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ORIGINAL ARTICLE

Acute coronary syndrome prevalence and outcomes in a Tanzanian emergency department: Results from a prospective surveillance study

Julian T Hertz [a,b,1], Francis M Sakita [c,1], Wai Yan Min Htike [d,1,*], Kilonzo G Kajiru [e,1], Blandina T Mmbaga [f,1], Tumsifu G Tarimo [c,1], Godfrey L Kweka [c,1], Jerome J Mlangi [c,1], Amedeus V Maro [c,1], Lauren Coaxum [a,1], Sophie W Galson [a,1], Alexander T Limkakeng [a,1], Gerald S Bloomfield [b,g,1]

[a] Duke University School of Medicine, Department of Emergency Medicine, Durham, NC, USA
[b] Duke Global Health Institute, Duke University, Durham, NC, USA
[c] Kilimanjaro Christian Medical Centre, Department of Emergency Medicine, Moshi, Tanzania
[d] Division of applied and natural science, Duke Kunshan University, Kunshan, China
[e] Kilimanjaro Christian Medical Centre, Department of Internal Medicine, Moshi, Tanzania
[f] Kilimanjaro Christian Research Institute, Tumaini University, Moshi, Tanzania
[g] Duke University School of Medicine, Department of Medicine, Durham, NC, USA

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ABSTRACT

Background: Preliminary data suggests that the burden of acute coronary syndrome (ACS) is high in Tanzania. After efforts to improve ACS care, we sought to describe ACS diagnosis rates, care processes, and outcomes in a Tanzanian Emergency Department (ED).

Methods: Adults presenting to a northern Tanzanian ED with acute chest pain or shortness of breath were enrolled from November 2020 to January 2023. ACS was defined as per Fourth Universal Definition of Myocardial Infarct criteria. All treatments given in the ED were observed and recorded. Thirty-day follow-up was conducted with all participants via telephone or home visit.

Results: Of 568 participants with chest pain or shortness of breath, 129 (22.7 %) had ACS, including 61 (47 %) with STEMI and 68 (53 %) with non-STEMI. Of participants with ACS, 77 (59.7 %) were male, and the mean (SD) age was 64.5 (16.6) years. The mean duration of symptoms among ACS participants prior to presentation was 2.9 (3.0) days, and 26 (20.2 %) reported no known medical comorbidities. In the ED, 39 (30.2 %) participants with ACS received aspirin and 33 (25.6 %) received clopidogrel. Follow-up was achieved for all 129 ACS participants; 42 (32.6 %) of participants with ACS died within 30 days of presentation. Participants with ACS were significantly more likely to die within 30 days than participants without ACS (32.6 % vs 16.4 %, OR 2.45, 95 % CI: 1.56–3.83, $p < 0.001$).

Conclusions: ACS is common in a northern Tanzanian ED. Interventions are needed to improve uptake of evidence-based ACS care and reduce ACS-associated mortality.

African relevance:

- The study found that 22.7 % of adults presenting with chest pain or shortness of breath in the Tanzanian emergency department (ED) had acute coronary syndrome (ACS). This high prevalence highlights the critical need for enhanced cardiovascular diagnostic and treatment capabilities in Tanzanian and similar African healthcare settings.
- The research reveals significant challenges in managing ACS within resource-constrained settings, where limited access to advanced diagnostic tools like ECGs and cardiac biomarkers contributes to delayed or missed diagnoses, ultimately leading to worse patient outcomes. This situation reflects broader healthcare limitations across sub-Saharan Africa.

* Corresponding author.
E-mail address: waiyan.willy@duke.edu (W.Y. Min Htike).
[1] This author takes responsibility for all aspects of the reliability and freedom from bias of the data presented and their discussed interpretation

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- Thirty-day mortality among ACS patients in this study was extremely high (32.6 %), which is substantially higher than ACS mortality rates in high-income countries. These findings underscore the need for urgent interventions to address critical gaps in ACS care in African emergency departments.
- By providing the first prospective data on ACS prevalence and outcomes in a Tanzanian ED, this study fills a critical gap in regional epidemiological knowledge. These insights are essential for informing public health strategies aimed at reducing the burden of cardiovascular diseases in Africa.

Introduction

Although acute coronary syndrome (ACS) is a leading cause of morbidity and mortality globally[1], there is a dearth of epidemiologic data describing ACS burden and outcomes in sub-Saharan Africa (SSA) [2]. Indeed, a recent systematic review found that there were no published studies on ACS in nearly half of the countries in the region [3]. As the burden of cardiovascular disease in the region continues to rise rapidly [4,5,6], more data is needed about the prevalence and care of ACS to inform policy-makers and clinicians as they navigate the epidemiologic transition in SSA.

In Tanzania, we conducted the first surveillance study of ACS in the country and found that the prevalence of ACS was high: 22 % of adults presenting to the Emergency Department (ED) with chest pain or shortness of breath had ACS when screened with electrocardiography (ECG) and troponin testing [7]. Notably, in this preliminary study, non-ST elevation myocardial infarction (NSTEMI) was defined by a single abnormally elevated troponin, due to resource limitations and inability to perform serial troponins. This approach likely resulted in the inclusion of patients with chronic kidney disease, heart failure, or other causes of chronic myocardial injury [8], raising questions about whether some NSTEMI patients may have been misclassified.

Our preliminary studies in Tanzania, similar to others conducted elsewhere in SSA [9,10,11,12,13], also identified multiple opportunities for improvement in evidence-based ACS care. Of 152 ACS patients, only 23 % received aspirin in the ED, 43 % had died within 30 days, and only 5 % underwent coronary angiography or percutaneous coronary intervention within the following year [7,14,15]. Although ACS remains under-studied in SSA in general, a handful of studies from across the region have also revealed that considerable geographic variability exists and thus, there are opportunities for improvements in ACS care and outcomes [9,10,11,12,13]. For example, in recent studies in South Africa, Ivory Coast, and Senegal, thirty-day mortality rates for ACS cases ranged from 2 % to 19 %, considerably lower than the mortality rates observed in Tanzania [3,16,17].

In response to these preliminary findings from Tanzania, the clinical team at the study hospital, Kilimanjaro Christian Medical Centre (KCMC), implemented a number of quality improvement measures in the ED, including [1]: hiring additional ED physicians with residency training in emergency medicine [2], conducting ACS training for all clinical staff with an emphasis on ACS treatment protocols, and[3] creation of a WhatsApp group with an interventional cardiology team at the country's only specialized cardiac hospital to facilitate expedited expert consultation and referral.

The aims of this study were[1] to determine the prevalence of ACS in the KCMC ED using a more rigorous serial troponin testing protocol [2], to prospectively describe ACS care and outcomes following the implementation of quality improvement measures at KCMC, and[3] to identify predictors of 30-day mortality among patients with ACS at KCMC. To do so, we conducted a prospective observational study in northern Tanzania.

Materials and methods

Setting

This study was conducted in the ED at KCMC, a large referral hospital in northern Tanzania, where the incidence of ACS is similar to that of the United States [18]. KCMC covers a catchment area with approximately 15 million people, and was the site of our team's preliminary studies of ACS burden and outcomes [7,14,15,18,19,20,21,22]. The KCMC ED operates 24 h per day, 7 days per week, and is staffed by clinical officers and physicians. At the time of this study, KCMC did not have any formally trained cardiologists on staff and did not have capacity for percutaneous coronary intervention (PCI). The nearest PCI-capable facility is Jakaya Kikwete Cardiac Institute in Dar es Salaam, which is approximately 10 h from KCMC by road. No referral is necessary to be seen at the KCMC ED; all patients presenting to the hospital for urgent unscheduled care are seen there.

Participant selection

To allow for meaningful comparisons, our inclusion criteria and approach to enrollment were identical to our prior studies of ACS at KCMC [7,14,15,18,19,20,21,22]. Inclusion criteria were [1]: adult patient (age $\geq$ 18 years) presenting to the KCMC ED, and[2] primary or secondary complaint of chest pain or shortness of breath. Exclusion criteria were[1] inability to provide informed consent [2], traumatic chest pain, and[3] self-reported fever.

Study timeline

This study was conducted from 5 November 2020, until 31 January 2023. Because of shipping delays of point-of-care troponin cartridges due to the global COVID-19 pandemic, enrollment was halted on two occasions: from 6 February to 3 May 2021, and from 1 September 2021, to 8 February 2022. Enrollment was otherwise conducted 7 days per week, from 8AM until 11PM.

Study procedures

Trained research assistants approached eligible patients while they were in the ED to discuss the study and obtain informed consent. Upon enrollment, research assistants recorded participants' sociodemographic, past medical history, and history of present illness via standardized data collection form. At the time of enrollment, a resting 12-lead ECG was obtained by the research team and a point-of-care Troponin T assay was also performed using the Roche Cobas h 232 instruments (Roche Diagnostics, Basel, Switzerland). Research assistants also directly measured participants' blood pressure, weight, and height. Three hours after the initial troponin assay, a second troponin assay was performed if[1] the participant's symptoms had been present for less than 6 h or[2] the initial troponin value was abnormally elevated ($\geq$40ng/L, the lower limit of the assay's measuring range, which is above the 99th percentile upper reference limit, as per manufacturer instructions). Participants with more than 6 h of symptoms and initial troponin $<$40 ng/L were considered to have ruled out and therefore

additional troponin assays were not performed on these patients by the study team. All clinical data collected by the research team, including ECGs and troponin results, were made immediately available to the ED clinical team.

Research assistants also observed and recorded all treatments and diagnostic testing that participants received while in the ED, using both direct observation and the electronic medical record. Final diagnoses from the ED clinical team and serum creatinine level (if obtained under usual care) were also collected directly from the electronic medical record system. Thirty days following enrollment, participants were contacted via telephone to assess vital status and administer a follow-up questionnaire. The follow-up questionnaire included questions about symptom status, medication use, follow-up visits, and patient understanding of their diagnosis. In cases where the research team was unable to contact participants via telephone, a research assistant visited the participant's home to administer the follow-up questionnaire in-person.

Patient and public involvement

The study protocol was shared with a local community advisory board prior to study initiation and study results have already been shared with the hospital staff and community advisory board through formal presentations.

ECG interpretation

The KCMC ED is staffed by ED physicians 24 h per day, and all ECGs obtained on participants were immediately shared with the treating ED physician for immediate clinical action. For study purposes only, ECGs obtained on participants underwent additional external adjudication by physicians who were not part of the clinical team and who were blinded to clinical data (apart from participant age and sex). For study purposes, all ECGs were read by two independent physicians, with residency training in emergency medicine. Physician adjudicators determined the presence of ST-elevation myocardial infarction (STEMI) as per the Fourth Universal Definition of Myocardial Infarction guidelines [23]: ≥1 mm of ST-segment elevation in ≥2 contiguous leads, except for leads V2 and V3 where larger age- and sex-based cutoff values were used [23]. In cases of left bundle branch block, the modified Sgarbossa criteria were used [24]. Agreement among adjudicators regarding the presence of STEMI was excellent (91.2 % agreement); in cases of disagreement, a third physician adjudicator served as the tiebreaker.

Study definitions

The study definition for ACS was taken directly from the Fourth Universal Definition of Myocardial Infarction [23]. Specifically ACS was defined by the presence of STEMI on ECG (as described above) or non-STEMI (NSTEMI), as defined by an abnormally elevated initial troponin T value (>40ng/L, the lower limit of the assay's measuring range, which is >99th percentile upper reference limit, as per manufacturer guidance) with an abnormal three-hour delta troponin. An abnormal three-hour delta troponin was defined by a delta troponin >11 % of the initial troponin value or an absolute delta troponin >20ng/L. The threshold of 11 % for an abnormal delta troponin was selected to correspond with the manufacturer-defined coefficient of variation (11 %), suggesting that a delta troponin of 11 % was more than the variation expected based on assay precision.

Participants' past medical history, outpatient medication use, substance use, and family history were defined by participant self-report. Physical activity level was categorized in accordance with World Health Organization recommendations [25]: specifically, an active lifestyle was defined by participant self-report of ≥150 min of moderately vigorous physical activity per week; a sedentary lifestyle was defined by <150 min of moderately vigorous physical activity per week.

Statistical analyses

Continuous variables are presented as means with standard deviations, and categorical variables are presented as proportions. Body mass index was calculated directly by dividing the weight (in kg) by the square of the height (in m). Estimated glomerular filtration rate was calculated from measured serum creatinine using the race-neutral 2021 CKD-EPI equation [26,27]. Self-reported household incomes were converted from Tanzanian shillings to United States Dollars (USD) using the World Bank official exchange rate for 2021 [28]. Thirty-day mortality rates among participants with and without ACS were compared using Pearson's chi-squared and an odds ratio was calculated directly from a 2 × 2 contingency table. To identify baseline predictors of thirty-day mortality among participants with ACS, assessments of univariate association were performed using Pearson's chi-squared for categorical variables and Welch's *t*-test for continuous variables. Fisher's exact test was used when expected cell count was <10. Multivariate generalized linear modeling using the binomial distribution was then performed to identify multivariate predictors of thirty-day mortality. Any baseline characteristic with evidence of potential univariate association ($p < 0.10$) with thirty-day mortality was included in the multivariate model. The pool of potential predictor variables was selected from among baseline characteristics with a putative association with thirty-day mortality. A threshold of $p < 0.05$ was used to define statistical significance. All statistical analyses were performed in the R Suite.

Ethics

This study received ethical approval from institutional review boards at Duke Health (Pro00090902), KCMC (Proposal No 893), and the Tanzania National Institute of Medical Research (NIMR/HQ/R.8/Vol IX/2436). All participants provided written informed consent prior to enrollment.

Results

During the study period, 7943 patients were screened, of whom 569 (7.2 %) met eligibility criteria. Of these, 568 (99.8 %) consented to participate in the study and were enrolled (Fig. 1, 2). Of participants, 129 (22.7 %) met the study definition for ACS, including 61 participants with STEMI and 68 participants with NSTEMI. Table 1 presents the baseline characteristics of participants with MI. Of participants with MI, 77 (59.7 %) were male, and the mean (SD) age was 64.5 (16.6) years. The most common self-reported co-morbidities among participants were hypertension ($n = 87$, 67.4 %), heart failure ($n = 47$, 36.4 %), and diabetes mellitus ($n = 30$, 23.3 %). About one in five participants ($n = 26$, 20.2 %) reported no known medical problems.

Table 2 shows the presenting symptoms and diagnostic test results among participants with ACS. The most common chief complaints among participants with MI were dyspnea ($n = 78$, 69.4 %) and chest pain ($n = 35$, 27.1 %). The majority ($n = 120$, 93.0 %) of participants with ACS reported that their symptoms were worsened with exertion, and the mean (sd) duration of symptoms prior to ED presentation was 2.9 (3.0) days.Table 3 summarizes the treatments that participants with ACS received while in the ED. Of those with MI, 39 (30.2 %) were treated with aspirin; 87 (67.4 %) did not receive any antiplatelet agent in the ED.

Thirty-day follow-up was achieved for all participants with ACS. At 30 days, 42 (32.6 %) participants with ACS had died. Of participants without ACS, 438 (99.8 %) completed thirty-day follow-up; of these, 72 (16.4 %) had died. Participants with ACS were significantly more likely to die within 30 days than participants without ACS (OR 2.45, 95 % CI: 1.56–3.83, $p < 0.001$). Of participants with ACS, 12 (9.3 %) reported undergoing coronary angiography in the 30 days following their presentation. Table 4 summarizes univariate associations between participant characteristics and 30-day mortality. On univariate analysis, lower

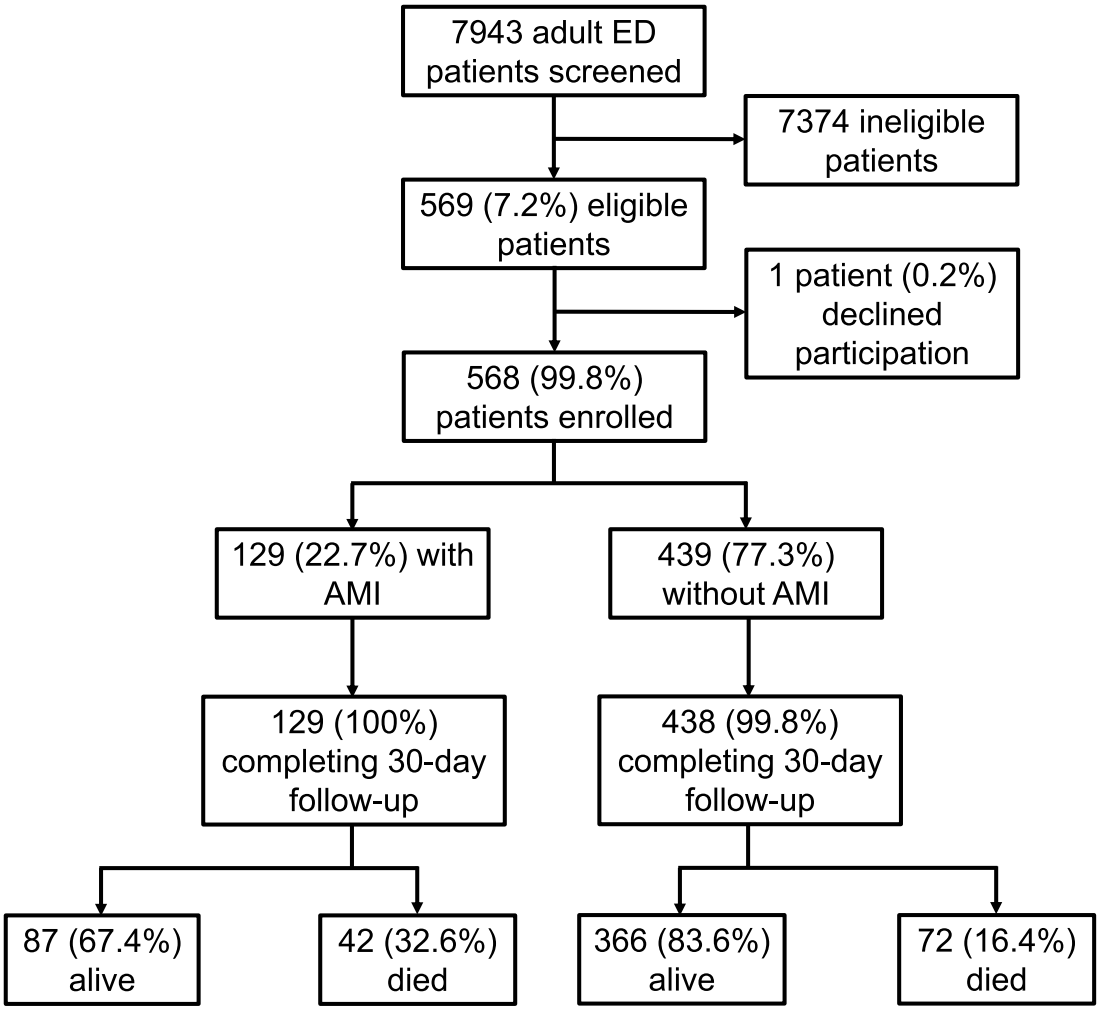

Fig. 1. Flow diagram of study participants.

systolic blood pressure (134 vs 150 mmHg, $p = 0.020$) showed evidence of association ($p < 0.05$) with thirty-day mortality. On multivariate analysis, no single baseline variable had a significant association ($p < 0.05$) with thirty-day mortality.

Discussion

This study is among the first to prospectively evaluate ACS burden and outcomes in an ED in SSA. The aims of this study were[1] to determine the prevalence of ACS in the KCMC ED using a more rigorous serial troponin testing protocol [2], to prospectively describe ACS care and outcomes following the implementation of quality improvement measures at KCMC, and[3] to identify predictors of 30-day mortality among patients with ACS at KCMC. In this follow-up study using a more rigorous serial troponin testing protocol, we found a similarly large burden of ACS and observed modest improvements in some care processes and mortality. These findings call attention to the need for additional study of ACS burden elsewhere in SSA as well as the need for more robust interventions to improve ACS care in Tanzania.

With the addition of a serial troponin testing protocol to define ACS, we found a nearly identical proportion of ACS among patients presenting to the ED with chest pain or shortness of breath (22.3 % in 2019[7] vs 22.7 % in the present study). Although many participants were elderly and reported multiple typical risk factors, it is notable that more than one in five participants with ACS reported no known medical problems. This is likely due in part to the large burden of undiagnosed comorbidities in our setting: recent studies from across SSA suggest that a substantial proportion of patients with hypertension, diabetes, and other risk factors in SSA have not been diagnosed due to limited screening [29,30]. This finding underscores the need for ED physicians in Tanzania to maintain a high index of suspicion for ACS, even among patients with no known risk factors. To our knowledge, there have not been other studies conducted elsewhere in SSA in which all ED patients with chest pain or dyspnea are screened for ACS; further research is needed to determine if the burden of ACS among ED patients is similarly large elsewhere in the region. Like other recent studies in Tanzania [7, 19], we found that most patients with ACS did not present to the hospital until several days after onset of symptoms. This may be partly due to low awareness of ACS and its symptoms in the community: recent community-based surveys from northern Tanzania found that few adults knew the symptoms of ACS and few considered chest pain to be a reason to present to the hospital [31,32]. Additional efforts are needed to promote community awareness of ACS and its symptoms in Tanzania.

In our 2019 study of ACS at KCMC, we identified several opportunities for improvement in ACS care: only 23 % were treated with aspirin in the ED and only 9 % received clopidogrel [7]. After efforts to improve training and awareness among ED staff at KCMC, we observed some improvements in care, with 30 % receiving aspirin and 26 % receiving clopidogrel. Moreover, in 2019, only 3 % of ACS patients at KCMC underwent percutaneous coronary intervention and 43 % had died within 30 days of presentation [14,15]. After our quality improvement initiatives which included direct communication with the country's only interventional cardiology team in Dar es Salaam, we observed modest reduction in all-cause mortality and a modest increase in percutaneous

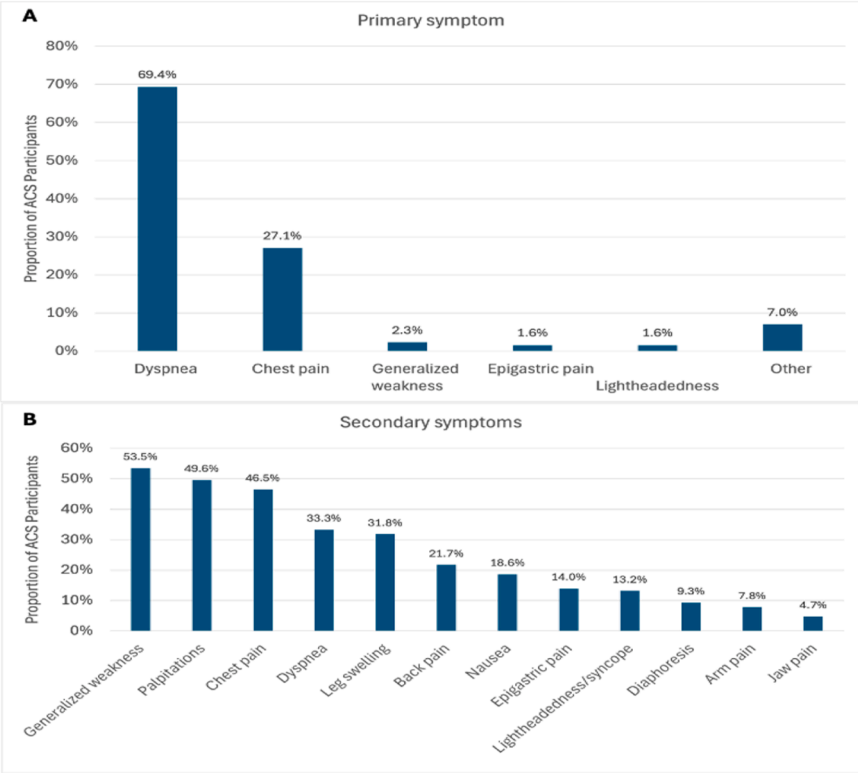

Fig. 2. Presenting symptoms of patients with acute coronary syndrome presenting to the emergency department, northern Tanzania, 2020–2023 ($N = 129$). Panel A: Primary symptom. Panel B: Secondary symptoms.

coronary intervention, with 33 % of participants with ACS dying and 9 % undergoing coronary angiography within 30 days. These improvements are encouraging, but additional work is needed to increase uptake of evidence-based ACS treatments, improve access to percutaneous coronary intervention, and reduce mortality. In particular, additional study is needed to understand the reasons for low rates of aspirin administration; aspirin, a World Health Organization 'Best Buy' for noncommunicable disease, is widely available in Tanzania and has proven mortality benefit for ACS [33,34]. In the handful of studies examining ED-based ACS care elsewhere in SSA, uptake of evidence-based therapies was higher: for example, in Ethiopia 63 % of patients with ACS received aspirin in the ED [9]. There are many factors which may contribute to sub-optimal uptake of evidence-based ACS care in Tanzania. Qualitative research from the country has found that provider training, failure to consider the diagnosis of ACS, and complex systems are important barriers to high-quality ACS care in Tanzania [20,35]. Focused efforts to address these and other barriers to evidence-based care that reduces ACS mortality are sorely needed, as the 30-day mortality rate we observed in northern Tanzania is among the highest ever reported globally [36]. Only one participant with ACS in our study received thrombolytic therapy, likely due in part to delayed patient presentations (as the mean duration of symptoms prior to ED presentation among participants was 3 days). Therefore, community- and systems-based interventions are needed to encourage faster presentation to hospital to increase uptake of time-senstive reperfusion therapies.

Although thirty-day all-cause mortality at KCMC improved from 43 % in our prior study to 33 % in our current study, mortality rates at our center remain very high, even when compared to other studies from SSA: in a recent systematic review of ACS in SSA that included studies from twelve different countries, none reported thirty-day mortality rates over 30 % [3]. The particularly high mortality rate in Tanzania underscores the need to improve access to life-saving interventions such as PCI, improve provider training in evidence-based care, and address other systemic barriers to care in the country, We did not identify any statistically significant predictors of 30-day mortality among patients with ACS in our study likely due to our small sample size; larger, multisite studies are needed to identify predictors of short-term ACS mortality in Tanzania. Although our study was focused on acute ED-based ACS care, future research is needed to evaluate uptake of guideline-directed medical therapy for post-ACS patients with stable coronary artery disease [37].

Study limitations

This study had several strengths, including uniform screening procedures, adherence to rigorous international guidelines for ACS case definition [23], and a 100 % follow-up rate for participants with ACS. This study also had several limitations. First, as discussed above, we relied on participant self-report for medical comorbidities, which likely led to underestimation of the prevalence of cardiovascular risk factors among our participants. Secondly, because a substantial proportion of participants did not present to the ED for several days after onset of symptoms, our approach may have failed to detect some subacute ACS cases if their troponin levels and ECG tracings no longer met the study definition for ACS. This may have resulted in an underestimation of the ACS burden in our study. Thirdly, although we used standard criteria for our ACS study definition, there are other conditions, such as myocarditis, Takotsubo's syndrome, and pulmonary embolism, which may result in similar ECG and troponin results [23]. This may have resulted in an overestimation of the ACS burden in our study. Although not possible in our study, coronary angiography, echocardiography, and cardiac magnetic resonance imaging, would have helped us distinguish occlusive ACS and Type I NSTEMI from other conditions. Finally, we only collected data on all-cause mortality, so it is unknown whether ACS was the direct or indirect cause of death among our participants with ACS.

Table 1
Characteristics of patients with acute coronary syndrome presenting to the emergency department, northern Tanzania, 2020–2023($N = 129$).

Characteristic	N	(%)
Gender:		
Female	52	(40.3)
Male	77	(59.7)
Age, mean (SD), years	64.5 (16.6)	
Highest education level		
None	5	(3.9)
Primary school	80	(62.0)
Secondary school	25	(19.4)
University	19	(14.7)
Health insurance coverage		
Has health insurance	65	(50.4)
Does not have health insurance	64	(49.6)
Monthly household income, mean (SD), USD	88.39 (429.08)	
Literacy		
Able to read	120	(93.0)
Unable to read	9	(7.0)
Mobile phone access		
Has access to a mobile phone	118	(91.5)
Does not have access to a mobile phone	11	(8.5)
Tobacco use		
Current tobacco user	13	(10.1)
Former tobacco user	42	(32.6)
Never tobacco user	74	(57.4)
Alcohol use		
Current alcohol user	31	(24.0)
Former alcohol user	60	(46.5)
Never alcohol user	38	(29.5)
Vegetable consumption		
Eats vegetables daily	16	(12.4)
Does not eat vegetables daily	113	(87.6)
Fruit consumption		
Eats fruits daily	11	(8.5)
Does not eat fruits daily	118	(91.5)
Self-reported medical problems		
Hypertension	87	(67.4)
Heart failure	47	(36.4)
Diabetes	30	(23.3)
Chronic kidney disease	16	(12.4)
HIV infection	6	(4.7)
Prior stroke	5	(3.9)
Coronary artery disease or prior MI	4	(3.1)
Hyperlipidemia	2	(1.6)
No known medical problems	26	(20.2)
Current outpatient medications		
Anti-hypertensive	70	(54.3)
Anti-diabetic	25	(19.4)
Aspirin	13	(10.1)
Clopidogrel	13	(10.1)
Physical activity		
Active lifestyle	27	(20.9)
Sedentary lifestyle	102	(79.1)
Family history		
Family history of MI or stroke	25	(19.4)
No known family history of MI or stroke	104	(80.6)

SD standard devistion, USD United States Dollars, MI myocardial infarction.

Table 2
Presenting symptoms, vital signs, and results of diagnostic testing among patients with acute coronary syndrome presenting to the emergency department, northern Tanzania, 2020–2023 ($N = 129$).

	n	(%)
Duration of symptoms, mean (sd), days	2.9 (3.0)	
Association with physical exertion		
Symptoms worsened by exertion	120	(93.0)
Symptoms not affected by exertion	9	(7.0)
Prior care seeking for this episode of illness		
None; directly to study site ED	65	(50.4)
Went to another hospital first	37	(28.7)
Went to a clinic first	26	(20.2)
Went to a traditional healer first	1	(0.8)
Aspirin use on day of presentation		
Self-administered aspirin prior to presentation	5	(3.9)
Did not take aspirin prior to presentation	124	(96.1)
Systolic blood pressure, mean (sd), mmHg	144.9 (35.6)	
Diastolic blood pressure, mean (sd), mmHg	83.7 (22.7)	
Pulse, mean (sd), beats per minute	93.2 (23.0)	
Body mass index, mean (sd), kg/m^2	24.9 (5.7)	
Myocardial infarction type		
ST elevation myocardial infarction	61	(47.3)
Non-ST elevation myocardial infarctio	68	(52.7)
Initial serum troponin T, mean (sd), ng/L[a]	285 (474)	
Estimated glomerular filtration rate (ml/min/1.73m^2)		
≥60	31	(24.0)
45–59	14	(10.9)
30–44	10	(7.8)
15–29	21	(16.3)
<15	23	(17.8)
Not obtained	30	(23.3)

[a] Manufacturer-defined 99th percentile upper reference limit = 50 ng/L; *ED Emergency Department.*

Table 3
Emergency department treatment of patients with acute coronary syndrome, northern Tanzania, 2020–2023 ($N = 129$).

Medications administered in the emergency department	n	(%)
Antiplatelet agents		
Aspirin	39	(30.2)
Clopidogrel	33	(25.6)
Either aspirin or clopidogrel	42	(32.6)
Both aspirin and clopidogrel	30	(23.3)
No antiplatelet agent administered	87	(67.4)
Heparin	7	(5.4)
Statin	31	(24.0)
Nitroglycerin or isosorbide dinitrate	14	(10.9)
Morphine	11	(8.5)
Calcium channel blocker	9	(7.0)
Beta blocker	5	(3.9)
Furosemide	38	(29.5)
Hydralazine	4	(3.1)
Intravenous fluid bolus	4	(3.1)
ACE inhibitor	2	(1.6)
Digoxin	2	(1.6)
Dopamine	3	(2.3)
Epinephrine	2	(1.6)
Thrombolytic	1	(0.8)

Conclusions

In conclusion, in a northern Tanzania, ACS is common and associated with high mortality. Although modest improvements in some ACS care processes and mortality have occurred, there are important opportunities for improving uptake of evidence-based ACS care in our setting. Targeted interventions are needed to improve ACS care in Tanzania and reduce excess mortality.

Dissemination of results

The findings of this research were disseminated to the local community and healthcare stakeholders through a series of presentations and discussions with KCMC as well as representatives from the Ministry of Health. This included sharing results with the medical staff at the participating emergency department, engaging with local and national health authorities, and conducting workshops aimed at improving ACS care protocols based on the study's outcomes. The goal was to ensure that the insights gained from this research were effectively communicated to those who could implement changes and improve patient outcomes in the region. The results of this study were used to inform a collaborative quality improvement project focused on ACS care at KCMC.

Table 4
Univariate and multivariate associations between participant characteristics and thirty-day mortality among patients with acute MI, northern Tanzania, 2020–2023 (N = 129).

Categorical variables	Participants surviving to 30 days, n (%), N = 87	Participants dying within 30 days, n (%), N = 42	Univariate OR (95 % CI)	p	Multivariate OR (95 %)	p
Male gender	52 (60 %)	25 (60 %)	0.99 (0.47, 2.13)	0.979		
Post-primary education	31 (36 %)	13 (31 %)	0.81 (0.36, 1.78)	0.599		
Health insurance ownership	47 (54 %)	18 (43 %)	0.64 (0.30, 1.35)	0.235		
Current tobacco use	10 (11 %)	3 (7 %)	0.61 (0.13, 2.19)	0.545		
Current alcohol use	21 (24 %)	10 (24 %)	0.99 (0.40, 2.32)	0.967		
Self-reported hypertension	55 (63 %)	32 (76 %)	1.84 (0.81, 4.43)	0.141		
Self-reported diabetes	23 (26 %)	7 (17 %)	0.57 (0.20, 1.41)	0.218		
Self-reported heart failure	30 (34 %)	17 (40 %)	1.29 (0.60, 2.77)	0.507		
Outpatient anti-platelet use at baseline	17 (20 %)	6 (14 %)	0.70 (0.23, 1.86)	0.465		
Active lifestyle	20 (23 %)	7 (17 %)	0.68 (0.24, 1.72)	0.408		
Received an antiplatelet in the ED	31 (36 %)	11 (26 %)	0.65 (0.28, 1.44)	0.284		
Continuous variables	Participants surviving to 30 days, mean (sd), N = 87	Participants dying within 30 days, mean (sd), N = 42		p	Multivariate OR (95 %)	p
Age, years	62.6 (16.8)	68.5 (15.7)		0.056	1.01 (0.99–1.04)	0.295
Monthly household income, USD	122.76 (519.13)	17.20 (42.35)		0.063		
Duration of symptoms prior to presentation, days	3.0 (3.1)	2.9 (2.4)		0.822		
Systolic blood pressure, mmHg	150[34]	134[36]		0.020 *	0.99 (0.98–1.00)	0.074
Pulse, beats per minute	90[19]	99[29]		0.060	1.02 (1.00–1.04)	0.058
Initial serum troponin T, ng/L	294 (507)	264 (401)		0.719	1.00 (1.00–1.00)	0.183
Body mass index, kg/m^2	25.5 (6.1)	23.7 (4.5)		0.066	0.97 (0.90–1.04)	0.417

* $p < 0.05$. OR odds ration; CI confidence interval; ED emergency department; *USD United States Dollars*

CRediT authorship contribution statement

Julian T Hertz: Conceptualization, Formal analysis, Funding acquisition, Data curation, Supervision, Writing – original draft, Writing – review & editing. **Francis M Sakita:** Conceptualization, Formal analysis, Supervision. **Wai Yan Min Htike:** Data curation, Writing – original draft, Writing – review & editing. **Kilonzo G Kajiru:** Conceptualization. **Blandina T Mmbaga:** Conceptualization. **Tumsifu G Tarimo:** Data curation. **Godfrey L Kweka:** Data curation. **Jerome J Mlangi:** Data curation. **Amedeus V Maro:** Formal analysis. **Lauren Coaxum:** Formal analysis. **Sophie W Galson:** Formal analysis. **Alexander T Limkakeng:** Methodology. **Gerald S Bloomfield:** Methodology.

Declaration of competing interest

The authors declared no conflicts of interest.

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