

Factors Associated with Delayed Hospital Arrival among Patients with Acute Coronary Syndrome in Addis Ababa, Ethiopia: A Cross-Sectional Study

Aklilu

Belay^{1*},

Aklilu

Azazh¹,

Nahom

Mesfin¹

ABSTRACT

Background: Acute coronary syndrome (ACS) carries substantial mortality and morbidity, and delayed presentation worsens outcomes. Prehospital delay is common but poorly characterized in Ethiopia and other low-resource settings.

Objective: To identify factors associated with delayed hospital arrival among patients with ACS in Addis Ababa.

Methods: A prospective cross-sectional study was conducted from May to September 2024 among 114 ACS patients treated at four hospitals in Addis Ababa (Tikur Anbessa Specialized Hospital, Zewditu Memorial Hospital, St. Paul's Hospital Millennium Medical College, and St. Peter Hospital), enrolled by convenience sampling. Data were collected using an interviewer-administered semi-structured questionnaire and analyzed in SPSS version 27 using descriptive statistics and bivariate/multivariate logistic regression. Delayed presentation was defined as arrival more than 12 hours after symptom onset.

Results: Most participants were male (68.4%) and aged 40–60 years (53.5%). Mean time from symptom onset to first medical contact was 14.0 hours, and 57% of patients presented after 12 hours. Chest pain was the presenting symptom in 77.9% of patients; the overall complication rate was 30.7%, with acute decompensated heart failure most common (15.8%). On multivariate analysis, no formal education (AOR 1.55, 95% CI 1.20–3.10, $p = 0.018$), absence of health insurance (AOR 3.20, 95% CI 2.67–4.21, $p = 0.002$), and residence more than 10 km from a health facility (AOR 1.70, 95% CI 1.25–4.21, $p = 0.004$) were independently associated with delayed presentation, while ambulance use was protective (AOR 0.86, 95% CI 0.23–0.97, $p = 0.032$).

Conclusion: More than half of ACS patients in this study presented beyond the 12-hour window. Education, health insurance coverage, distance from care, and ambulance utilization are key modifiable determinants of prehospital delay. Targeted public health education and strengthened emergency medical services are needed to promote timely presentation.

Citation: Aklilu Belay, Aklilu Azazh, Nahom Mesfin. Factors Associated with Delayed Hospital Arrival among Patients with Acute Coronary Syndrome in Addis Ababa, Ethiopia: A Cross-Sectional Study. PAJEC.2026; 4(2): page number 82-90.

Keywords: Acute coronary syndrome; prehospital delay; emergency medical services; Ethiopia; cross-sectional study

1. Addis Ababa University, Addis Ababa, Ethiopia.

Correspondence: Aklilu Belay

Email: aklilu725@gmail.com

Received: July 12, 2026;

Accepted: September 5, 2026;

Published: September 19, 2026

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1. Introduction

Acute coronary syndrome (ACS), encompassing ST-segment elevation myocardial infarction (STEMI), non-ST-segment elevation myocardial infarction (NSTEMI), and unstable angina, results from compromised coronary blood flow and remains one of the most significant causes of mortality and morbidity worldwide.^[1,2] Complications may be electrical, such as arrhythmia occurring early in the disease course, or mechanical, such as cardiogenic shock, free wall rupture, or ventricular septal rupture, which typically occur later.^[3] Because rapid diagnosis and treatment minimize irreversible cardiac damage, timely access to prehospital and emergency care is critical to reducing ACS-related morbidity and mortality.^[3,4]

Numerous patient-related, system-related, sociocultural, and health-literacy barriers can delay presentation of ACS patients to care, and such delays are consistently associated with worse outcomes.^[5,6] In Ethiopia, more than 30% of ACS patients are reported to die from related complications,^[7] yet data characterizing the drivers of prehospital delay remain limited, particularly outside single-center or emergency-department-only samples. Understanding these barriers is important both for guiding clinical practice and for informing policy: timely presentation reduces the need for costly interventions, shortens hospital stays, and improves survival.^[7-9]

This study aimed to examine the factors associated with delayed hospital arrival among patients with ACS presenting to major referral hospitals in Addis Ababa, with specific objectives of describing the time from symptom onset to arrival, identifying sociodemographic and system-level determinants of delay, and assessing the level of prehospital care utilization.

2. Materials and Methods

Study design and setting

This was a prospective cross-sectional study conducted from May to September 2024 at four government hospitals in Addis Ababa, Ethiopia: Tikur Anbessa Specialized Hospital, a national referral and teaching hospital; Zewditu Memorial Hospital, a referral hospital serving patients from within and outside Addis Ababa; St. Paul's Hospital Millennium Medical College, which maintains a cardiac intensive care unit and catheterization laboratory; and St. Peter Hospital. These sites were selected as principal referral centers for ACS in the city.

Study subject and sampling

The source population comprised patients diagnosed with ACS; the study population comprised ACS patients treated at the four study hospitals during the study period. Patients were enrolled by convenience sampling. Using a single population proportion formula ($Z_{\alpha/2} = 1.96$, $p = 0.5$, $d = 0.05$), a minimum sample of 384 was calculated and then corrected for the finite eligible population (approximately 120 patients over the preceding four months), yielding a corrected sample of 102; after adjusting for a 10% non-response rate, the final target sample size was 114, which was achieved.

Patients aged 18 years or older with a confirmed diagnosis of ACS who consented to participate were included. Patients who declined participation, whose ACS diagnosis was not confirmed, who were under 18 years of age, or who had cognitive impairment affecting recall were excluded.

Study variables and operational definitions

The primary outcome was time from symptom onset to first medical contact, dichotomized as early (≤ 12 hours) or delayed (> 12 hours) presentation, consistent with a cut-point used in prior regional research;^[13] time to presentation was additionally analyzed using a 4-hour cut-point. Independent variables included age, sex, marital status, education level, occupation, comorbidities, health insurance status, awareness of ACS

symptoms, mode of transport, and distance from a health facility.

Data collection and analysis

Data were collected using an interviewer-administered, semi-structured questionnaire adapted from a previously validated instrument used in Bangladesh [13] and modified for the local context, administered via Google Forms by five trained data collectors in the patient's preferred language. The instrument was pretested on 5% of the target population prior to full data collection. Completed questionnaires were reviewed for completeness, coded, and entered into Microsoft Excel before export to SPSS version 27 for analysis. Descriptive statistics (frequencies, means, medians, standard deviations) summarized sociodemographic and clinical characteristics. Bivariable and multivariable logistic regression were used to identify factors associated with delayed presentation; variables with $p < 0.05$ in the multivariable model were considered statistically significant.

Ethical considerations

Ethical clearance was obtained from the ethical review committee of the Department of Emergency and Critical Care Medicine, Addis Ababa University, prior to data collection. The principles of beneficence, non-maleficence, autonomy, and justice were upheld throughout the study, and written informed consent was obtained from all participants.

3. Results

Sociodemographic characteristics

Of 114 participants, 78 (68.4%) were male, and 36 (31.6%) were female; 61 (53.5%) were aged between 40 and 60 years. Most participants (66.7%) were married, and educational attainment was fairly evenly distributed, with college-level education most common (28.1%). Just over half of participants (51.8%) had no health insurance. Comorbidities included hypertension (55.8%), type 2 diabetes mellitus (28.3%), ischemic heart disease (10.5%), chronic kidney disease (6.1%), and chronic obstructive pulmonary disease (4.4%). Fewer than 40% of participants demonstrated awareness of ACS symptoms prior to their event (Table 1).

Table 1. Sociodemographic characteristics of patients with acute coronary syndrome, May-September 2024, Addis Ababa, Ethiopia (n=114).

Age group (years)	< 40	14 (12.3)
	40–60	61 (53.5)
	> 60	39 (34.2)
Sex	Female	36 (31.6)
	Male	78 (68.4)
Marital status	Married	76 (66.7)
	Single	8 (7.0)
	Divorced	19 (16.7)
	Widowed	11 (9.6)
Highest education level	No formal education	24 (21.1)
	Primary	17 (14.9)
	Secondary	23 (20.2)
	College	32 (28.1)
	University	18 (15.8)
Health insurance	Yes	55 (48.2)
	No	59 (51.8)
Distance from health facility	< 5 km	18 (15.8)
	5–10 km	53 (46.5)

	> 10 km	43 (37.7)
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Prehospital care-seeking and time to presentation

The point of first medical contact was a health center for 42.1% of participants, while 24.6% presented directly to one of the four study hospitals. Only 37.7% of participants knew a government ambulance number, and 34.2% knew a private ambulance number. Ambulance was the mode of arrival at the study hospital for 39.5% of patients;

taxis (37.7%), private vehicles (12.3%), and walking (10.5%) accounted for the rest (Table 2). The mean time from symptom onset to first medical contact was 14.0 hours (range 1–144 hours), and the mean time from first medical contact to arrival at the study hospital was 7 hours (range 1–66 hours). Only 14 patients (11.9%) presented within 4 hours of symptom onset, and 57% presented more than 12 hours after onset.

Table 2. Prehospital care-seeking and transport characteristics of patients with acute coronary syndrome, Addis Ababa, Ethiopia (n=114).

Point of first contact	This hospital (direct)	28 (24.6)
	Health center	48 (42.1)
	Private clinic	19 (16.7)
	Other hospital	19 (16.7)
Knew a government ambulance number	Yes	43 (37.7)
	No	71 (62.3)
Knew a private ambulance number	Yes	39 (34.2)
	No	75 (65.8)
Mode of arrival at hospital	Ambulance	45 (39.5)
	Taxi	43 (37.7)
	Private car	14 (12.3)
	Walking	12 (10.5)

Clinical presentation, complications, and management

Chest pain was the presenting symptom in 88 patients (77.9%), followed by shortness of breath (76.1%), diaphoresis (46.5%), and nausea/vomiting (43.9%). By subtype, 52% of patients had STEMI and 32% had NSTEMI. The overall

complication rate was 30.7%, with acute decompensated heart failure the most frequent complication (15.8%), followed by death (7.9%) and arrhythmia (7.0%). Most patients (72.6%) received no reperfusion therapy; 27.4% underwent percutaneous coronary intervention, and none received thrombolytics (Table 3).

Table 3. Clinical presentation, complications, and management of patients with acute coronary syndrome, Addis Ababa, Ethiopia (n=114).

Presenting symptom	Chest pain	88 (77.9)
	Shortness of breath	86 (76.1)
	Diaphoresis	53 (46.5)
	Nausea and vomiting	50 (43.9)
Complication	None	79 (69.3)
	Acute decompensated heart failure	18 (15.8)
	Death	9 (7.9)
	Arrhythmia	8 (7.0)
Reperfusion therapy received	None	82 (72.6)
	Percutaneous coronary intervention	31 (27.4)

Determinants of delayed presentation

On multivariable logistic regression, no formal education (AOR 1.55, 95% CI 1.20–3.10, $p = 0.018$), absence of health insurance (AOR 3.20,

95% CI 2.67–4.21, $p = 0.002$), and residence more than 10 km from a health facility (AOR 1.70, 95% CI 1.25–4.21, $p = 0.004$) were independently associated with delayed presentation. Residence within 5 km of a facility was protective (AOR 0.80, 95% CI 0.53–0.96, $p = 0.015$), and use of an ambu-

lance for transport (AOR 0.86, 95% CI 0.23–0.97, $p = 0.032$). Age, sex, marital status, awareness of ACS, and mode of transport other than ambulance were not independently associated with delay (Table 4).

Table 4. Bivariable and multivariable logistic regression analysis of factors associated with delayed presentation among patients with acute coronary syndrome, Addis Ababa, Ethiopia (n=114)

Variable	COR (95% CI)	p-value	AOR (95% CI)	p-value
Age	1.90	0.977	1.40 (0.16–12.59)	0.764
Male sex	1.80†	0.931	2.50 (0.50–12.56)	0.266
Marital status	1.01 (0.94–1.09)	0.799	1.50 (0.22–10.04)	0.676
No formal education	1.50 (1.06–2.13)	0.023*	1.55 (1.08–2.23)	0.018*
Primary education	1.02 (0.97–1.07)	0.450	5.05 (0.30–85.55)	0.262
College/university education	1.76 (0.24–13.03)	0.580	1.61 (0.28–9.36)	0.596
No health insurance	2.30 (1.29–4.11)	0.005*	3.20 (1.53–6.69)	0.002*
Low awareness of ACS	1.20 (0.97–1.48)	0.090	1.03 (0.96–1.10)	0.377
Ambulance transport	0.75 (0.49–1.14)	0.180	0.86 (0.75–0.99)	0.032*
Taxi transport	1.05 (0.96–1.15)	0.300	1.67 (0.17–16.06)	0.657
Walking to facility	1.45 (0.97–2.17)	0.070	1.06 (0.85–1.32)	0.607
Residence <5 km	0.70 (0.51–0.97)	0.030*	0.80 (0.67–0.96)	0.015*
Residence 5–10 km	1.03 (1.00–1.07)	0.090	1.08 (0.91–1.28)	0.380
Residence >10 km	1.23 (1.05–1.44)	0.010*	1.70 (1.18–2.44)	0.004*
ACS subtype	1.07 (0.99–1.15)	0.070	1.23 (0.98–1.54)	0.070
Presence of chest pain	1.40 (0.99–1.99)	0.060	1.21 (0.37–3.91)	0.750

4. Discussion

This study identified sociodemographic, economic, and system-level factors independently associated with delayed hospital arrival among ACS patients in Addis Ababa. Most participants were over 40 years of age and male, consistent with established coronary risk patterns; however, unlike some prior evidence in which female sex was associated with delay,^[13] sex was not an independent predictor of delay in this cohort.

Over half of participants (57%) presented more than 12 hours after symptom onset, and only 11.9% presented within the first 4 hours, a markedly longer delay than the roughly 4-hour average reported in a large Chinese cohort,^[12] though shorter than the multi-day delays reported in one prior Ethiopian study.^[15] The clinical profile in this cohort, dominated by chest pain (77.9%), is consistent with a 2019 Addis Ababa study reporting chest pain in 81.7% of ACS patients.^[19]

Lack of formal education, absence of health insurance, and greater distance from a health facility each independently predicted delay, while ambulance use and residence within 5 km of a facility were protective. These findings align with prior work from China and Bangladesh identifying education, insurance status, and geographic access as key structural determinants of prehospital delay.^[8,13] In particular, prehospital ambulance-based anti-ischemic medication administration was essentially absent in this cohort, and most participants lacked knowledge of an ambulance phone number, underscoring substantial gaps in the local emergency medical services system.

This study has several limitations. The relatively short enrolment period estimates a modest sample size, and convenience sampling across four hospitals may limit generalizability to the broader ACS population in Addis Ababa. Comparative regional evidence on this topic is scarce, limiting the

ability to contextualize some findings against similar settings.

5. Conclusion

More than half of ACS patients presenting to major referral hospitals in Addis Ababa arrived more than 12 hours after symptom onset. Educational attainment, health insurance coverage, distance from care, and ambulance utilization were the principal modifiable determinants of delay, while overall awareness of ACS symptoms and use of emergency medical services remained low. Public health campaigns to raise awareness of ACS symptoms, expansion of health insurance coverage, and strengthening of prehospital emergency medical services, particularly ambulance availability and public knowledge of ambulance access, are recommended to promote timely presentation and improve outcomes.

Abbreviations

ACS: Acute coronary syndrome

ADHF: Acute decompensated heart failure

AOR: Adjusted odds ratio

CI: Confidence interval

COR: Crude odds ratio

NSTEMI: Non-ST-segment elevation myocardial infarction

PCI: Percutaneous coronary intervention

STEMI: ST-segment elevation myocardial infarction

Author Contributions

Conception and design, data acquisition (AB), analysis and interpretation (AB, NM), drafting the manuscript (AB, NM), critical revision, and final approval (AA)

Funding

This study was funded by Addis Ababa University (total project cost: 25,000 ETB).

Competing interests

The authors declare no competing interests.

Acknowledgments

The authors thank the staff of Tikur Anbessa Specialized Hospital, Zewditu Memorial Hospital, St. Paul's Hospital Millennium Medical College, and St. Peter Hospital, and the data collection team, for their support during this study.

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