Thirty-Day Outcomes and Predictors of Mortality Following Acute Myocardial Infarction in Northern Tanzania: a Prospective Observational Cohort Study

by

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Thesis submitted in partial fulfillment of
the requirements for the degree of
Master of Science in the Duke Global Health Institute
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ABSTRACT

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Abstract

Background:

There is a rising burden of acute myocardial infarction (AMI) within sub-Saharan Africa. Prospective studies of detailed AMI outcomes in the region are lacking.

Methods:

Adult patients with confirmed AMI from a prospective surveillance study in northern Tanzania were enrolled in a longitudinal cohort study after baseline health history, medication use, barriers to care, and sociodemographics were obtained. Thirty days following hospital presentation, symptom status, rehospitalizations, medication use, and mortality were assessed via telephone or in-person interviews using a standardized follow-up questionnaire. Multivariate logistic regression was performed to identify baseline predictors of thirty-day survival.

Results:

Thirty-day follow-up was achieved for 150 (98.7%) of 152 enrolled participants. Of these, 85 (56·7%) survived to thirty-day follow-up. Of the surviving participants, 71 (83·5%) reported persistent anginal symptoms, four (4·7%) reported taking aspirin regularly, seven (8·2%) were able to identify AMI as the reason for their hospitalization, and 17 (20·0%) had unscheduled rehospitalizations. Baseline predictors of thirty-day survival included self-reported history of diabetes (OR 0·32, 95% CI 0·10-0·89, $p = 0·04$), self-reported history of hypertension (OR 0·34, 95% CI 0·15-0·74, $p = 0·01$) and antiplatelet use at initial presentation (OR 0·19, 95% CI 0·04-0·65, $p = 0·02$).

Conclusions:

In northern Tanzania, thirty-day outcomes following AMI are poor, and mortality is associated with comorbidities and medication usage. Further investigation is needed to develop interventions to improve care and outcomes of AMI in Tanzania.

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Acknowledgements

Kilimanjaro Christian Medical Centre, Gloria Temu MD, Francis M Sakita MD, Godfrey L Kweka CO, Tumsifu G Tarimo BS, Nathan M Thielman MD, Janet P Bettger ScD, Gerald S Bloomfield MD, Alexander T Limkakeng MD, study participants, and Julian Hertz MD.

1. Introduction

Acute myocardial infarction (AMI) is a leading cause of death in adults globally.[1] In Sub-Saharan Africa (SSA), the burden of AMI is presumed to be rising as the region proceeds through the epidemiologic transition,[2] but data regarding AMI incidence or prevalence in SSA remain limited.[3] A recent study in Tanzania found that AMI was common among patients presenting to the emergency department, but that AMI cases were frequently missed by providers and the use of evidence-based AMI treatment was rare.[4]

Against this backdrop, little is known about patient-level AMI outcomes in SSA. A handful of studies have investigated in-hospital or thirty-day mortality rates in SSA.[5–8] These studies, which were conducted in advanced centers with capacity for cardiac catheterization, reported in-hospital mortality rates ranging from 9 to 17%.[5–8] However, advanced cardiac centers are scarce in SSA;[7,9] in 2017, for example, there were only 12 cardiac catheterization facilities within three countries in East and Central Africa[7], a region containing 29 countries and a population of approximately 1.1 billion[10]. In a recent study at a Tanzanian hospital without cardiac catheterization capacity, a 43% thirty-day mortality rate was observed,[4] suggesting that AMI outcomes may be worse in settings without access to specialized cardiac care.

Beyond the limited crude mortality data described above, much remains to be learned about AMI outcomes in SSA. Specifically, to our knowledge, no published studies have reported healthcare utilization following discharge, use of evidence-based therapies for secondary prevention, re-hospitalization rates, or patient-perceived barriers to care. Furthermore, to our knowledge, there are no data regarding predictors of death following AMI or symptom status among AMI survivors

in SSA. Obtaining such data would aid clinicians, researchers, and policy-makers in identifying gaps in care and targets for strengthening existing systems of care.

The aim of this prospective observational study was to report several thirty-day outcomes including healthcare utilization, predictors of death, and mortality among adult patients with confirmed AMI in the Kilimanjaro Region of northern Tanzania.

2. Methods

2.1 Setting

This study was conducted in the Kilimanjaro Region of northern Tanzania. In 2014, the community prevalence of hypertension among adults living in Kilimanjaro was 28%,[11] and the prevalence of diabetes was 6%.[12] The dominant local tribe is the Chagga tribe. The local tertiary care center is Kilimanjaro Christian Medical Centre (KCMC), which was not staffed with a trained cardiologist or equipped with a cardiac catheterization lab at the time of this study.

2.2 Participants

The participants in this study were enrolled from a prospective AMI surveillance study in northern Tanzania, with methods described elsewhere.[4] The surveillance study was conducted in the KCMC emergency department (ED). Adult patients (age ≥ 17 years) presenting with acute chest pain or shortness of breath to the ED were eligible for enrollment in the surveillance study; and underwent testing for AMI with electrocardiogram and point-of-care troponin-I testing (Abott iSTAT cTnI assay, Abbott Point of Care, Princeton, New Jersey, United States). Patients in the surveillance study who were found to have AMI were enrolled into the longitudinal follow-up study.

2.3 Procedures

At initial presentation, trained research assistants administered a standardized questionnaire to all participants, eliciting information about past medical history, medication use, and sociodemographic information. Thirty days following presentation to the ED, participants were

contacted via telephone and a standardized follow-up questionnaire was administered by research assistants. Participants were asked to provide information about their symptom progression, rehospitalizations, medication use, and barriers to care subsequently encountered. They were also asked to identify their diagnosis in their own words. If participants were initially unreachable by telephone, they were called on five separate days. If they remained unreachable, a home visit was conducted by a member of the study team to complete the follow-up questionnaire face-to-face. If the participant had died, the survey was administered to a relative. In case of participant death, a brief verbal autopsy based on the World Health Organization (WHO) 2016 verbal autopsy instrument was administered to available relatives.[13]

2.4 Measures

The primary outcome was death from any cause. Secondary outcomes included death from AMI, location of death, resolution of symptoms, rehospitalization, numbers of days hospitalized, prescribed medications, follow-up rates, and participant knowledge of their disease. Causes of death were adjudicated by a committee of three physicians from Tanzania and the United States. The adjudicating committee reviewed the verbal autopsy data, documented clinical diagnoses, patient demographics, vital signs at hospital presentation, electrocardiograms, laboratory data including troponin values, and all other available clinical data such as presenting symptoms and symptom duration prior to hospital presentation. After reviewing these data, the adjudicating committee ascribed one of the following causes of death to each case: myocardial infarction, heart failure, stroke, renal failure, other, or indeterminant. The adjudicating committee also reviewed participants' self-identified diagnoses to determine whether or not the patient accurately identified AMI as their diagnosis. Any patient description that was felt by the committee to describe AMI (for example, "heart attack" or "heart problem") was characterized as an accurate

identification of the diagnosis. When patients did not know their diagnosis or provided a diagnosis unrelated to AMI (for example, “pneumonia” or “malaria”), they were categorized as being unable to identify AMI as their diagnosis. Disagreements among committee members were resolved by consensus.

2.4.1 Acute MI

For study purposes, AMI was defined according to the Fourth Universal Definition of AMI criteria:[14] any patient with pathologic ST elevation in contiguous leads or pathologically elevated troponin (>0·08ng/ml) were considered to have an AMI. Three external independent physician adjudicators reviewed electrocardiograms to determine pathologic ST elevations and reviewed ECG and troponin levels to determine presence or absence of MI. Troponin and ECG results were shared immediately with the clinical team, but for study purposes determination of AMI was performed by independent adjudicators.

2.4.2 Number of days hospitalized

Number of days hospitalized (if hospitalized) from initial ED visit until discharge, as per patient-self report. Rehospitalizations were not included in this count.

2.4.3 Sedentary lifestyle

Sedentary lifestyle was defined as participant self-report of less than 150 minutes of moderately vigorous exercise per week, in accordance with WHO guidelines.[15]

2.4.4 Poor diet

Poor diet was defined as participant self-report of not eating vegetables and fruits daily, consistent with the known association between daily fruit and vegetable consumption and reduced risk of cardiovascular disease.[16]

2.4.5 Body Mass Index (BMI)

Body mass index (BMI) was calculated using Excel directly from measured height (m) and weight (kg).

2.4.6 Alcohol and tobacco use

Current and prior alcohol and tobacco use were defined by patient self-report.

2.4.7 Baseline comorbidities

Baseline medical co-morbidities included diabetes (DM), hypertension, hyperlipidemia (HL), cardiovascular disease (CVD), HIV, chronic kidney disease (CKD), and congestive heart failure (CHF) were defined by self-report.

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2.4.8 Symptom status

Patient self-report of worsened, unchanged, improved, or resolved symptoms at thirty-day follow-up.

2.4.9 Medication use

Based on self-report, patients could list medications they were currently taking at initial presentation and at thirty-day follow-up, including antiplatelet agents, anti-hypertensives, anti-hyperglycemics, and statins.

2.4.10 Barriers to care

Follow-up barriers, as well as barriers to care were assessed through participant self-report. Participants were asked to choose from a picklist of potential barriers to care that included: not recognizing symptoms as important, cost, wait times, transportation, poor communication from providers, inadequate care, providers that are uncaring, and medication side effects; an "other" option was also listed for participants to describe barriers not included in the picklist.

2.5 Analysis

Statistical analyses were performed in the R Suite (Ver 1·3·1056·1). Descriptive statistics were used to report participant characteristics and outcomes; continuous variables are presented as medians (interquartile ranges) and categorical variables are presented as frequencies and proportions. We secondarily sought to identify predictors of thirty-day mortality. A pool of potential predictor variables was developed based on biologic plausibility and known predictors of mortality in high-income settings.[17] Univariate analyses were performed to assess associations between predictor variables obtained at enrollment and mortality, using Pearson's chi-square for categorical variables and Welch's t-test for continuous variables. Odds ratios and corresponding 95% confidence intervals were calculated directly from two-by-two contingency tables. Multivariate logistic regression was then performed to identify predictors of thirty-day mortality.

Any variable with evidence of univariate association with mortality ($p < 0{\cdot}1$) was included in the model; age and sex were also forced into the model.

3. Results

Of 681 screened patients, a total of 152 participants with AMI were identified and enrolled in this study. Baseline sociodemographic characteristics and medical comorbidities of participants are presented in Table 1. The median (IQR) age of participants was 61 (49, 76) years and the median BMI was 23·2 (20·8,26·4) kg/m^2, and 91 participants (59·9%) were male. At presentation, 94 (61·8%) participants reported a known history of hypertension and 27 (17·8%) reported a known history of diabetes. Eighteen (11·8%) participants reported taking an antiplatelet medication regularly prior to presentation.

Table 1. Characteristics of Adults Presenting with Acute Myocardial Infarction in a Tanzanian Emergency Department, 2019 (N=152)

	Median	IQR
Age	61	49·0,76·0
BMI	23·2	20·8,26·4
Troponin (ng/ml)	0·12	0·02,0·42
	Number of Participants	**(%)**
Sex		
Male	91	59·9%
Female	61	40·1%
Education		
None	10	6·6%
Primary	88	57·9%
Secondary	20	13·2%
Post-Secondary	34	22·4%
History of prior myocardial infarction	4	2·6%
Current tobacco use	16	10·5%
Current alcohol use	54	35·5%
Poor diet	140	92·1%
Sedentary lifestyle	91	59·9%
Given aspirin in the ED	35	23·0%
Medical History, self-reported		
Diabetes	27	17·8%
Hyperlipidemia	8	5·3%
Hypertension	94	61·8%
HIV	5	3·3%
Chronic kidney disease	16	10·5%
Taking antiplatelet medication at presentation	18	11·8%

Barriers to care were assessed for all 152 participants (Table 2). The most common barrier to care was participants' general attitude toward seeking care, with 62 (40·8%) participants reporting that they delayed seeking care initially because they did not think their symptoms were serious. Cost was cited as a barrier by 25 (16·4%) participants and wait times were identified as a barrier by 20 (13·2%) participants. Eighteen (11·2%) participants identified transportation as a barrier care, while 17 (11·2%) participants listed provider communication as a barrier.

Table 2: Barriers to Care Reported by Patients with Acute Myocardial Infarction, Northern Tanzania (N=152)

	Number of participants (N=152)	(%)
Patient didn't initially recognize symptoms as important	62	40.8%
High cost of care	25	16.4%
Wait times	20	13.2%
Transportation difficulties	18	11.8%
Poor communication from providers	17	
Inadequate care	10	6.6%
Providers that are uncaring	8	5.3%
Medication side effects	5	3.3%

Thirty-day follow-up was achieved for 150 (98·7%) participants; two participants were lost to follow-up. Of the 150 for whom follow-up was obtained, 65 (43·3%) died. Table 3 summarizes outcomes of the 85 participants surviving to thirty-day follow-up. Of the 85 participants who survived to thirty-day follow-up, 14 (16·5%) reported their symptoms resolved, 53 (62·4%) reported symptom improvement, and 18 (21·2%) reported their symptoms had worsened or were unchanged. Among surviving patients, four (4·7%) reported taking aspirin daily and seven

(8·2%) were able to identify AMI as their diagnosis. In the 30 days following initial hospital presentation, 36 (42·4%) reported receiving a scheduled follow-up appointment and 17 (20·0%) reported having an unscheduled re-hospitalization for recurrent AMI symptoms.

Table 3. Thirty Day Outcomes Among Patients with Acute Myocardial Infarction Surviving to Thirty-Day Follow-Up, Northern Tanzania, 2019 (N=85)

All surviving patients (N=85*)	Number of Participants	(%)
Symptom Progression at 30 days		
Resolved	14	16.5%
Improved	53	63.4%
Worsened or unchanged	18	21.2%
Received a prescription at hospital discharge	81	95.3%
Reports taking medications as prescribed (N=81)	75	92.6%
Reports taking aspirin	4	4.7%
Identified AMI as their diagnosis	7	8.2%
Feels they understand their treatment	64	75.3%
Given 30-day follow-up appointment	36	42.4%
Attended follow-up clinic appointment (N=36)	23	63.9%
Unscheduled Hospitalizations for recurrent chest pain/shortness of breath after discharge	17	20.0%
***2 lost to follow up**		

The adjudicated causes of death are summarized in Table 4. Of the 65 deaths occurring within thirty days, 17 (26·2%) were due to myocardial infarction, 17 (26·2%) were due to heart failure, and 10 (15·4%) were due to renal failure. The majority of deaths (53, 81·5%) occurred in a hospital, and the median (IQR) time interval between hospital presentation and death was three (1, 16) days.

Table 4. Cases of Death Among Adults Dying within Thirty Days of Acute Myocardial Infarction, Northern Tanzania, 2019 (N=65)

	Number of participants	(%)
Location of death		
Hospital	53	81·5%
Home	6	9·2%
Other facility	6	9·2%
Physician-adjudicated cause of death		
Myocardial infarction	17	26·2%
Heart failure	17	26·2%
Renal failure	10	15·4%
Indeterminate	21	32·3%
	Median	**IQR**
Days from hospital presentation to death	3	1,16

Table 5 presents univariate analyses of predictors of thirty-day mortality. The following baseline characteristics were found to be potentially significant predictors of lower thirty-day mortality ($p < 0{\cdot}10$) and were included in the multivariate model: self-reported history of diabetes (OR 0·40, 95% CI 0·15-0·98, $p = 0{\cdot}044$), self-reported history of hypertension OR 0·26, 95% CI 0·18-0·72, $p = 0{\cdot}003$, taking antiplatelet medication at presentation OR 0·34, 95% CI 0·09-1·03, $p = 0{\cdot}054$, higher BMI ($p = 0{\cdot}014$) and lower troponin level ($p = 0{\cdot}053$).

The results of a multivariate analysis of predictors of death are summarized in Table 6. Self-reported history of diabetes (OR 0·32, 95% CI 0·10-0·89, $p = 0{\cdot}04$), self-reported history of hypertension (OR 0·34, 95% CI 0·15-0·74, $p = 0{\cdot}01$), and taking antiplatelet at presentation (OR 0·19, 95% CI 0·04-0·65, $p = 0{\cdot}02$) were associated with lower odds of 30-day mortality.

Table 5. Univariate Analysis of Predictors of Thirty Day Mortality Following Acute Myocardial Infarction, Northern Tanzania, 2019

	Participants surviving to 30 days n(%)	Participants dying within 30 days n(%)	Univariate OR (95% CI)	*p*
Male sex	51(60·0%)	38(58·5%)	0·94(0·48,1·82)	0·849
Post-primary education	40(47·1%)	13(20·0%)	0·23(0·05,0·94)	0·025*
Poor diet	77(90·6%)	61(93·8%)	1·55(0·46,6·27)	0·466
Sedentary lifestyle	50(58·8%)	40(61·5%)	1·12(0·58,2·18)	0·737
Self-reported History of diabetes	20(23·5%)	7(10·8%)	0·40(0·15,0·98)	0·044*
Self-reported History of hypertension	62(72·9%)	32(50·0%)	0·36(0·18,0·72)	0·003*
Self-reported History of hyperlipidemia	7(8·2%)	1(1·5%)	0·20(0·01,1·18)	0·138
Self-reported History of chronic kidney disease	9(10·6%)	7(10·8%)	1·02(0·34,2·95)	0·972
Current Alcohol Use	25(43·8%)	27(51·9%)	1·37(0·65,2·96)	0·400
Current Tobacco Use	8(25·8%)	7(31·8%)	1·34(0·38,4·60)	0·632
Given Aspirin in the ED	23(27·1%)	12(18·5%)	0·62(0·27,1·34)	0·217
Taking Antiplatelet at Presentation	14(16·5%)	4(6·2%)	0·34(0·09,1·03)	0·054
	Mean (s.d)	**Mean (s.d.)**		***P***
Age (years)	60·08(16·01)	63·34(21·17)		0·303
Troponin (ng/ml)	0·43 (1·32)	1·70(5·05)		0·053
BMI	24·57(4·29)	22·83(4·6)		0·014*

ED: Emergency Department
BMI: Body Mass Index

Table 6. Multivariate Analysis of Predictors of Thirty Day Mortality Following Acute Myocardial Infarction, Northern Tanzania, 2019

	Multivariate OR (95% CI)	*p*
Age	1·02 (1·00,1·04)	0·054
Male Sex	0·86 (0·41,1·80)	0·693
Post-Primary Education	0·20 (0·03,1·06)	0·062
Self-Reported History of Diabetes	0·32 (0·10,0·89)	0·037*
Self-Reported History of Hypertension	0·34 (0·15,0·74)	0·008*
Taking Antiplatelet at Presentation	0·19 (0·04,0·65)	0·016*
Troponin Level	1·18 (1·02,1·53)	0·118
BMI	0·92(0·84,1·01)	0·072

BMI: body mass index

4. Discussion

To our knowledge, this is one of the first studies to assess multiple thirty-day outcomes following AMI in sub-Saharan Africa. In northern Tanzania, we found that thirty days following AMI, the majority of patients had died and over three-quarters of those surviving reported persistent anginal symptoms. Few patients understood their diagnosis, and one in five surviving patients was re-hospitalized. Furthermore, use of evidence-based secondary prevention medications such as antiplatelet therapy was low. These findings call attention to an urgent need to develop patient-centered interventions to improve AMI care and outcomes in Tanzania.

As discussed elsewhere, the thirty-day mortality rate within this cohort is among the highest reported globally.[4] The majority of deaths occurred within three days of hospital presentation and occurred in-hospital. Recent quantitative and qualitative studies from Tanzania have identified potential contributors to poor AMI outcomes, including inadequate physician training, lack of diagnostic capacity, frequent AMI misdiagnosis, and an inefficient referral system.[4,18] Our findings suggest that short term AMI outcomes in Tanzania are substantially worse than in other world regions, and our data identify multiple potential explanations for these poor outcomes: low rates of ED aspirin administration, lack of local percutaneous coronary intervention capacity, low uptake of secondary prevention therapies, inconsistent follow-up appointments, and poor patient understanding.

Even among the patients who survived to thirty days, the majority (84%) reported persistent anginal symptoms, which may be due in part to the inability to obtain revascularization in these patients. This stands in contrast to what has been observed in high-income settings: in the United

States for example, approximately 17% of patients report persistent angina thirty days following AMI.[19] In addition to high prevalence of persistent anginal symptoms, patient understanding of their disease appeared to be low: only a minority were aware that they had a recent AMI. Improved understanding of disease and risk factors leads to improved health outcomes in a wide variety of settings, including in Tanzania.[20,21] Perhaps most concerningly, few patients reported taking secondary prevention medications such as antiplatelet medications, statins, and antihypertensives, which are known to reduce morbidity and mortality following AMI.[22–24] The 5% of patients observed to be taking antiplatelet therapy following AMI stands in stark contrast to data from other settings: in high-income settings like Australia and the United States, the vast majority of patients are taking antiplatelets and other recommended secondary prevention therapies.[25,26] Even in low- and middle-income countries outside of SSA, a recent WHO study found that 81% of patients with recent AMI were taking aspirin.[27]

Also, few patients reported receiving 30-day follow-up and one in five were re-hospitalized for recurrent AMI symptoms. The 20% unscheduled 30-day rehospitalization rate observed in our study is also worse than what has been reported in other settings: recent studies from China and the United States reported 30-day rehospitalization rates of 6% and 14%, respectively.[28,29]

Patients reported multiple barriers, but the most commonly identified barrier was lack of understanding of the significance of their symptoms or placing other priorities above seeking care. Such a barrier may be attributed to a lack of understanding of their disease. Recent community-based studies in Tanzania found that few Tanzanian adults knew the symptoms of AMI or whether present to a hospital for such symptoms.[30,31] This lack of appreciation of the importance of their symptoms likely explains why patients with AMI in northern Tanzania

typically present to hospitals after prolonged delays.[4] Education at both patient and the community levels is needed to address such barriers. Appropriately designed educational interventions may reduce care-seeking delays and improve short term outcomes.

Statistically significant predictors of thirty-day survival included self-reported history of diabetes, self-reported history of hypertension, and taking an antiplatelet agent on presentation. These results are in contrast to prior studies of AMI outcomes in other settings: a review of AMI outcomes in Europe, for example, found that diabetes and hypertension are significant predictors of death.[32] The apparent protective effect of a self-reported hypertension and diabetes in our cohort was unexpected. However, in the sub-Saharan African context, where a large majority of patients with hypertension and diabetes are unaware of their diagnoses,[33–35] a self-reported history of diabetes and hypertension may be a proxy for health awareness, engagement with the healthcare system, and pre-existing use of secondary prevention therapies. This finding emphasizes the critical need for expanded screening, treatment, and education for hypertension and diabetes in SSA. The association between ongoing use of antiplatelet agent and improved AMI mortality is unsurprising; treating AMI patients with aspirin was recently cited by the WHO as a "best buy" for reducing noncommunicable disease morbidity and mortality.[36, 37] Given the low numbers of AMI patients observed to be treated with aspirin in the ED or taking aspirin on thirty-day follow-up, there is an urgent need to develop interventions to increase aspirin use in this patient population. Unfortunately, a recent systematic review of the WHO recommendations found no published studies of interventions to increase aspirin therapy for AMI patients in low-income countries.[38]

4.1 Implications for policy and practice

In a literature search for published studies regarding AMI in SSA, no studies were identified in which prospective AMI screening was coupled with prospective outpatient follow-up in SSA nor were their studies identifying and describing detailed outcomes or predictors of thirty-day mortality. Results from this study help to fill this knowledge gap in northern Tanzania. In northern Tanzania, AMI is associated with high thirty-day mortality, and uptake of secondary preventative therapies is low. Patients who are already engaged with the healthcare system and taking preventative therapies at time of initial presentation are at lower risk of mortality. Efforts are needed to improve AMI care and outcomes in northern Tanzania.

4.2 Implications for further research

Further investigation is needed to understand associations found among this cohort. Results from this study indicate that among this cohort self-reported hypertension, self-report diabetes, and taking antiplatelet medications were associated with lower thirty-day mortality, likely reflecting prior preventive care and health knowledge. Improved knowledge of predictors of mortality can indicate potential contributors to high thirty-day mortality, which can inform interventions to improve AMI care and outcomes in northern Tanzania.

4.3 Study strengths and limitations

The findings of this study must be interpreted in light of its limitations. A major limitation of this study is that only patients presenting to a referral center hospital with typical AMI symptoms were enrolled. Those who did not survive to hospital, those who chose not to present to the hospital at all or went to a different facility, and those who had an atypical presentation were not

included in our study. These patients likely had worse outcomes and perhaps were even less likely to be taking appropriate preventative medications. Furthermore, we relied on patient self-report to identify their comorbidities and medications at thirty-day follow-up. To maximize the accuracy of these data, research assistants asked the patients to read their prescriptions to them over the phone and when in-home follow-up visits were done, research assistants directly looked at the prescriptions. Nonetheless, it is possible that in some cases patients misidentified or forgot certain medications, which would have led to an underestimation of the proportion of patients on appropriate preventative therapy. Finally, as coronary angiography is not currently available at KCMC, we were unable to describe the degree and severity of our participants' underlying coronary artery disease, which may have been an important unexplored predictor of death. Our study may have been under-powered to detect other important associations with death.

5. Conclusion

In conclusion, in northern Tanzania, thirty-day outcomes following AMI are poor and there are multiple opportunities to improve post-AMI care. Among this cohort, self-reported hypertension, self-reported diabetes, and taking antiplatelet medications were associated with lower thirty-day mortality, likely reflecting prior preventive care and health knowledge. Further investigation is needed to understand these associations. Interventions are needed to improve care and outcomes of AMI in Tanzania.

Appendix A

Ethics

All participants provided written informed consent prior to study participation. This study received ethics approval from Duke Health, KCMC, and the Tanzanian National Institute for Medical Research.

Role of the Funding Source

The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.

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