Specialized Hospital (TASH) and St. Paul's Hospital Millennium Medical College. At the time of this study, these hospitals were the only institutions training emergency physicians and nurses in Ethiopia. These hospitals also have critical care services with a limited number of beds and professionals. There were a total of 60 beds in the two ECs and 30 ICU beds out of a total of 1400 hospital beds. The combined EC volumes were approximately 40,000 visits per year.

This was a prospective cohort study conducted from September through November 2016. During this time, critically ill patients presenting to the adult ECs of the two study hospitals were tracked until they left the EC. Patients were eligible for inclusion in the study if they met the Society of Critical Care Medicine (SCCM) ICU admission criteria and stayed in the EC for more than six hours [11]. This study used the ICU priority model and diagnostic model classification from the SCCM guidelines (Table 1). Children less than 13 years old and those patients who without a reliable guardian for consent were excluded from the study.

A structured questionnaire was prepared and pre-tested including information regarding patient demographics, triage acuity, time of arrival to EC, time of disposition, working diagnosis, procedures performed, and location of patient disposition.

Data were collected by emergency and critical care nurses working in the study hospitals with the support of EC physicians. Data collectors were trained for one day and collected data on off duty days. Patients were enrolled after evaluation by the treating doctor. The questionnaires were filled upon ICU bed request and were completed during disposition with documentation of time of disposition. Principal investigators working in both hospitals supervised the quality of data by collecting the questionnaires frequently and by reviewing the completeness of data. This study used IBM SPSS Statistics version 20 to check and code data and to analyse descriptive statistics including frequencies, means, medians, and proportions.

The study was approved by the Institutional Review Board of St. Paul's Hospital Millennium Medical College. Informed consent was obtained from conscious and oriented patients directly. Informed assent was requested for those less than 18 years of age and for those unable to provide informed consent.

Results

During the three-month study period, the two ECs cared for a total of 7661 patients. Among these patients, 3959 were classified as medical patients, 2531 as trauma patients, and 1171 as other surgical patients. The ICUs of the hospitals admitted a total of 431 patients during the study period.

During the study period, a total of 291 critically ill patients had a prolonged stay of more than six hours and were therefore enrolled in the study (Table 2). The length of stay ranged from 6 to 240 h. The median length of stay was 48 h, interquartile range (IQR) of 25–72 h, and a mean length of stay was 53 h, with a standard deviation (SD) of 38.5. The mean age of the patients was 43 ± 18.5 years, with a range 13–90 years. A majority of these patients (59.1%) were 18–50 years of age. Males constituted 58.4% of the study population. The largest percentage of patients came from Addis Ababa (n = 135, 46.4%), followed by the neighbouring Oromiya region (n = 123, 42.3%); the remainder of patients came from various other regions of Ethiopia (n = 33, 11.3%). The largest percentage of patients (n = 103, 35.4%) arrived in the afternoon and an additional 85 (29.2%) arrived during evening hours.

Of the 291 patients enrolled, 107 (36.8%) met criteria as SCCM Priority 1 and 106 (36.4%) met criteria as SCCM Priority 2 [11]. A significant number (n = 48, 16.5%) were SCCM Priority 4B, indicating that they were terminal and facing irreversible illness. Neurological disease was the most common indication for ICU care (n = 87, 29.9%), followed by cardiovascular disease (n = 61, 21.0%), infectious disease (n = 29, 10.0%), respiratory disease (n = 26, 8.9%), renal disease (n = 26, 8.9%), and gastrointestinal disease (n = 25, 8.6%) (Table 3).

Of the 291 critically ill patients enrolled in the study, 94 (32.3%) died in the EC, 86 (29.6%) were treated and successfully discharged from the EC, 62 (21.3%) were admitted to the ICU, 42 (14.4%) were stabilized enough to be admitted to non-ICU wards, 4 (1.4%) left against medical advice, and 3 (1.0%) did not have disposition data recorded. Of the 94 patients who died in the EC, 48 (51%) were SCCM Priority 4B patients and 20 (21.3%) were Priority 1 patients. Severe

Table 1
ICU admission priority model classification adapted from the SCCM guideline.

Priority model		Description
Priority 1		Unstable patients in need of intensive treatment and monitoring that cannot be Provided outside of the ICUs.
Priority 2		Patients requiring intensive monitoring and may potentially need immediate intervention.
Priority 3		Unstable critically ill patients but have a reduced likelihood of recovery because of underlying disease or nature of their acute illness.
Priority 4	A	Little or no anticipated benefit from ICU care based on low risk of active intervention that could not safely be administered in a non-ICU setting (too well to benefit from ICU care).
	B	Patients with terminal and irreversible illness facing imminent death (too sick to benefit from ICU care).

ICU, intensive care unit.

Table 2
Demographic and initial clinical characteristics of patients.

		Number	Percentage
Age	< 18	28	9.6
	18–50	172	59.1
	> 50	91	31.3
Sex	Male	170	58.4
	Female	121	41.6
EC arrival time	0000–0559 h	44	15.1
	0600–1159 h	59	20.3
	1200–1759 h	103	35.4
	1800–2359 h	85	29.2
SCCM Priority	Priority 1	107	36.8
	Priority 2	106	36.4
	Priority 3	25	8.6
	Priority 4B	53	18.2
Origin of referral	Government Clinic	183	62.9
	Private Clinic	26	8.9
	Self-Referral	82	28.2

EC, emergency centre; SCCM, Society of Critical Care Medicine.

traumatic brain injury was the most common cause of death (n = 15, 16.0%), followed by severe sepsis with multi-organ failure (n = 12, 12.8%) (Table 4).

Many patients were transferred from the EC to other departments in the hospital, but then returned to the EC due to a shortage of ICU beds. A total of 45 patients returned to the EC after haemodialysis, ten returned from the operating theatre after craniotomy for intracranial bleeding, and five returned after orthopaedic or general surgical procedures.

Of the 86 patients who were able to be successfully treated and discharged from the EC, SCCM Priority 1 and Priority 2 patients accounted for 38 (43.7%) and 36 (41.4%), respectively (Table 5).

Discussion

This study reported the admission clinical characteristics, clinical course, and outcomes for 291 critically ill patients cared for more than six hours over three months in the ECs of two tertiary care hospitals in Addis Ababa. Due to the shortage of ICU beds, all of these patients required prolonged stays in the EC, potentially hampering their clinical outcomes and placing a significant burden on EC resources. These patients represented nearly 4% of all patients cared for in these two ECs during this time. Their median length of stay in EC was 48 h, highlighting the drain on existing EC resources.

Nearly one third of these critically ill patients died during their prolonged stays in the EC. The high mortality rate may be a reflection of multiple existing situations and does not necessarily predict their outcome had they been in the ICU in a timelier manner from the EC. Many of these critically ill patients presented to the ECs late with poor primary care and a likely prolonged prehospital course. In addition, hospital support in the ECs in terms of staffing and clinical training of staff, should be reassessed and strengthened. Delayed admission of critically ill patients to the ICU has been associated with increased length of stay, ICU mortality, and overall in-hospital mortality [12–14]. These findings emphasize the need for improved critical care capacity, both in the EC and in the ICU. Even excluding SCCM Priority 4B patients who likely would not have benefited from an ICU admission, a large proportion, 46 of 238 (19.3%), patients still died in the EC.

Nevertheless, a total of 83 out of 238 (34.9%) Priority 1–3 patients were successfully treated and discharged from the EC, reflecting the capabilities of the EC to successfully care for many of these patients. However, we were unable to assess how caring for these critically ill patients for such a prolonged period of time impacted on the care for other patients in the EC. The discharge of a critically ill patient from the EC is uncommon and can reflect the shortage of regular ward beds in addition to the shortage of ICU beds. Similarly, determining the financial and human resources impact of providing this care was beyond the scope of this present study.

Previous reports on the hospitals from this study show that acute infectious and cardiovascular diseases accounted for approximately half of ICU admissions [7,15,16]. More specifically, diabetic ketoacidosis, acute myocardial infarction, and stroke were the leading admission diagnoses. In contrast, we found that a significant proportion of patients in the EC who required prolonged critical care were trauma patients

Table 3
Clinical diagnoses and indications for critical care.

Organ System	Diagnosis	Number	Percentage
Neurological	Severe head trauma	26	8.9
	Acute stroke with raised intracranial pressure	24	8.2
	Coma: metabolic, toxic, or anoxic	9	3.1
	Status epilepticus	8	2.7
	Acutely altered sensorium with potential for airway compromise	8	2.7
	Guillain-Barré syndrome	6	2.1
	Acute spinal cord compression or impending compression	4	1.4
	Meningitis with altered mental status	1	0.3
	Acute subarachnoid haemorrhage	1	0.3
Cardiovascular	Shock states	18	6.2
	Acute coronary syndrome	12	4.1
	Congestive heart failure with respiratory failure and/or requiring haemodynamic support	11	3.7
	Acute pulmonary oedema	7	2.4
	Hypertensive emergencies	5	1.7
	Life-threatening dysrhythmias	4	1.4
	Cardiac tamponade with hemodynamic instability	2	0.7
	Post-cardiac arrest	1	0.3
	Complete heart block	1	0.3
Infectious diseases	Severe sepsis with multi-organ failure	26	8.9
	Complicated falciparum malaria	2	0.7
	Severe tetanus	1	0.3
Respiratory	Acute respiratory failure requiring ventilator support	18	6.2
	Acute pulmonary embolism with hemodynamic instability	6	2.1
	Massive haemoptysis	1	0.3
	Upper air way obstruction	1	0.3
Renal	Requirement for haemodialysis in an unstable patient	26	8.9
Gastrointestinal	Life-threatening gastrointestinal bleeding	22	7.6
	Acute hepatic failure leading to coma and hemodynamic instability	3	1.0
Endocrine	Diabetic ketoacidosis complicated by haemodynamic instability	10	3.4
	Thyroid storm	2	0.7
Surgical	Polytrauma	8	2.7
	High-risk perioperative patients	5	1.7
Haematological	Disseminated intravascular coagulation	2	0.7
	Severe coagulopathy and/or bleeding diathesis	2	0.7
	Severe anaemia resulting in hemodynamic compromise	1	0.3
Toxicological	Insecticide poisoning	3	1.0
	Drug overdose	1	0.3
	Snake bite	1	0.3
Other		2	0.7

Table 4
Characteristics of critically ill patients who died in emergency centres.

Category	Characteristic	Number	Percentage
Age	< 18 years	7	7.4
	18–50 years	58	61.7
	> 50 years	29	30.9
Sex	Male	56	59.6
	Female	38	40.4
SCCM Priority	Priority 1	20	21.3
	Priority 2	16	17.0
	Priority 3	10	10.6
	Priority 4B	48	51.1
Primary diagnosis	Severe head trauma	15	16.0
	Severe sepsis with multi-organ failure	12	12.8
	Acute stroke with raised intracranial pressure	8	8.5
	Requirement for haemodialysis in an unstable patient	8	8.5
	Acute respiratory failure requiring ventilator support	7	7.4
	Shock states	6	6.4
	Coma: metabolic, toxic, or anoxic	5	5.3
	Life-threatening gastrointestinal bleeding	5	5.3
	Acutely altered sensorium with potential for airway compromise	4	4.3
	Polytrauma	4	4.3
	Acute hepatic failure leading to coma and hemodynamic instability	3	3.2
	Acute pulmonary embolism with hemodynamic instability	3	3.2
	Acute coronary syndrome	2	2.1
	Disseminated intravascular coagulation	2	2.1
	Other	10	10.6

SCCM, Society of Critical Care Medicine.

and those with shock and multi-organ failure. Most ICU patients have multiple complications, such as trauma in addition to chronic non-communicable diseases. Healthcare systems in sub-Saharan Africa need to adapt and evolve to care for this growing population of complex patients. Our data also confirmed neurosurgical care as the most common admission to the surgical ICU in sub-Saharan Africa [17,18].

Our study only included a relatively short period of time of data collection, making generalizability to all settings and times of year limited. In addition, most critically ill patients are referred to the study hospitals, thereby skewing the study patient population to be more ill and requiring more medical and staff resources. Also, this study did not assess the number of patients and outcomes among patients who did not have prolonged EC stays, nor among those patients who were discharged from the EC to the general hospital ward or to home. In addition, the admission diagnoses were working diagnoses and did not always correspond to the final diagnoses.

In recent years, the Ethiopian government has endeavoured to open additional ICUs in different parts of the country, but the number of ICU beds available in tertiary hospitals has not kept up with the demand. In the meantime, ECs and emergency care providers have been required to address this issue and care for critically ill patients that should be in the ICU. The lack of ICU space will also increase EC overcrowding in Ethiopia and will likely contribute to poor patient satisfaction and clinical outcomes. This could potentially lead to burnout and attrition among providers. One possible solution would be to develop intermediate care units or transition areas where patients can be closely monitored and treated until an ICU bed becomes available. Increasing the capacity of non-ICU medical and surgical wards to care for higher acuity patients, for example, haemodynamically stable haemodialysis or diabetic ketoacidosis patients, may also help decrease the burden on the EC and ICU.

Table 5
Characteristics of critically ill patients who were discharged from the Emergency centres.

Category	Characteristic	Number	Percentage
Age	< 18 years	2	2.3
	18–50 years	57	66.3
	> 50 years	27	31.4
Sex	Male	53	61.6
	Female	33	38.4
SCCM Priority	Priority 1	38	44.2
	Priority 2	36	41.9
	Priority 3	9	10.5
	Priority 4B	3	3.5
Primary diagnosis	Life-threatening gastrointestinal bleeding	11	12.8
	Acute stroke with raised intracranial pressure	10	11.6
	Shock states	7	8.1
	Acute coronary syndrome	6	7.0
	Requirement for haemodialysis in an unstable patient	6	7.0
	Diabetic ketoacidosis complicated by haemodynamic instability	5	5.8
	Severe head trauma	5	5.8
	Acute pulmonary oedema	4	4.7
	Status epilepticus	4	4.7
	Hypertensive emergencies	4	4.7
	Severe sepsis with multi-organ failure	2	2.3
	Acutely altered sensorium with potential for airway compromise	2	2.3
	Life-threatening dysrhythmias	2	2.3
	Congestive heart failure with respiratory failure and/or requiring haemodynamic support	2	2.3
	Acute respiratory failure requiring ventilator support	2	2.3
	Acute spinal cord compression or impending compression	2	2.3
	Other	12	14.0

SCCM, Society of Critical Care Medicine.

In this prospective cohort study in two tertiary ECs in Addis Ababa, we found that a large number of critically ill patients had prolonged stays in the EC, often with adverse clinical outcomes. This speaks to the need for increased ICU capacity, especially in referral hospitals, in order to improve EC flow and decrease the adverse effects on other acute care patients. Within Ethiopia, we found that a nearly equal number of our patients were referred from the Oromia region as were from Addis Ababa itself, indicating a pressing need to increase ICU capacity in this part of the country as well.

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Conflicts of interest

The authors declare no conflicts of interest.

Dissemination of results

The results were disseminated to the participating emergency centres from the study. The results were also presented at an annual meeting of the Ethiopian Medical Association.

Authors' contributions

Authors contributed as follows to the conception or design of the

work; the acquisition, analysis, or interpretation of data for the work; and drafting the work or revising it critically for important intellectual content: MS contributed 40%; AA and IT contributed 20% each; GM and FD contributed 10% each. All authors approved the version to be published and agreed to be accountable for all aspects of the work.

References

[1] Baelani I, Jochberger S, Laimer T, Otieno D, Kabutu J, Wilson I, et al. Availability of critical care resources to treat patients with severe sepsis or septic shock in Africa: a self-reported, continent-wide survey of anaesthesia providers. Crit Care 2011;15(1):R10.

[2] Melaku Z, Alemayehu M, Oli K, Tizazu G. Pattern of admissions to the medical intensive care unit of Addis Ababa University teaching hospital. Ethiop Med J 2006;44(1):33–42.

[3] LeDuc Media. Health profile Ethiopia, http://www.worldlifeexpectancy.com/country-health-profile/ethiopia; 2015 [accessed 25 November 2017].

[4] Chalya PL, Gilyoma JM, Dass RM, McHembe MD, Matasha M, Mabula JB, et al. Trauma admissions to the intensive care unit at a reference hospital in northwestern Tanzania. Scand J Trauma Resusc Emerg Med 2011;19:61.

[5] Green RS, MacIntyre JK. Critical care in the emergency department: an assessment of the length of stay and invasive procedures performed on critically ill ed patients. Scand J Trauma Resusc Emerg Med 2009;17:47.

[6] Taye BW, Yassin MO, Kebede ZT. Quality of emergency medical care in gondar University referral hospital, northwest Ethiopia: a survey of patients' perspectives. BMC Emerg Med 2014;14:2.

[7] Giday A, Weldeyes E. Trends in cardiovascular disease over time: a 30-year retrospective analysis of medical-ICU admissions in Addis Ababa, Ethiopia. Ethiop Med J 2015;53(3):133–9.

[8] Adhikari NK, Fowler RA, Bhagwanjee S, Rubenfeld GD. Critical care and the global burden of critical illness in adults. Lancet 2010;376(9749):1339–46.

[9] Weingart SD, Sherwin RL, Emlet LL, Tawil I, Mayglothling J, Rittenberger JC. ED intensive care units. Am J Emerg Med 2013;31(3):617–20.

[10] Sultan Menbeu, Debebe Finot, Azazh Aklilu. The status of emergency medicine in Ethiopia, challenges and opportunities. Ethiop Med J 2018;56(2):119–24.

[11] Task Force of the American College of Critical Care Medicine, Society of Critical Care Medicine. Guidelines for intensive care unit admission, discharge, and triage. Crit Care Med 1999;27(3):633–8.

[12] Cardoso LT, Grion CM, Matsuo T, Anami EH, Kauss IA, Seko L, et al. Impact of delayed admission to intensive care units on mortality of critically ill patients: a cohort study. Crit Care 2011;15(1):R28.

[13] Chalfin DB, Trzeciak S, Likourezos A, Baumann BM, Dellinger RP. group D-Es. Impact of delayed transfer of critically ill patients from the emergency department to the intensive care unit. Crit Care Med 2007;35(6):1477–83.

[14] Fromm Jr. RE, Gibbs LR, McCallum WG, Niziol C, Babcock JC, Gueler AC, et al. Critical care in the emergency department: a time-based study. Crit Care Med 1993;21(7):970–6.

[15] Agalu A, Mirkuzie W, Ayele Y, Bedada W. Reasons for admission and mortalities following admissions in the intensive care unit of a specialized hospital, Ethiopia. Int J Med Med Sci 2014;6(9):195–200.

[16] Kedir S, Berhane A, Bayisa T, Wuletaw T. Admission patterns and outcomes in the medical intensive care unit of st. Paul's hospital millennium medical college, Addis Ababa, Ethiopia. Ethiop Med J 2017;55(1):19–26.

[17] Smith ZA, Ayele Y, McDonald P. Outcomes in critical care delivery at Jimma University Specialised Hospital, Ethiopia. Anaesth Intensive Care 2013;41(3):363–8.

[18] Poluyi EO, Fadiran OO, Poluyi CO, Alabi EO, Falohun SA. Profile of intensive care unit admissions and outcomes in a tertiary care center of a developing country in West Africa: a 5 year analysis. J Intens Crit Care 2016;2(3):29.