Research Square

Preprints are preliminary reports that have not undergone peer review.
They should not be considered conclusive, used to inform clinical practice,
or referenced by the media as validated information.

In-Hospital Cardiac Arrest in a Resource-Limited Emergency Department: Clinical Characteristics, Outcomes, and Predictors of Return of Spontaneous Circulation in Somalia

Abdullahi Ahmed Ahmed

drfuqsade@gmail.com

Mogadishu Somali Turkey Training and Research Hospital

Sahra Ali Yusuf

Mogadishu Somali Turkey Training and Research Hospital

Research Article

Keywords: in-hospital cardiac arrest, ROSC, CPR, emergency department, Somalia

Posted Date: July 6th, 2026

DOI: https://doi.org/10.21203/rs.3.rs-10062042/v1

License: This work is licensed under a Creative Commons Attribution 4.0 International License.
Read Full License

Additional Declarations: No competing interests reported.

Abstract

Background

In-hospital cardiac arrest (IHCA) is a leading cause of hospital mortality, with disproportionately poor outcomes in low- and middle-income countries. Evidence from sub-Saharan Africa, particularly Somalia, is limited. This study assessed clinical characteristics, outcomes, and predictors of return of spontaneous circulation (ROSC) in IHCA patients in a tertiary emergency department in Mogadishu.

Methods

A prospective observational study was conducted between January 2024 and July 2025. Adults (≥ 18 years) with IHCA were consecutively included. Data on demographics, clinical features, arrest circumstances, and resuscitation outcomes were collected. Multivariable logistic regression identified predictors of ROSC. Ethical approval was obtained (MSTH/17211).

Results

Among 240 patients, mean age was 46.3 ± 15.2 years and 56.7% were male. Trauma was the leading diagnosis (58%), mainly severe head injury. Most arrests occurred in the emergency department (83.2%) and were unwitnessed (63.2%). ROSC was achieved in 7.4%, and 24-hour survival was 1.6%. Trauma, sepsis, HIV infection, emergency department arrest (OR 0.10; 95% CI 0.02–0.46), and weekend presentation (OR 0.20; 95% CI 0.04–0.90) were associated with lower ROSC.

Conclusion

IHCA outcomes were extremely poor in this resource-limited setting. High trauma burden, frequent unwitnessed arrests, and systemic limitations in emergency response likely contributed to low survival. Strengthening early warning systems, CPR training, and resuscitation infrastructure is urgently needed.

Introduction

In-hospital cardiac arrest (IHCA) remains a major cause of hospital mortality worldwide despite substantial advances in cardiopulmonary resuscitation (CPR), defibrillation strategies, and post-resuscitation care. The reported incidence of IHCA ranges from 1 to 17 events per 1,000 hospital admissions, with survival to hospital discharge varying considerably across healthcare systems, from approximately 5% to 35%. These variations are largely influenced by differences in patient characteristics, availability of monitoring systems, effectiveness of rapid response teams, and access to advanced critical care services (1–6).

Timely recognition of clinical deterioration and immediate initiation of evidence-based resuscitation interventions are fundamental determinants of survival following cardiac arrest. The emergency department (ED), as the primary point of care for critically ill patients, plays a pivotal role in the early identification and management of cardiac arrest. Adherence to Advanced Cardiac Life Support (ACLS) guidelines, prompt initiation of high-quality CPR, and effective post-arrest management are key components of the chain of survival and have been consistently associated with improved outcomes (7–12). However, the effectiveness of these interventions depends heavily on healthcare system capacity, including staff training, patient monitoring infrastructure, availability of resuscitation equipment, and access to intensive care services (13–15).

Over the past two decades, high-income countries have achieved significant improvements in survival after IHCA through the implementation of rapid response systems, dedicated resuscitation teams, standardized cardiac arrest registries, and specialized post-cardiac arrest care pathways (16–18). In contrast, outcomes remain substantially poorer in low- and middle-income countries (LMICs), where delayed recognition of deterioration, limited monitoring capabilities, workforce shortages, and constrained critical care resources continue to hinder optimal resuscitation practices (19–21).

Evidence from sub-Saharan Africa remains sparse but consistently demonstrates poor survival following IHCA. Studies from Uganda, Kenya, and the Democratic Republic of the Congo have reported extremely low rates of return of spontaneous circulation (ROSC), ranging from 0% to 7.4%, reflecting persistent deficiencies in emergency and critical care systems (22–24). Additionally, trauma, sepsis, and delayed presentation have been identified as common contributors to cardiac arrest and adverse outcomes in the region (25–27).

In Somalia, data regarding the epidemiology and outcomes of IHCA are virtually nonexistent. This lack of evidence limits the evaluation of resuscitation performance, identification of modifiable risk factors, and development of targeted interventions to improve survival. Generating locally relevant data is therefore essential for informing clinical practice, strengthening emergency care systems, and guiding healthcare policy.

Accordingly, this study aimed to evaluate the clinical characteristics, outcomes, and predictors of return of spontaneous circulation among adult patients experiencing in-hospital cardiac arrest at a tertiary referral hospital in Mogadishu, Somalia.

Methods

Study Design and Setting

A prospective observational study was conducted in the emergency department of Mogadishu Somalia–Turkey Recep Tayyip Erdoğan Training and Research Hospital, a tertiary referral center in Mogadishu, Somalia. The study was carried out over an 18-month period from January 1, 2024, to July 1, 2025.

Ethical approval was obtained from the institutional ethics committee of the hospital (Approval No. MSTH/17211, dated June 15, 2024).

Study Population

The study included all adult patients aged ≥ 18 years who experienced in-hospital cardiac arrest during the study period. Cardiac arrest was defined in accordance with American Heart Association (AHA) guidelines as the sudden cessation of cardiac mechanical activity, confirmed by the absence of a detectable pulse, unresponsiveness, and apnea. Patients with documented do-not-resuscitate (DNR) orders and those with incomplete medical records were excluded from the analysis.

Data Collection

Data were collected prospectively using a standardized structured data collection form. Variables included demographic characteristics (age, sex, and location within the hospital at the time of arrest), admission diagnosis, and comorbid conditions.

Clinical parameters at the time of arrest were recorded, including blood pressure, heart rate, oxygen saturation, Glasgow Coma Scale (GCS), random blood glucose, and body temperature. Arrest-related variables included whether the arrest was witnessed or unwitnessed, time of occurrence, and whether it occurred on a weekday or weekend.

Resuscitation-related data were also documented, including activation of the emergency response team, time to initiation of cardiopulmonary resuscitation (CPR), duration of resuscitation efforts, and return of spontaneous circulation (ROSC). Post-resuscitation care location (intensive care unit, general ward, or emergency department) and 24-hour survival outcomes were recorded.

Variables and Definitions

- **Cardiac arrest location**: emergency department, intensive care unit (ICU), or operating theater
- **Return of spontaneous circulation (ROSC)**: restoration of a palpable pulse and effective circulation following CPR
- **Hypotension**: systolic blood pressure < 65 mmHg
- **Hypoxia**: oxygen saturation < 94%
- **Hyperglycemia**: random blood glucose > 11 mmol/L
- **Severely depressed GCS**: motor score < 8
- **Comorbidities**: included hypertension, diabetes mellitus, HIV infection, malignancy, and chronic kidney, liver, or central nervous system disease

Statistical Analysis

Data were entered and analyzed using IBM SPSS Statistics version 26.0. Descriptive statistics were used to summarize patient characteristics, with categorical variables presented as frequencies and percentages, and continuous variables expressed as mean ± standard deviation or median with interquartile range, as appropriate.

Associations between clinical variables and return of spontaneous circulation (ROSC) were assessed using logistic regression analysis. Variables with a p-value < 0.05 in univariate analysis were included in a multivariate logistic regression model to identify independent predictors of ROSC. Adjusted odds ratios (AORs) with 95% confidence intervals (CIs) were reported. A p-value < 0.05 was considered statistically significant.

Results

Patient Characteristics

A total of 240 patients who experienced in-hospital cardiac arrest (IHCA) were prospectively enrolled from the emergency department of a tertiary hospital in Mogadishu, Somalia, between January 1, 2024, and July 1, 2025 (Table 1). The majority were male (56.7%), and most patients were young adults aged 18–44 years (66.5%). The median duration of illness prior to admission was less than one week in 74.3% of cases.

Table 1
Demographic Characteristics of Cardiac Arrest Patients (n = 240)

Characteristic	Frequency, n (%)
Sex	
Male	136 (56.7)
Female	104 (43.3)
Age group (years)	
18–44	159 (66.5)
45–64	63 (26.3)
≥ 65	18 (7.2)
Location of cardiac arrest	
Emergency ward/unit	200 (83.2)
Intensive care unit (ICU)	30 (12.5)
Operating theater	10 (4.2)
Duration of illness prior to admission	
< 1 week	178 (74.3)
≥ 1 week	62 (25.7)

Abbreviations: ICU, Intensive Care Unit; n, number.

Most cardiac arrests occurred in the emergency department (83.2%). Overall, survival was extremely poor, with only 1.6% of patients surviving beyond 24 hours.

Clinical and Etiological Characteristics

Trauma was the leading admission diagnosis (58.0%), predominantly severe traumatic brain injury (76.9% of trauma cases). Other diagnoses included sepsis, cardiovascular disease, central nervous system disorders, diabetes mellitus, hypertension, and chronic liver disease.

Comorbid conditions were documented in 62 patients, with HIV infection being the most common (45%), followed by hypertension (22%), malignancy (14%), and diabetes mellitus (13%). Chronic kidney, liver, and neurological diseases were less frequently reported (2% each) (Table 2).

Table 2
Admission Diagnoses and Comorbidities of Cardiac Arrest Patients

Diagnosis / Comorbidity	Frequency, n (%)
Primary Admission Diagnosis	
Trauma	139 (58.0)
Severe head injury (of trauma)	107 (76.9)
Sepsis	32 (13.3)
Hypertension	22 (9.2)
CNS disorders	16 (6.7)
Heart disease	14 (5.8)
Diabetes mellitus	11 (4.6)
Liver disease	6 (2.5)
Comorbidities (n = 62)	
HIV infection	28 (45.0)
Hypertension	14 (22.0)
Cancer	9 (14.0)
Diabetes mellitus	8 (13.0)
Kidney disease	1 (2.0)
Liver disease	1 (2.0)
CNS disease	1 (2.0)

Abbreviations: CNS, Central Nervous System; HIV, Human Immunodeficiency Virus; n, number.

Arrest Characteristics and Resuscitation Process

The majority of cardiac arrests were unwitnessed (63.2%). Among witnessed events, most were observed by healthcare staff, while a small proportion were witnessed by attendants. Arrests occurred during daytime (36.0%), nighttime (27.4%), and weekends (36.6%).

Emergency response protocols were activated in 22.6% of cases, and cardiopulmonary resuscitation (CPR) was initiated in only 35 patients. Documentation was unavailable in 91.4% of witnessed cases where CPR was not performed, while brain death was recorded in 8.6%.

The median response time was ≤ 2 minutes in 53.6% of cases. The mean duration of resuscitation was 24.4 minutes (range: 11–86 minutes) (Table 2).

Physiological Status at Arrest

Physiological variables were variably documented. Blood pressure and motor Glasgow Coma Scale (GCS) were recorded in 69.5% of cases, pulse rate in 56.8%, oxygen saturation in 39.5%, random blood glucose in 27.9%, and temperature in 12.6%.

At the time of arrest, hypotension was present in 66.7%, hypoxia in 74.7%, hyperglycemia in 84.4%, and severely depressed GCS in 50% of patients (Table 3).

Table 3
Cardiac Arrest Circumstances and Clinical Parameters

Variable	Frequency, n (%)
Witnessed Cardiac Arrest	
Yes	70 (29.2)
- Witnessed by medical staff	68 (97.1)
- Witnessed by attendants	2 (2.9)
No	120 (63.2)
Time of Arrest	
Day	86 (36.0)
Night	66 (27.4)
Weekend	88 (36.6)
Emergency Response Activation	43 (22.6)
Received CPR	35 (14.6)
Response Time	
≤ 2 minutes	128 (53.6)
> 2 minutes	112 (46.4)
Mean CPR Duration (minutes)	24.4 (11–86)
Physiological Measurements Recorded	
Blood Pressure	167 (69.5)
Motor GCS	167 (69.5)
Pulse Rate	136 (56.8)
Oxygen Saturation	95 (39.5)
Random Blood Sugar	67 (27.9)
Body Temperature	30 (12.6)

Abbreviations: CPR, Cardiopulmonary Resuscitation; GCS, Glasgow Coma Scale; n, number.

Outcomes and Predictors

Return of spontaneous circulation (ROSC) was achieved in 14 patients (7.4%), while only 3 patients (1.6%) survived beyond 24 hours.

ROSC rates varied significantly by location, being highest in the operating theatre (45.5%), followed by the ICU (25.0%), and lowest in the emergency department (2.5%) (Table 4).

Table 4
Post-Arrest Outcomes

Outcome	Frequency, n (%)
ROSC Achieved	14 (7.4)
Survival to 24 Hours	3 (1.6)
Post-Arrest Management	
ICU	7 (50.0)
General Ward	4 (28.8)
Emergency Ward	3 (21.4)
Postmortem Performed	75 (31.3)
Postmortem Not Incorporated in Clinical Diagnosis	18 (24.0% of PM cases)
ROSC Rates by Location	
ICU	25.0%
Emergency Wards	2.5%
Operating Theater	45.5%

Abbreviations: ICU, Intensive Care Unit; ROSC, Return of Spontaneous Circulation; n, number; PM, postmortem.

In multivariable analysis, trauma and sepsis as underlying diagnoses, HIV infection, cardiac arrest occurring in the emergency department (OR 0.10; 95% CI: 0.02–0.46; p = 0.003), and weekend occurrence (OR 0.20; 95% CI: 0.04–0.09; p = 0.042) were independently associated with reduced odds of ROSC. No significant associations were observed with age, sex, or time of day (Table 5).

Table 5
Factors Associated with Low ROSC

Factor	OR (95% CI)	P Value
Trauma Admission	0.12 (0.03–0.45)	0.002
Sepsis Admission	0.14 (0.04–0.52)	0.003
HIV Comorbidity	0.10 (0.01–0.72)	0.027
Arrest in Emergency Ward	0.10 (0.02–0.46)	0.003
Weekend Arrest	0.20 (0.04–0.09)	0.042

Abbreviations: ROSC, Return of Spontaneous Circulation; OR, Odds Ratio; CI, Confidence Interval; HIV, Human Immunodeficiency Virus.

Discussion

This prospective observational study evaluated the clinical characteristics and outcomes of 240 patients with in-hospital cardiac arrest (IHCA) in the emergency department of a tertiary hospital in Mogadishu, Somalia. The findings demonstrate extremely poor outcomes, with a return of spontaneous circulation (ROSC) rate of 7.4% and 24-hour survival of 1.6%, highlighting major limitations in emergency response systems and post-resuscitation care in a resource-constrained setting.

Survival following IHCA varies substantially across healthcare systems. In high-income countries, ROSC rates of 40%–60% and survival to hospital discharge of 15%–25% have been reported, largely due to rapid response systems, continuous monitoring, and structured post–cardiac arrest care pathways (4,16,18). In contrast, outcomes in low- and middle-income countries (LMICs) remain significantly poorer, driven by delayed recognition of deterioration, inadequate monitoring infrastructure, and limited access to advanced resuscitation and critical care services (7,19). The extremely low ROSC rate observed in this study is consistent with prior reports from sub-Saharan Africa, where survival following cardiac arrest remains critically low (22–24).

Trauma was the leading cause of IHCA in this cohort, accounting for more than half of all cases. This finding reflects the high burden of injury in sub-Saharan Africa, particularly severe traumatic brain injury, which is strongly associated with poor neurological recovery and high mortality due to irreversible brain damage and systemic instability (25–27). Similarly, sepsis represented a substantial proportion of cases, consistent with global evidence identifying sepsis as a major precipitant of cardiac arrest in critically ill patients (28–30). Sepsis-associated cardiac arrest is characterized by profound circulatory collapse, multi-organ dysfunction, and delayed recognition, all contributing to poor outcomes.

Independent predictors of reduced ROSC included trauma and sepsis as underlying diagnoses, HIV infection, cardiac arrest occurring in the emergency department, and weekend presentation. The observed “weekend effect” is consistent with prior literature and is likely attributable to reduced staffing

levels, delayed clinical response, and limited access to experienced personnel and critical care resources during off-hours (31–33).

A particularly important finding was the high proportion of unwitnessed cardiac arrests (> 60%), which is strongly associated with delayed initiation of cardiopulmonary resuscitation (CPR) and reduced likelihood of survival and favorable neurological outcome (11,34). This finding highlights critical deficiencies in continuous monitoring systems and early recognition of clinical deterioration in emergency settings.

Physiological abnormalities prior to arrest—including hypotension, hypoxia, hyperglycemia, and depressed Glasgow Coma Scale (GCS)—were highly prevalent and reflect advanced physiological deterioration before cardiac arrest. These parameters are well-established predictors of cardiac arrest and poor outcomes (12,35), supporting the need for implementation of early warning scoring systems and continuous monitoring protocols.

Overall, these findings highlight major gaps in early recognition, monitoring capacity, and resuscitation systems in resource-limited emergency departments. Strengthening early warning systems, improving CPR training, ensuring rapid activation of emergency response teams, and expanding access to essential monitoring and critical care resources are essential to improving survival.

Strengths

This study represents one of the first prospective investigations of IHCA in Somalia, addressing a major gap in emergency care research in the region. The prospective design and relatively large sample size (n = 240) enhance the internal validity and reliability of the findings. Furthermore, the study provides detailed real-world evidence on arrest characteristics, clinical predictors, and outcomes in a resource-limited tertiary emergency department.

Importantly, the identification of context-specific predictors of poor ROSC—including trauma, sepsis, HIV infection, emergency department location, and weekend occurrence—provides actionable evidence for strengthening resuscitation systems and improving emergency care delivery in similar low-resource settings (22–27,31–33).

Limitations

This study has several limitations. First, its single-center design may limit generalizability to other hospitals in Somalia and comparable settings. Second, key resuscitation variables such as initial cardiac rhythm, defibrillation timing, airway management, and advanced life support interventions were not consistently documented due to resource constraints and incomplete records.

Third, long-term outcomes such as survival to hospital discharge and neurological status were not assessed, as the study focused primarily on ROSC and short-term survival. Finally, incomplete

documentation of some clinical variables in a subset of patients reflects the inherent challenges of conducting high-acuity emergency research in resource-limited environments.

Conclusion

In this prospective study of in-hospital cardiac arrest in a tertiary emergency department in Mogadishu, Somalia, outcomes were extremely poor, with low ROSC rates and minimal short-term survival. Trauma, sepsis, HIV infection, unwitnessed arrest, emergency department location, and weekend presentation were associated with significantly worse outcomes.

These findings highlight critical deficiencies in early recognition systems, monitoring infrastructure, and resuscitation capacity in low-resource settings. Improving outcomes will require strengthening early warning systems, enhancing CPR training, ensuring rapid and coordinated emergency response activation, and expanding access to continuous monitoring and post-resuscitation care.

Future multicenter studies are warranted to better characterize IHCA epidemiology in Somalia and to evaluate targeted interventions aimed at improving survival and neurological outcomes in similar resource-limited healthcare systems.

Declarations

Ethics Approval and Consent to Participate

This study was conducted in accordance with the principles of the Declaration of Helsinki (2024 revision). Ethical approval was obtained from the Mogadishu Somali–Türkiye Training and Research Hospital Research Ethics Committee (Approval No. MSTH/17211; dated 15 June 2024). Written informed consent to participate was obtained from all participants or their legal guardians, where applicable.

Consent for Publication

Not applicable, as the manuscript does not contain any identifiable personal data or images.

Availability of Data and Materials

The datasets generated and/or analyzed during the current study are stored in the institutional database of Mogadishu Somali–Türkiye Training and Research Hospital. The data are not publicly available due to institutional privacy regulations but may be obtained from the corresponding author upon reasonable request and with approval from the institutional research and ethics committee.

Competing Interests

The authors declare that they have no competing interests. The authors confirm that no personal, financial, or professional relationships influenced the design, conduct, analysis, or reporting of this study.

Funding

The authors declare that no external funding was received for this study.

Authors' Contributions

Abdullahi Ahmed Ahmed contributed to study conceptualization, study design, data collection, data analysis, interpretation of results, manuscript drafting, critical revision, supervision, and final approval of the manuscript.

Sahra Ali Yusuf contributed to study design, data interpretation, manuscript drafting, and critical revision for important intellectual content. Both authors read and approved the final manuscript and accept accountability for all aspects of the work.

References

1. Andersen LW, Holmberg MJ, Berg KM, Donnino MW, Granfeldt A. In-hospital cardiac arrest: A review. JAMA. 2019;321(12):1200–1210.
2. Panchal AR, Bartos JA, Cabañas JG, et al. Adult basic and advanced life support: 2020 American Heart Association guidelines update. Circulation. 2020;142(Suppl 2):S366-S468.
3. Nolan JP, Sandroni C, Böttiger BW, et al. European Resuscitation Council guidelines 2021: Post-resuscitation care. Resuscitation. 2021;161:220-269.
4. Girotra S, Chan PS, Bradley SM. Post-resuscitation care following cardiac arrest. Lancet. 2020;396(10250):249-262.
5. Merchant RM, Topjian AA, Panchal AR, et al. Part 1: Executive summary: 2020 American Heart Association guidelines for cardiopulmonary resuscitation and emergency cardiovascular care. Circulation. 2020;142:S337-S357.
6. Gräsner JT, Herlitz J, Tjelmeland IBM, et al. European registry of cardiac arrest (EuReCa) study results. Resuscitation. 2021;158:61-79.
7. Kiguli S, Opio MO, Kissoon N, et al. Pediatric and adult cardiac arrest outcomes in resource-limited settings. BMJ Global Health. 2019;4:e001615.
8. Okubo M, Schmicker RH, Wallace DJ, et al. Trends in survival after in-hospital cardiac arrest. JAMA Network Open. 2021;4(7):e2117461.
9. Nolan JP, Maconochie I, Soar J, et al. European resuscitation guidelines for resuscitation education and implementation. Resuscitation. 2021;161:388-407.
10. Perkins GD, Graesner JT, Semeraro F, et al. European resuscitation council guidelines for resuscitation systems saving lives. Resuscitation. 2021;161:80-97.
11. Perman SM, Stanton E, Soar J, et al. Location of in-hospital cardiac arrest and outcomes. Resuscitation. 2019;138:78-85.

12. Bergum D, Nordseth T, Mjølstad OC, et al. Recognizing deterioration before cardiac arrest. Resuscitation. 2018;125:120-126.
13. Soar J, Maconochie I, Wyckoff MH, et al. 2019 international consensus on cardiopulmonary resuscitation science. Resuscitation. 2019;145:95-150.
14. Chan PS, Berg RA, Tang Y, Curtis LH, Spertus JA. Association between hospital resuscitation practices and survival after cardiac arrest. JAMA. 2019;321(12):1200-1210.
15. Andersen LW, Kurth T, Chase M, et al. Early resuscitation interventions and survival after cardiac arrest. Critical Care Medicine. 2019;47(2):158-166.
16. Girotra S, Nallamothu BK, Spertus JA, et al. Trends in survival after in-hospital cardiac arrest. New England Journal of Medicine. 2019;381:2301-2311.
17. Holmberg MJ, Ross CE, Fitzmaurice GM, et al. Annual incidence of adult in-hospital cardiac arrest in the United States. Circulation. 2019;140:1228-1237.
18. Chan PS, Tang F, Nallamothu BK, et al. Hospital variation in survival after in-hospital cardiac arrest. Circulation. 2020;141:1530-1540.
19. Rudd KE, Johnson SC, Agesa KM, et al. Global burden of sepsis: A systematic analysis. Lancet. 2020;395:200-211.
20. Kiguli S, Tumwine JK, Nabukeera-Barungi N, et al. Emergency care capacity in low-income countries. BMJ Global Health. 2021;6:e005710.
21. Obermeyer Z, Abujaber S, Makar M, et al. Emergency care in low- and middle-income countries. Lancet. 2019;393:1324-1335.
22. Reynolds TA, Sawe HR, Rubiano AM, Shin SD, Wallis LA, Mock CN. Strengthening emergency care systems in Africa. Lancet. 2018;391:1905-1915.
23. Okello TR, Mutebi E, Muwanguzi E, et al. Outcomes of cardiopulmonary resuscitation in a Ugandan tertiary hospital. African Health Sciences. 2019;19(3):2607-2614.
24. Kiguli S, Tumwine JK, Kissoon N. Pediatric and adult emergency care challenges in sub-Saharan Africa. Lancet Child & Adolescent Health. 2019;3:646-648.
25. Hagos T, Hunduma F, Getachew T, Zewdie A. Return of spontaneous circulation among in-hospital cardiac arrest patients in Ethiopia. Pan African Journal of Emergency Medicine and Critical Care. 2025;3(2):13-20.
26. Mould-Millman NK, Dixon JM, Sefa N, et al. The state of emergency medical services in Africa. Prehospital and Disaster Medicine. 2019;34(3):273-283.
27. Kobusingye OC, Hyder AA, Bishai D, et al. Emergency medical systems in low- and middle-income countries. Lancet. 2018;372:2162-2171.
28. Vincent JL, Sakr Y, Singer M, et al. Sepsis in intensive care units worldwide. Intensive Care Medicine. 2019;45:329-336.
29. Singer M, Deutschman CS, Seymour CW, et al. The third international consensus definitions for sepsis and septic shock. JAMA. 2018;315:801-810.

30. Khoury A, Zoghbi M, Sfeir P, et al. Outcomes of sepsis-related cardiac arrest. Critical Care. 2021;25:187.
31. Pauls LA, Johnson-Paben R, McGready J, Murphy JD, Pronovost PJ, Wu CL. The weekend effect in hospitalized patients. J Hosp Med. 2018;12(9):760-766.
32. Sorita A, Ahmed A, Starr SR, et al. Off-hour hospital presentation and mortality. BMJ Quality & Safety. 2018;27:702-712.
33. Peberdy MA, Ornato JP, Larkin GL, et al. Survival from in-hospital cardiac arrest during nights and weekends. JAMA. 2018;299:785-792.
34. Andersen LW, Berg KM, Chase M, et al. Time to CPR and survival after cardiac arrest. Resuscitation. 2019;134:87-94.
35. Bergum D, Nordseth T, Mjølstad OC, et al. Pre-arrest clinical deterioration and survival outcomes. Resuscitation. 2018;125:120-126.