DOI: 10.7860/JCDR/2026/84789.22465

Original Article

Internal Medicine Section

# Concordance with Evidence-based Acute Coronary Syndrome Care Metrics and Predictors of Cardiovascular Outcomes: Data from an Indian Tertiary-care Setting

PREET CHAPATWALA[1], VAIBHAV R SURYAWANSHI[2], VAIBHAV B PATIL[3], SANKET DHARMA[4], AKSHATA SHIRODKAR[5], SHIVAKUMAR IYER[6], ATMARAM PAWAR[7]



## ABSTRACT

**Introduction:** Acute Coronary Syndrome (ACS) remains a leading cause of morbidity and mortality worldwide, with India experiencing a disproportionately high burden of premature Cardiovascular Disease (CVD). International guidelines provide evidence-based care metrics to optimise outcomes, yet adherence to these recommendations in real-world Indian practice is often inconsistent.

**Aim:** To assess the extent of concordance with evidence-based ACS care metrics in Indian clinical practice, and to evaluate its association with clinical outcomes while identifying key predictors of cardiovascular events.

**Materials and Methods:** The present prospective observational study was conducted over 1.5 years at a university hospital based in western India. Concordance with evidence-based ACS care, defined by a total of 16 "American Heart Association (AHA)" quality metrics, was evaluated in relation to clinical outcomes. The primary outcomes assessed were all-cause mortality, Discharge Against Medical Advice (DAMA), recurrent Myocardial Infarction (MI), Major Adverse Cardiac And Cerebrovascular Events (MACEs), and cardiac rehospitalisation. Secondary outcomes included length of hospital stay and other medical complications. Multivariate regression analyses were employed to examine the association between concordance with evidence-based ACS care and clinical outcomes, as well as to identify predictors of mortality and MACEs.

**Results:** Among 190 ACS admissions, ST-elevation MI (STEMI) was diagnosed in 121 (63.7%) patients, non-ST-elevation MI (NSTEMI) in 35 (18.4%) patients, and Unstable Angina (UA) in 34 (17.9%) patients. The median age was 59.5 years {Inter-quartile Range (IQR), 48-67}. Eligible patients received intravenous thrombolysis (80/98, 81.6%) and primary Percutaneous Coronary Intervention (PCI) (51/62, 82.3%), with concordance to recommended Door To Needle (DTN) and Door To Ballooning (DTB) times observed in 39/80 (48.7%) and 23/51 (45.1%) patients, respectively. Overall concordance (all-or-none metrics) varied across ACS subtypes, highest in STEMI patients {64/121 (52.8%)}. Adherence to thrombolysis, primary PCI, and all-or-none metrics was significantly associated with reduced mortality and MACEs ($p<0.001$). In STEMI, predictors of mortality and MACEs included age >60 years, dyslipidaemia, uncontrolled diabetes, History, Electrocardiogram (ECG), Age, Risk factors, and Troponin (HEART) score 7-10, delayed hospitalisation (>6 hours), DTN >30 minutes, and DTB >90 minutes.

**Conclusion:** Beyond other identified predictors, adherence to evidence-based ACS care metrics was strongly associated with improved outcomes, underscoring the critical role of timely primary PCI and intravenous thrombolysis in acute management.

**Keywords:** Compliance, Determinants, Performance measures, Practice guideline

## INTRODUCTION

Ischaemic Heart Disease (IHD) remains the foremost cause of mortality worldwide, with nearly 80% of related deaths occurring in low and middle-income countries [1,2]. Within this spectrum ACS including STEMI, NSTEMI, and UA represent the most critical and life-threatening manifestations. India reports an age-standardised mortality rate of 272 per 100,000 population [3], accounting for approximately 1.54 million deaths and 36.99 million Disability-adjusted Life Years (DALYs) [4-6]. Notably, South Asian population exhibit a higher prevalence of risk factors and experience IHD at comparatively younger age [7,8]. In 2017, the American College of Cardiology (ACC) and the AHA have compiled a set of quality metrics (also called performance measures) that serve as a vehicle to accelerate the translation of scientific evidence into clinical practice [9]. This set of quality metrics are endorsed by the Cardiological Society of India (CSI) and recommends them to be utilised as a standard hospital process-of-care and an assessment tool in ACS care [10,11].

The implementation of evidence-based therapies in the management of ACS is essential for rationalising treatment and improving cardiovascular outcomes. Assessing concordance with these therapies in non-Western regions, particularly in Southeast Asia, is critical given the rising incidence of IHD and its associated risk factors [12]. In contemporary healthcare systems, quality metrics are increasingly emphasised by government agencies, professional societies, accreditation councils, and insurance providers. These performance indicators especially process-of-care metrics play a pivotal role in shaping hospital referral patterns and reimbursement policies [13]. By promoting consistent application of evidence-based therapies, quality metrics aim to enhance patient outcomes. Published evidence from select regions of the United States has demonstrated that adherence to ACC/AHA quality metrics is associated with improved clinical outcomes, with the greatest benefits observed when full compliance was achieved [9,12,14,15].

A literature gap exists regarding the reliability of hospital process-of-care assessments as indicators of cardiovascular outcomes in ACS, particularly in developing nations where socioeconomic disparities and heterogeneous clinical presentations are common. This gap is further compounded by multiple

confounding factors that may influence outcomes in such settings. Evidence from India is especially limited, where resource constraints and practice variations challenge adherence to guideline-based ACS care. Addressing this literature gap by clarifying whether guideline adherence improves outcomes and identifying predictors of adverse cardiovascular events is essential to strengthen evidence-based practice, enhance quality of care, and inform national strategies to reduce the CVD burden.

The primary research question of the present study was: Does adherence to evidence-based ACS care interventions, as defined by the sixteen 'AHA' quality metrics, influence cardiovascular outcomes among Indian patients treated at a University Tertiary-Care Hospital? The literature review revealed that only a limited number of studies from Indian settings have addressed this clinical issue [8,16,17]. Thus, the study aimed to evaluate the association between adherence to these evidence-based ACS care metrics and clinical outcomes, while also identifying key predictors of cardiovascular events among Indian patients.

## MATERIALS AND METHODS

The present prospective observational study was conducted over a 1.5-year period (July 2023 to December 2024), using data from patients diagnosed with ACS and admitted to 'Bharati Hospital and Research Centre, Pune, Maharashtra, India. Ethical approval was obtained from the study hospital (Reference no. BVDU/MC/IEC/2023/015). Informed consent was obtained from study participants for accessing their medical records and publication of study reports.

**Inclusion criteria:** (a) Patients above the age of eighteen and exhibiting symptoms suggestive of ACS, such as dyspnea, burning, shoulder pain, sweating, palpitations, back pain, or jaw pain; (b) Diagnosed with ACS {either STEMI or NSTEMI or UA} and admitted to a medical wards or cardiac critical care unit; and (c) Eligible for at least one of total sixteen evidence-based (AHA recommended) quality metrics [9].

**Exclusion criteria:** (a) Patients admitted with a primary diagnosis other than ACS; (b) Patients with a prior haemorrhagic stroke in the past six months and contraindicated to antiplatelet and antithrombotic therapies; (c) Patients who received intravenous thrombolysis for conditions other than MI; and (d) Pregnant women admitted for ACS care.

**Sample size selection:** All consecutive patients admitted with ACS during the study period were recruited using a convenience sampling strategy, based on the center's ACS admission rate and feasibility considerations. With a baseline admission rate of 10 to 13 ACS cases per month at study centre, the projected accrual over 1.5 years, for an anticipated 5-10% loss to follow-up, was estimated at 180-200 patients. This range was taken as the final sample size for the study after consulting with Biostatistician.

### Study Procedure

The patient medical records and the case files were used for data collection and abstraction. The confirmed diagnosis of ACS was obtained from a Cardiologist or an Intensivist. This confirmation was based on various criteria, including Electrocardiogram (ECG) changes, elevated cardiac markers (especially troponin-I levels and CPK-MB levels), and the presence of coronary artery occlusion on angiography and nuclear cardiac stress testing. Study patients' information, including their demographics, detailed medical history, clinical characteristics, initial diagnostic findings, therapeutic interventions provided, discharge medications, and follow-up details, was extracted in a specially prepared (for study purposes only) patient profile form.

The clinical condition at emergency arrival, risk assessment using Thrombolysis for Myocardial Infarction (TIMI) score [18,19], Global Registry of Acute Coronary Events (GRACE) score [20,21], and HEART score [22,23], and other relevant details were also obtained. The risk of MACE occurrence was calculated using the HEART score [22,23].

**Evidence-based quality metrics:** Sixteen evidence-based ACS care quality metrics (acute and discharge) recommended by the American College of Cardiology /American Heart Association (ACC/AHA) [9] were considered for the assessment of adherence and its' association with clinical outcomes. Acute metrics included the following 10 quality metrics: (a) Intravenous thrombolysis; (b) Door-to-needle (within 30 minutes); (c) Primary PCI; (d) Door-to-ballooning (within 90 minutes); (e) Aspirin at arrival; (f) P2Y12 inhibitors at arrival; (g) Heparin; (h) Nitrates; (i) Glycoprotein IIb/IIIa inhibitors; and (j) Beta-blockers at arrival. Discharge metrics included the following six quality metrics: (a) Aspirin at discharge; (b) P2Y12 inhibitors at discharge; (c) Beta-blockers at discharge; (d) High-Intensity Statins (HIS) at discharge; (e) ACEI or ARB for Left-Ventricular Systolic Dysfunction (LVSD) at discharge; and (f) Smoking cessation counselling and intervention.

Additionally, two pivotal metrics were integrated and evaluated in the present study. These were the critical metrics that helped in assessing comprehensive adherence to quality metrics [9,12,14]. The first one was an all-or-none metrics of ACS care, reflecting the percentage of qualified patients who received all the prescribed interventions. The second measure was graded as a composite score of ACS care, with a spectrum ranging from 0 (representing no adherence) to 1 (representing full adherence), to measure the extent to which patients received ACS care that aligns with the best available evidence. This calculation was performed by taking the count of quality metrics actually provided and dividing it by the potential total number of quality metrics applicable to the patient.

**Study endpoints-clinical outcomes:** All-cause mortality (in-hospital and 30-day post-discharge), DAMA, recurrent MI (in-hospital and 30-day post-discharge), MACE (which included congestive heart failure, cardiogenic shock, cardiac arrest, re-infarction, and stroke or TIA), and cardiac rehospitalisations were evaluated as the primary outcomes. The total duration of hospitalisation, length of stays in the intensive care unit, and medical complications (in-hospital and 30-day post-discharge) such as arrhythmias, nosocomial infections, renal insufficiency, bleeding complications, cardiopulmonary failure, bed sores or decubitus ulcers, and deep vein thrombosis were evaluated as the secondary outcomes. All patients with ACS were followed up in an Outpatient Clinic for outcome assessment on day 30 (post-discharge) after being interviewed over the phone.

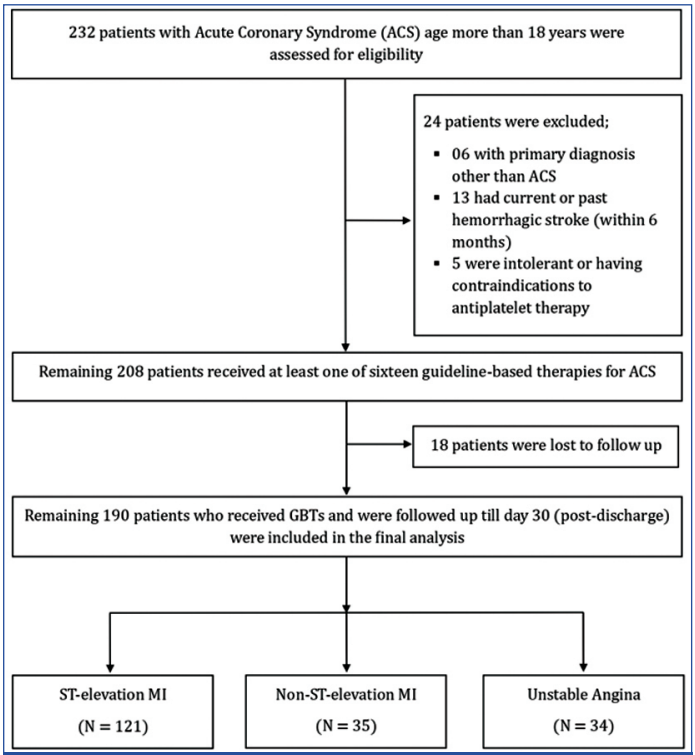
## STATISTICAL ANALYSIS

Data was analysed by ACS subtypes (STEMI, NSTEMI, and UA). For nominal and categorical variables mean, median, and proportions were used. For statistical association, all categorical variables were subjected to Pearson's Chi-square tests, and continuous variables were subjected to Mann-Whitney's U test. Multivariable Cox proportional hazards and multivariate regression models were utilised to examine the correlation between clinical outcomes and adherence to evidence-based quality metrics. The same models were also used to determine variables predictive of mortality and MACE. These models were adjusted for age, gender, risk factors, and other clinical characteristics. Considering significant limitations in data handling of the patients, the regression models were not adjusted for important confounders including socioeconomic status and insurance, prehospital and ambulatory care, and therapy administered in prehospital settings. Pearson's Chi-square and Fisher's-exact test were used to determine the probability values for categorical row variables, with statistical significance defined at $p<0.05$. The Bonferroni correction method was used for post-hoc analysis, with a significance threshold of $p<0.05$. Furthermore, Bonferroni adjustment for multiple comparisons was set at $p<0.017$ (0.05/3). All the statistical analyses were conducted using Statistical Package for the Social Sciences (SPSS) software (version 21.0).

'SQUIRE 2.0 guidelines' given by 'EQUATOR Network' for reporting quality improvement studies were referred for writing this study report.

## RESULTS

A total of 232 patients aged >18 years with ACS were screened for eligibility. Of these, 24 were excluded and 18 were lost to follow-up. The remaining 190 patients, all of whom received evidence-based quality metrics and were followed up to day 30 (post-discharge) for outcome assessment, were included in the final analysis [Table/Fig-1]. Patients lost to follow-up (n=18) were excluded from the outcome assessment, and their data were omitted from both the final analysis and the evaluation of associations between evidence-based metrics and clinical outcomes.




**[Table/Fig-1]:** Patient selection and study flow.
Abbreviations: ACS: Acute coronary syndrome; GBTs: Guideline-based therapies; MI: Myocardial infarction

The final analysis comprised 190 patients with ACS, with a median (IQR) age of 59.5 (48-67) years. Of 190 ACS patients, 121 (63.7%) had STEMI, 35 (18.4%) had NSTEMI, and 34 (17.9%) had UA. Most of the patients {89 (46.8%)} were above 60 years of age. Male 123 (64.7%) preponderance was observed in the study participants. Prior HF and prior MI were documented in 34.2% (65/190) and 8.9% (17/190) of study patients. On presentation, 52.3% (34/65) patients had HF with Killip Class >1, wherein 5.8% (11/190) patients had cardiogenic shock. Symptom onset to hospitalisation <6 hours was observed in 47.9% (91/190) ACS patients. Intravenous thrombolysis rate was 51.3% (80/156) patients. Primary PCI was performed in 26.8% (51/190) patients [Table/Fig-2].

| Variables | Total; N=190, n (%) | STEMI; N=121, n (%) | NSTEMI; N=35, n (%) | UA; N=34, n (%) |
|---|---|---|---|---|
| **Age (Years):** | | | | |
| Median (IQR), | 59.5 (48-67) | 58 (48-65) | 61 (49-69) | 60.5 (50-71) |
| 18 to 30 | 5 (2.6) | 4 (3.3) | 1 (2.8) | - |
| 31 to 45 | 34 (17.8) | 24 (19.8) | 5 (14.2) | 5 (14.7) |
| 46 to 60 | 62 (32.6) | 39 (32.2) | 11 (31.4) | 12 (35.2) |
| Above 60 | 89 (46.8) | 54 (44.6) | 18 (51.4) | 17 (50) |
| **Gender, n (%)** | | | | |
| Male | 123 (64.7) | 86 (71) | 17 (48.5) | 20 (58.8) |
| Female | 67 (35.2) | 35 (29) | 18 (51.5) | 14 (41.2) |
| **BMI (Kg/m$^2$)** | | | | |
| Median (IQR) | 25.4 (22.7-28.3) | 25.6 (22.6-28.4) | 25.8 (23.4-28.9) | 24.4 (22.5-27.1) |
| **History and risk factors:** | | | | |
| Current or past smoking | 136 (71.6) | 93 (76.8) | 23 (65.7) | 20 (58.8) |
| Hypertension | 102 (53.6) | 59 (48.8) | 19 (54.3) | 24 (70.6) |
| Uncontrolled diabetes | 75 (39.5) | 46 (38) | 18 (51.4) | 11 (32.3) |
| Prior HF | 65 (34.2) | 44 (36.4) | 11 (31.4) | 10 (29.4) |
| Dyslipidaemia | 54 (28.4) | 37 (30.5) | 11 (31.4) | 6 (17.6) |
| Prior MI | 17 (8.9) | 8 (6.6) | 6 (17.1) | 3 (8.8) |
| Prior PCI | 16 (8.4) | 9 (7.4) | 3 (8.5) | 4 (11.7) |
| Prior CABG | 7 (3.6) | 3 (2.4) | 3 (8.5) | 1 (2.9) |
| Known arrhythmias | 5 (2.6) | 4 (3.3) | 1 (2.8) | - |
| Prior stroke/TIA | 5 (2.6) | 5 (4.1) | - | - |
| Known PVD | 1 (0.5) | - | - | 1 (2.9) |
| **Clinical features on presentation:** | | | | |
| SBP (mmHg), mean (SD) | 134.7 (25.9) | 133.3 (25.9) | 139.8 (25.9) | 134.5 (25.7) |
| DBP (mmHg), mean (SD) | 83.7 (18.2) | 83.7 (18.6) | 84.1 (17.8) | 80.9 (17.6) |
| HR (beats/min), mean (SD) | 84 (16.6) | 85.9 (16.6) | 81 (16.9) | 80.1 (16.2) |
| EF <40%, n (%) | 52 (27.4) | 40 (33) | 7 (20) | 5 (14.7) |
| HF (Killip class >1) | 34 (52.3) | 21 (47.7) | 7 (63.6) | 6 (60) |
| Cardiogenic shock | 11 (5.8) | 8 (6.6) | 2 (5.7) | 1 (2.9) |
| Symptom onset to hospitalisation <6 hours | 91 (47.9) | 57 (47.1) | 17 (48.6) | 17 (50) |
| **Intravenous thrombolysis:** | | | | |
| n (%) | 80/156 (51.3) | 69 (57) | 11 (31.4) | - |
| **Percutaneous Coronary Intervention (PCI):** | | | | |
| n (%) | 135 (71) | 89 (73.5) | 24 (68.5) | 22 (64.7) |
| **Primary PCI (PPCI):** | | | | |
| n (%) | 51 (26.8) | 39 (32.2) | 12 (34.3) | - |
| **Coronary Artery Bypass Graft (CABG):** | | | | |
| n (%) | 3 (1.6) | 3 (2.5) | - | - |
| **Reperfusion (thrombolysis, PCI, or CABG):** | | | | |
| n (%) | 141 (74.2) | 93 (76.8) | 26 (74.3) | 22 (64.7) |
| **TIMI Score:** | | | | |
| mean (SD) | 4.6 (2.1) | 4.6 (2.1) | 4.8 (2.1) | 4.2 (2.1) |
| **GRACE Score:** | | | | |
| mean (SD) | 112.8 (34.2) | 116.5 (34.1) | 107.2 (34.8) | 105.7 (34.5) |
| **HEART Score:** | | | | |
| mean (SD) | 5.8 (1.9) | 5.8 (1.9) | 5.1 (1.9) | 4.7 (1.9) |
| **Time windows, median (IQR)** | | | | |
| Symptom onset to hospitalisation (<6 hours) | 6.7 (2.8 - 16.6) | 6.5 (2.5 - 16.3) | 6.8 (3.1 - 17.2) | 6.2 (2.4 - 15.6) |
| Door To Needle (DTN) <30 minutes | 34 (25 - 58) | 34 (23 - 54) | 36 (26 - 63) | - |
| Door To Ballooning (DTB) <90 minutes | 96 (75 - 107) | 94 (78 - 108) | 99 (76 - 107) | - |

**[Table/Fig-2]:** Background data, clinical characteristics, and time windows.
Abbreviations: BMI: Body mass index; MI: Myocardial infarction; HF: Heart failure; PCI: Percutaneous coronary intervention; CAD: Coronary artery disease; CABG: Coronary artery bypass graft surgery; SVT: Supraventricular tachycardia; TIA: Transient ischaemic attack; SBP: Systolic blood pressure; DBP: Diastolic blood pressure; HR: Heart rate; EF: Ejection fraction; HFrEF: Heart failure with reduced ejection fraction, TIMI: Thrombolysis in myocardial infarction score; GRACE: Global registry of acute coronary events score.

The eligible patients (in the denominator) were the ones who fulfilled AHA/ACC criteria [9] for intravenous thrombolysis and primary PCI. The rate of intravenous thrombolysis was comparatively higher in STEMI patients {85.2% (69/81)} than NSTEMI patients {64.7% (11/17)} (p<0.0001). The concordance with guideline recommended time window for DTN (<30 minutes) was observed in 49.3% patients with STEMI and 45.4% patients with NSTEMI. Similarly, the concordance with guideline recommended time window for DTB (<90 minutes) was observed in 46.1% patients with STEMI and 41.7% patients with NSTEMI. Nitrates exhibited the highest degree of variance (p<0.0001) in ACS patients with the highest prescribing rate in UA patients 76.5% (26/34), followed by ACEI or ARB for LVSD at discharge (p=0.001) with the highest prescribing rate in STEMI patients 80.2% (73/91), beta-blockers at discharge (p=0.029) with the highest prescribing rate in STEMI patients 87.6% (106/121), and GP IIb/IIIa inhibitors (p=0.041) with the highest prescribing rate in STEMI patients 39.3% (48/121). Considering all-or-none quality metrics, the highest overall adherence was exhibited in STEMI patients {52.8% (64/121)} and lowest overall adherence was exhibited in UA patients {35.3% (12/34)} (p=0.030) [Table/Fig-3].

{adjusted HR, 0.48 (95% CI, 0.22-1.18); p=0.096} and MACEs {adjusted HR, 0.25 (95% CI, 0.18-0.51); p<0.001} in patients with STEMI [Table/Fig-5].

In STEMI cohort, variables including age>60 years {adjusted odds ratio (aOR), 5.61}, dyslipidaemia (aOR, 5.15), symptom onset to hospitalisation>6 hours (aOR, 2.35), and door-to-needle>30 minutes (aOR, 1.73) were among the highest predictors of mortality (p<0.01). Whereas HEART score of 7 to 10 (aOR, 7.55), uncontrolled diabetes (aOR, 2.69), and symptom onset to hospitalisation >6 hours (aOR, 1.91) were among the highest predictors of MACEs (p<0.01). In NSTEMI and UA cohorts, symptom onset to hospitalisation >6 hours (aOR, 3.81) and dyslipidaemia (aOR, 3.02) were among the highest predictors of MACEs, respectively (p<0.01) [Table/Fig-6].

## DISCUSSION

The study identified several key predictors of outcomes in patients with ACS. Age>60 years, dyslipidaemia, delayed hospitalisation beyond 6 hours, door-to-needle time>30 minutes, and door-to-balloon time>90 minutes emerged as independent predictors of mortality. Independent predictors of MACEs included uncontrolled diabetes,

| S. No. | Evidence-based quality metrics | STEMI (N = 121), n (%) | NSTEMI (N = 35), n (%) | UA (N = 34), n (%) | p-value |
|---|---|---|---|---|---|
| 1. | i.v. thrombolysis# | 69/81 (85.2) | 11/17 (64.7) | - | <0.0001 |
| 2. | Door-to-needle <30 minutes# | 34/69 (49.3) | 5/11 (45.4) | - | 0.381 |
| 3. | Primary PCI# | 39/45 (86.6) | 12/17 (70.6) | - | 0.041 |
| 4. | Door-to-ballooning <90 minutes# | 18/39 (46.1) | 5/12 (41.7) | - | 0.354 |
| 5. | Aspirin at arrival | 121 (100) | 35 (100) | 33 (97) | 0.251* |
| 6. | Aspirin at discharge | 109 (90.1) | 29 (82.8) | 30 (88.2) | 0.236 |
| 7. | P2Y12 inhibitor at admission | 118 (97.5) | 34 (97.1) | 33 (97) | 0.981 |
| 8. | P2Y12 inhibitor at discharge | 101 (83.5) | 29 (82.8) | 28 (82.3) | 0.673 |
| 9. | Heparin | 113 (92.6) | 35 (100) | 32 (94.1) | 0.362* |
| 10. | Nitrates | 58 (47.5) | 19 (54.2) | 26 (76.5) | <0.0001 |
| 11. | GP IIb/IIIa inhibitors | 48 (39.3) | 10 (28.5) | 8 (23.5) | 0.041 |
| 12. | Beta-blockers at arrival | 117 (96.7) | 34 (97.1) | 31 (91.2) | 0.972 |
| 13. | Beta-blockers at discharge | 106 (87.6) | 26 (74.3) | 27 (79.4) | 0.029 |
| 14. | HIS at discharge | 103 (85.1) | 30 (85.7) | 29 (85.2) | 0.815 |
| 15. | ACEI/ARB for LVSD at discharge# | 73/91 (80.2) | 20/25 (80) | 17/23 (73.9) | 0.001 |
| 16. | Smoking cessation counseling and intervention# | 80/93 (86.1) | 18/23 (78.3) | 18/20 (90) | 0.075 |
| Composite score, mean (SD) | | 0.83 (0.11) | 0.73 (0.16) | 0.78 (0.12) | 0.232 |
| All-or-none measures (overall compliance) | | 64 (52.8) | 17 (48.6) | 12 (35.3) | 0.030 |

**[Table/Fig-3]:** Concordance with guideline-based ACS care metrics.
Abbreviations: i.v.: Intravenous; PCI: Percutaneous coronary intervention; P2Y12: Purinergic receptor; ACEI: Angiotensin-converting enzyme inhibitor; ARB: Angiotensin receptor blocker; HIS: High-intensity statin; LVSD: Left ventricular systolic dysfunction; GP: Glycoprotein.
*Fisher-exact test was used to determine statistical significance.
#The eligible patients (in the denominator) were the ones who fulfilled AHA/ACC criteria [9].

Considering primary outcomes, total all-cause mortality in ACS patients was 16/190 (8.4%) with around 11/16 (68.7%) in-hospital mortalities [Table/Fig-4]. Around 25/190 (13.1%) patients underwent DAMA. Recurrent MI was observed in a total of 10 patients, eight of them had recurrent MI at post-discharge 30-day. MACEs were observed in 35/190 (18.4%) patients. Cardiac rehospitalisation was documented in 14 (7.3%) patients. Considering secondary outcomes, median (IQR) length of hospitalisation was 5 (3-8) days. Medical complications were observed in 43/190 (22.6%) patients, arrythmias 19 (10%) and nosocomial infections 19 (10%) being most common.

Adherence to intravenous thrombolysis, primary PCI, beta-blockers, and nitrates were linked to reduced hazards of mortality (adjusted HR: 0.19, 0.31, 0.37, and 0.43, respectively). Similarly, adherence to intravenous thrombolysis, beta-blockers, and ACEin/ARBs for LVSD at discharge was linked to reduced hazards of MACEs (adjusted HR: 0.44, 0.33 and 0.38, respectively). Adherence to all-or-none metrics depicted reduced hazards of mortality delayed hospitalisation >6 hours, and a HEART score of 7-10. Conversely, concordance with all-or-none evidence-based ACS care metrics, intravenous thrombolysis, primary PCI, and the use of beta-blockers and nitrates were associated with reduced hazards of both mortality and MACEs. These findings underscore the importance of adherence to evidence-based ACS care metrics to improve cardiovascular outcomes.

Compared to developed countries, the current study observed a higher number of STEMI cases, longer delays in hospital admission, and relatively different practice patterns. Unlike European Heart Surveys [24,25] and global ACS registry [26-28], which show less than 50% of patients had STEMI, the current study observed over 60% of patients with STEMI, suggesting that ACS patients in Indian hospitals may have worse prognosis.

With a median age of 59.5 years current study's participants were younger than those in developed countries which were in range of 63-69 years (mean) [24-30]. Considering Indian registry

| S. No. | Outcomes | Total (N = 190), n (%) | STEMI (N =121), n (%) | NSTEMI (N =35), n (%) | UA (N = 34), n (%) | p-value |
|---|---|---|---|---|---|---|
| **Primary outcomes** | | | | | | |
| 1. | All-cause mortality (Total) | 16 (8.4) | 12 (9.9) | 3 (8.5) | 1 (2.9) | 0.096 |
| | Mortality (in-hospital) | 11 (5.8) | 9 (7.4) | 2 (5.7) | - | - |
| | Mortality (post-discharge 30-day) | 5 (2.6) | 3 (2.5) | 1 (2.8) | 1( 2.9) | 0.845 |
| 2. | DAMA | 25 (13.1) | 14 (11.5) | 4 (11.4) | 7 (20.5) | 0.164 |
| 3. | Recurrent MI (Total) | 10 (5.3) | 4 (3.3) | 3 (8.5) | 3 (8.8) | 0.215 |
| | Recurrent MI (in-hospital) | 2 (1.1) | 1 (0.8) | 1 (2.8) | - | - |
| | Recurrent MI (30-day post-discharge) | 8 (4.2) | 3 (2.4) | 2 (5.7) | 3 (8.8) | 0.394 |
| 4. | MACE* | 35 (18.4) | 24 (20) | 8 (22.8) | 3 (8.8) | 0.162 |
| | Heart failure | 20 (10.5) | 13 (10.7) | 5 (14.3) | 2 (5.8) | 0.514 |
| | Cardiogenic shock | 15 (7.8) | 11 (9.0) | 3 (8.6) | 1 (2.9) | 0.161 |
| | Cardiac arrest | 9 (4.7) | 7 (5.8) | 2 (5.7) | - | - |
| | Re-infarction | 6 (3.1) | 5 (4.1) | - | 1 (2.9) | - |
| | Stroke or TIA | 3 (1.6) | 3 (2.5) | - | - | - |
| 5. | Cardiac rehospitalisation* | 14 (7.3) | 7 (5.7) | 3 (8.5) | 4 (11.7) | 0.121 |
| **Secondary outcomes** | | | | | | |
| 1. | Total length of hospitalisation (days), median (IQR) | 5 (3 - 8) | 5 (3 - 9) | 5 (2 - 6) | 3 (2 - 6) | 0.197 |
| 2. | ICU length of hospitalisation, median (IQR) | 4 (3 - 5) | 4 (2 - 5) | 3 (2 - 5) | 2 (1 - 3) | 0.311 |
| 3. | Medical complications* | 43 (22.6) | 24 (19.8) | 12 (34.3) | 7 (20.6) | 0.151 |
| | (a) Arrhythmia | 19 (10) | 12 (9.9) | 5 (14.3) | 2 (5.9) | 0.205 |
| | (b) Nosocomial infections | 19 (10) | 12 (9.9) | 4 (11.4) | 3 (8.8) | 0.531 |
| | (c) Renal insufficiency | 17 (8.9) | 10 (8.3) | 5 (14.3) | 2 (5.9) | 0.433 |
| | (d) Cardiopulmonary failure | 9 (4.7) | 7 (5.8) | 1 (3) | 1 (2.9) | 0.662 |
| | (e) Bleeding complications | 6 (3.1) | 3 (2.5) | 2 (5.7) | 1 (2.9) | 0.082 |
| | (f) Bedsores or decubitus ulcers | 4 (2.1) | 2 (1.6) | 1 (3) | 1 (2.9) | 0.843 |
| | (g) Deep vein thrombosis | 2 (1.1) | 1 (0.8) | 1 (2.8) | - | - |

**[Table/Fig-4]:** Clinical outcomes (In-hospital and 30-day post-discharge) of ACS admissions.
Abbreviations: STEMI: ST-elevation myocardial infarction; NSTEMI: non-ST-elevation myocardial infarction; UA: Unstable angina; TIA: Transient ischaemic attack; i.v.: intravenous; DAMA: Discharge against medical advice; MACE: Major adverse cardiovascular and cerebrovascular event; IQR: Interquartile range; ICU: Intensive care unit.
*The mentioned count suggests number of patients with MACE/rehospitalisation at 30-days (post-discharge).

| Variables | Mortality†, aHR (95% CI) | | MACE†, aHR (95% CI) | |
|---|---|---|---|---|
| | STEMI | p-value | STEMI | p-value |
| IV-thrombolysis | 0.19 (0.32 - 0.81) | <0.001 | 0.44 (0.18 - 0.82) | 0.041 |
| Primary PCI | 0.31 (0.14 - 0.83) | <0.001 | 0.57 (0.26 - 0.91) | 0.072 |
| Beta-blockers | 0.37 (0.16 - 0.90) | 0.042 | 0.33 (0.14 - 0.71) | 0.036 |
| Nitrates | 0.43 (0.28 - 0.72) | 0.047 | 0.51 (0.28 - 0.74) | 0.068 |
| Glycoprotein IIb/IIIa inhibitors | 0.68 (0.36 - 0.92) | 0.193 | 0.73 (0.41 - 0.90) | 0.105 |
| ACEin/ARBs for LVSD at discharge | 0.55 (0.17 - 3.15) | 0.125 | 0.38 (0.15 - 0.93) | 0.003 |
| All-or-none metrics | 0.48 (0.22 - 1.18) | 0.096 | 0.25 (0.18 - 0.51) | <0.001 |

**[Table/Fig-5]:** Effect of concordance with guideline-based ACS care metrics on clinical outcomes in patients with ST-elevation MI.
Abbreviations: CI: Confidence interval; aHR: Adjusted hazard ratio; MACE: Major adverse cardiac and cerebrovascular event; PCI: Percutaneous coronary intervention; ACEin: Angiotensin-converting enzyme inhibitors; ARB: Angiotensin receptor blocker; LVSD: Left ventricular systolic dysfunction
†Mortality and MACE after receiving IV-thrombolysis, primary PCI, and other quality metrics.
Note: Hazard ratio was adjusted for age, gender, risk factors, and other clinical characteristics. NSTEMI and UA patients were not considered in this analysis considering fewer sample size.

(CREATE) the mean age of participants was found to be 57 years [16], with 50% of the patients admitted to the hospital coming from middle-lower socioeconomic backgrounds [31]. Despite this, the current study observed a high thrombolysis rate (81.6%, eligible) and primary PCI rate (82.3%, eligible) at the center, mostly due to the availability of medical insurance schemes and subsidised thrombolytic rates due to government intervention in the state. In CREATE registry, the PCI and CABG were performed in 8.4% and 3.6% of patients, respectively [16]. In another Indian study, IV-thrombolysis, PCI, and CABG rates were found to be 20.3%, 42.1%, and 12.4%, respectively [31]. Most patients in the present study had co-morbidities and risk factors, such as smoking, hypertension, uncontrolled diabetes, prior heart failure, dyslipidaemia, and MI, which was in accord with prior Indian studies [16,31,32]. On presentation, 52.3% of patients were in heart failure, 27.4% had ejection fraction <40% and 5.8% had cardiogenic shock. This was similar to the data presented in Indian registry [16,32].

The present study found that patients with STEMI or UA arrived at the hospital at a median of 6.5 hours, significantly longer than those

| S. No. | Variables | STEMI, aOR (95% CI) | | NSTEMI, aOR (95% CI) | | UA, aOR (95% CI) | |
|---|---|---|---|---|---|---|---|
| | | Mortality | MACE | Mortality | MACE | Mortality | MACE |
| 1. | Age >60 years | 5.61 (1.25 - 16.12)* | 1.43 (0.60 - 3.66) | 0.85 (0.12 - 5.40) | 0.94 (0.21 - 5.45)* | - | 2.35 (0.40 - 11.73) |
| 3. | Dyslipidaemia | 5.15 (1.82 - 14.50)* | 2.10 (0.83 - 5.28) | 1.17 (0.12 - 9.63) | 1.10 (0.26 - 7.22) | - | 3.02 (0.49 - 8.21)* |
| 4. | Uncontrolled diabetes | 1.46 (0.42 - 4.91) | 2.69 (1.02 - 6.51)* | 2.04 (0.22 - 16.31) | 2.17 (0.31 - 12.60) | - | 2.5 (0.43 - 12.15) |
| 5. | Hypertension | 0.94 (0.28 - 2.10) | 1.36 (0.41 - 2.47)* | 0.60 (0.03 - 4.74) | 0.83 (0.15 - 4.72) | - | 0.81 (0.15 - 5.33) |
| 6. | Symptom onset to hospitalisation >6 hours | 2.35 (0.80 - 4.52)* | 1.91 (0.78 - 4.71)* | 3.32 (0.75 - 20.81) | 3.81 (0.91 - 13.57)* | - | 1.80 (0.64 - 10.60) |
| 7. | GRACE (High, >140) | 1.90 (0.81 - 5.37) | NA | - | NA | - | NA |
| 8. | HEART (High, 7 to 10) | NA | 7.55 (2.36 - 26.61)* | NA | - | - | - |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 9. | Door-to-needle >30 minutes | 1.73 (0.86 - 2.44)* | 0.60 (0.12 - 3.04) | - | - | - | - |
| 10. | Door-to-balloon >90 minutes | 1.26 (0.25 - 2.17)* | 1.02 (0.28 - 5.81) | - | - | - | - |

**[Table/Fig-6]:** Predictors of mortality and MACE in ACS admissions.
Abbreviations: STEMI: ST-elevation myocardial infarction; NSTEMI: non-ST-elevation myocardial infarction; UA: Unstable angina; MACE: Major adverse cardiac and cerebrovascular event; aOR: adjusted odds ratio; CI: Confidence interval; NA: Not applicable; GRACE: Global registry of acute coronary events; HEART score: History; ECG, age, risk factors, troponin levels.
*Significant results were observed wherein p-value was <0.05.
Note: Odds ratio was adjusted for age, gender, risk factors, and other clinical characteristics.

in developed countries who arrived between 2.1 and 2.8 hours of symptom onset [24-30]. Patients with UA or NSTEMI also took longer to reach the hospital (median, 6.8 hours). Most of the patients travelled to the hospital via private or public transportation, with only a few taking an ambulance. Over 50% of patients experienced delayed hospitalisation, increasing the odds of mortality and MACEs. Dyslipidaemia also increased the odds of MACEs in UA by three times, similar to patients from the CREATE registry [16] and other studies [32,33]. The current study documented a median time of '6.7 hours' from symptom onset to hospitalisation. In Cardiac Registry on Evaluation of Acute Therapies in Emergency (CREATE - Indian ACS registry) study, 26.5% and 35.4% patients had time to hospitalisation 4 to 12 hours and >12 hours, respectively [16]. Factors contributing to delayed admission include lack of awareness of ACS as an emergency condition, economic burden, lack of trained ambulatory personnel, traffic congestion, long distances, and primary-care consultations. These factors were also observed in prior Indian studies [16,31,32]. After hospitalisation, thrombolysis (door to needle time) took longer (>40 minutes) for 33% of patients, compared to 30-40 minutes in developed countries [24,25,29,30,34] and 50 minutes in patients from CREATE registry [16]. Similarly, primary PCI took longer for >50% patients, compared to the results from developed countries [24-28].

The overall thrombolysis and primary PCI rate in current study was 51.3% and 26.8%. In contrast to developed countries, current study documented overall higher rates of thrombolytic therapy and relatively lower rates of primary PCI. This is most likely due to the fact that, around three-quarters of Indian patients pay for their own medical expenses. Similarly, in contrast to affluent nations, the rate of primary PCI for STEMI patients in current study was significantly lower (36% to 58% vs 28.1%) [24-30]. Patients with non-STEMI in current study had primary PCI rate of 34.3% which was comparable to the rate in developed countries (25% to 37%) [27,28]. The results were analogues with the results from CREATE registry, wherein primary PCI and thrombolysis rates were 7% to 8% and 59%, respectively) [16]. The use of antiplatelet drugs, nitrates, β-blockers, ACEI/ARBs for LVSD, and HISs was similar to global registries [24-30], as well as Indian data [16,31,32], indicating a high awareness of evidence-based therapies among clinicians and the availability of generic medications in Indian states. Though adequate use of life-saving and secondary prevention medicines was observed, the differences in revascularisation rates and interventional treatments delivered were more apparent, indicating the need for quality improvement.

Data on all-cause-mortality showed comparable rates with that of Indian [16,31] as well as global studies [26-28]. The predictors of mortality and MACEs are also studied in prior global [12,24-27,29,30,35] as well as Indian studies [16,31,32]. Dyslipidaemia, a HEART score of 7-10, symptom onset to hospitalisation >6 hours, DTN >30 minutes, and DTB >90 minutes were found to be most consistent [16,24,30,31,35]. Registry-based studies conducted in the United States [20,21,26,28], Europe [24,25,27], Middle-East [12], and India [16,32], have consistently identified these variables as predictors of cardiovascular mortality and MACEs. Additional factors such as the TIMI score [18,19] and Fractional Flow Reserve (FFR) [36] are also recognised as important predictors; however, evaluation of these variables was not feasible in the present study due to limitations in sample size and data availability. The CVD burden in India is substantially greater than the global average. The age-standardised DALY rate attributable to CVD is reported to be 1.3 times higher than the worldwide mean [37], whereas data from European [24,25] and US [29,30] registries show comparatively higher rate of 30-day mortality (STEMI, 7 to 8% and NSTEMI, 1 to 3%). The Prospective Urban Rural Epidemiology (PURE) study, involving 156,424 individuals assessed with the INTERHEART risk score, reported that participants from lower-income countries predominantly Indians (83%) experienced significantly higher rates of MACEs (7.39 per 1,000 person-years) and mortality (9.84 per 1,000 person-years) than those from high-income countries (3.64 and 2.19 per 1,000 person-years, respectively; p<0.001), despite having the lowest prevalence of risk factors [38]. Another registry study found 2-year mortality rate of 15% in Indian ACS patients which was higher compared to other low-income countries [34]. The CREATE registry found that variations in mortality across India's socioeconomic strata are primarily due to treatment and associated factors, rather than risk factors [16]. The socioeconomic status of patients and availability of medical insurance are the important influencers in their willingness to access the treatment modalities, which significantly impacts cardiovascular outcomes.

### Limitation(s)

The practice patterns observed at current study centre may not be representative of hospitals across the country, which constitutes a significant limitation of the study. Second, the reported mortality rate may be underestimated, as some patients might have succumbed in the emergency room or during hospital transit. Third, the study's ability to influence clinical practice and inform national standards is constrained by the absence of multi-center or registry-based data. Fourth, the impact of key confounders on clinical outcomes in the Indian context- including socioeconomic status, insurance coverage, prehospital and ambulatory care, and therapies administered before hospital admission was not evaluated due to limited statistical power and insufficient patient-level data.

## CONCLUSION(S)

In conclusion, there is a need to improve the overall rates of point-of-care interventions, including primary PCI and intravenous thrombolysis, in acute settings. Age >60 years, dyslipidaemia, hypertension, a HEART score of 7-10, symptom onset to hospitalisation >6 hours, DTN > 30 minutes, and DTB > 90 minutes were identified as predictors of mortality and MACEs. Adherence to evidence-based ACS care metrics, particularly all-or-none measures, is essential to achieve improved cardiovascular outcomes. Strategies aimed at reducing hospitalisation delays, enhancing affordability of care, and strengthening evidence-based ACS practices will help lower mortality and MACE rates among patients with ACS. Future multicentre (regional) and registry-based (countrywide) studies are warranted to generate more generalisable and meaningful inferences in this context.

## REFERENCES

[1] Lopez AD, Mathers CD, Ezzati M, Jamison DT, Murray CJ. Global and regional burden of disease and risk factors, 2001: Systematic analysis of population health data. Lancet. 2006;367(9524):1747-57.
[2] Reddy KS. Cardiovascular disease in non-Western countries. N Engl J Med. 2004;350(24):2438-40.
[3] Wang F, Yu Y, Mubarik S, Zhang Y, Liu X, Cheng Y, et al. Global burden of ischemic heart disease and attributable risk factors, 1990-2017: A secondary analysis based on the global burden of disease study 2017. Clinical Epidemiology. 2021:859-70.
[4] Prabhakaran D, Jeemon P, Roy A. Cardiovascular Diseases in India: Current epidemiology and future directions. Circulation. 2016;133(16):1605-20.

[5] Wu P, Yu S, Wang J, Zou S, Yao DS, Xiaochen Y. Global burden, trends, and inequalities of ischemic heart disease among young adults from 1990 to 2019: A population-based study. Frontiers in Cardiovascular Medicine. 2023;10:1274663.
[6] Yan W, Hua Y. Trends in deaths and disability-adjusted life-years of ischemic heart disease attributable to high body-mass index worldwide, 1990–2019. BMC Cardiovascular Disorders. 2024;24(1):482.
[7] Mohan V, Deepa R, Rani SS, Premalatha G; Chennai Urban Population Study (CUPS No.5). Prevalence of coronary artery disease and its relationship to lipids in a selected population in South India: The Chennai Urban Population Study (CUPS No. 5). J Am Coll Cardiol. 2001;38(3):682-87.
[8] Joshi P, Islam S, Pais P, Reddy S, Dorairaj P, Kazmi K, et al. Risk factors for early myocardial infarction in South Asians compared with individuals in other countries. JAMA. 2007;297(3):286-94.
[9] Jneid H, Addison D, Bhatt DL, Fonarow GC, Gokak S, Grady KL, et al. 2017 AHA/ACC clinical performance and quality measures for adults with ST-elevation and non-ST-elevation myocardial infarction: A report of the American College of Cardiology/American Heart Association Task Force on Performance Measures. Circulation: Cardiovascular Quality and Outcomes. 2017;10(10):e000032.
[10] Guidelines for Management of ST-Elevated Myocardial Infarction. National Programme for Prevention and Control of Non-communicable Diseases. Ministry of Health and Family Welfare, Government of India. https://dghs.gov.in/WriteReadData/userfiles/file/NPCDCS/Fin%20%20STEMI%20Guidline.pdf.
[11] Guha S, Sethi R, Ray S, Bahl VK, Shanmugasundaram S, Kerkar P, et al. Cardiological Society of India: Position statement for the management of ST elevation myocardial infarction in India. Indian Heart J. 2017;69 Suppl 1(Suppl 1):S63-S97.
[12] Longenecker JC, Alfaddagh A, Zubaid M, Rashed W, Ridha M, Alenezi F, et al. Adherence to ACC/AHA quality metrics for myocardial infarction in six Middle-Eastern countries: Association with in-hospital mortality and clinical characteristics. International Journal of Cardiology. 2013;167(4):1406-11.
[13] Epstein AM, Lee TH, Hamel MB. Paying physicians for high-quality care. N Engl J Med. 2004;350(4):406-10.
[14] Granger CB, Steg PG, Peterson E, López-Sendón J, Van de Werf F, Kline-Rogers E, et al; GRACE Investigators. Medication performance measures and mortality following acute coronary syndromes. Am J Med. 2005;118(8):858-65.
[15] Christian RP, Rana DA, Malhotra SD, Patel VJ. Evaluation of rationality in prescribing, adherence to treatment guidelines, and direct cost of treatment in intensive cardiac care unit: A prospective observational study. Indian J Crit Care Med. 2014;18(5):278-84.
[16] Xavier D, Pais P, Devereaux PJ, Xie C, Prabhakaran D, Reddy KS, et al. Treatment and outcomes of acute coronary syndromes in India (CREATE): A prospective analysis of registry data. The Lancet. 2008;371(9622):1435-42.
[17] Sharma YP, Vemuri KS, Bootla D, Kanabar K, Pruthvi CR, Kaur N, et al. Epidemiological profile, management and outcomes of patients with acute coronary syndrome: Single centre experience from a tertiary care hospital in North India. Indian Heart J. 2021;73(2):174-79.
[18] Antman EM, Cohen M, Bernink PJ, McCabe CH, Horacek T, Papuchis G, et al. The TIMI risk score for unstable angina/non–ST elevation MI: A method for prognostication and therapeutic decision making. JAMA. 2000;284(7):835-42.
[19] Morrow DA, Antman EM, Charlesworth A, Cairns R, Murphy SA, de Lemos JA, et al. TIMI risk score for ST-elevation myocardial infarction: A convenient, bedside, clinical score for risk assessment at presentation: An intravenous nPA for treatment of infarcting myocardium early II trial substudy. Circulation. 2000;102(17):2031-37.
[20] Granger CB, Goldberg RJ, Dabbous O, Pieper KS, Eagle KA, Cannon CP, et al. Predictors of hospital mortality in the Global Registry of Acute Coronary Events. Arch Intern Med. 2003;163(19):2345-53.
[21] Eagle KA, Lim MJ, Dabbous OH, Pieper KS, Goldberg RJ, Van de Werf F, et al. A validated prediction model for all forms of acute coronary syndrome: Estimating the risk of 6-month post discharge death in an international registry. JAMA. 2004;291(22):2727-33.
[22] Six AJ, Backus BE, Kelder JC. Chest pain in the emergency room: Value of the HEART score. Neth Heart J. 2008;16(6):191-96.
[23] Anwar I, Sony D. HEART Score: Prospective evaluation of its accuracy and applicability. Indian J Crit Care Med. 2024;28(8):748-52.
[24] Hasdai D, Behar S, Wallentin L, Danchin N, Gitt AK, Boersma E, et al. A prospective survey of the characteristics, treatments and outcomes of patients with acute coronary syndromes in Europe and the Mediterranean basin. The Euro Heart Survey of Acute Coronary Syndromes (Euro Heart Survey ACS). European Heart Journal. 2002;23(15):1190-201.
[25] Mandelzweig L, Battler A, Boyko V, Bueno H, Danchin N, Filippatos G, et al. The second Euro Heart Survey on acute coronary syndromes: Characteristics, treatment, and outcome of patients with ACS in Europe and the Mediterranean Basin in 2004. European Heart Journal. 2006;27(19):2285-93.
[26] Steg PG, Goldberg RJ, Gore JM, Fox KA, Eagle KA, Flather MD, et al. GRACE Investigators. Baseline characteristics, management practices, and in-hospital outcomes of patients hospitalized with acute coronary syndromes in the Global Registry of Acute Coronary Events (GRACE). The American journal of cardiology. 2002;90(4):358-63.
[27] Fox KA, Goodman SG, Klein WF, Brieger D, Steg PG, Dabbous O, et al. Management of acute coronary syndromes. Variations in practice and outcome. Findings from the Global Registry of Acute Coronary Events (GRACE). European Heart Journal. 2002;23(15):1177-89.
[28] Budaj A, Brieger D, Steg PG, Goodman SG, Dabbous OH, Fox KA, et al. Global patterns of use of antithrombotic and antiplatelet therapies in patients with acute coronary syndromes: Insights from the Global Registry of Acute Coronary Events (GRACE). American Heart Journal. 2003;146(6):999-1006.
[29] Rogers WJ, Canto JG, Barron HV, Boscarino JA, Shoultz DA, Every NR. Treatment and outcome of myocardial infarction in hospitals with and without invasive capability. Investigators in the National Registry of Myocardial Infarction. J Am Coll Cardiol. 2000;35(2):371-79.
[30] Rogers WJ, Canto JG, Lambrew CT, Tiefenbrunn AJ, Kinkaid B, Shoultz DA, et al. Investigators in the National Registry of Myocardial Infarction 1 2 and 3. Temporal trends in the treatment of over 1.5 million patients with myocardial infarction in the US from 1990 through 1999: The National Registry of Myocardial Infarction 1, 2 and 3. Journal of the American College of Cardiology. 2000;36(7):2056-63.
[31] Isezuo S, Subban V, Krishnamoorthy J, Pandurangi UM, Janakiraman E, Kalidoss L, et al. Characteristics, treatment and one-year outcomes of patients with acute coronary syndrome in a tertiary hospital in India. Indian Heart Journal. 2014;66(2):156-63.
[32] Huffman MD, Prabhakaran D, Abraham AK, Krishnan MN, Nambiar AC, Mohanan PP. Optimal in-hospital and discharge medical therapy in acute coronary syndromes in Kerala: Results from the Kerala acute coronary syndrome registry. Circulation: Cardiovascular Quality and Outcomes. 2013;6(4):436-43.
[33] Mehta RH, Chen AY, Alexander KP, Ohman EM, Roe MT, Peterson ED. Doing the right things and doing them the right way: Association between hospital guideline adherence, dosing safety, and outcomes among patients with acute coronary syndrome. Circulation. 2015;131(11):980-87.
[34] Prabhakaran D, Yusuf S, Mehta S, Pogue J, Avezum A, Budaj A, et al. Two-year outcomes in patients admitted with non-ST elevation acute coronary syndrome: Results of the OASIS registry 1 and 2. Indian Heart Journal. 2005;57(3):217-25.
[35] Constantinides SS, Gieowarsingh S, Halim M, Been M, Shiu MF. Predictors of mortality in patients with acute coronary syndrome undergoing percutaneous coronary intervention. Heart. 2003;89(10):1245-46.
[36] Bech GJ, Pijls NH, De Bruyne B, Peels KH, Michels HR, Bonnier HJ, et al. Usefulness of fractional flow reserve to predict clinical outcome after balloon angioplasty. Circulation. 1999;99(7):883-88.
[37] India State-Level Disease Burden Initiative CVD Collaborators; Prabhakaran D, Jeemon P, Sharma M, Roth GA, Johnson C, Harikrishnan S. The changing patterns of cardiovascular diseases and their risk factors in the states of India: The Global Burden of Disease Study 1990-2016. Lancet Glob Health. 2018;6(12):e1339-51.
[38] Yusuf S, Rangarajan S, Teo K, Islam S, Li W, Liu L, et al. Cardiovascular risk and events in 17 low-, middle-, and high-income countries. N Engl J Med. 2014;371(9):818-27.



**PARTICULARS OF CONTRIBUTORS:**
1. Pharm D Intern, Department of Pharmacy Practice, Bharati Vidyapeeth (Deemed to be University), Poona College of Pharmacy, Pune, Maharashtra, India.
2. Assistant Professor, Department of Pharmacy Practice, Bharati Vidyapeeth (Deemed to be University), Poona College of Pharmacy, Pune, Maharashtra, India.
3. Associate Professor, Department of Cardiology, Bharati Vidyapeeth (Deemed to be University), Medical College, Pune, Maharashtra, India.
4. Pharm D Intern, Department of Pharmacy Practice, Bharati Vidyapeeth (Deemed to be University), Poona College of Pharmacy, Pune, Maharashtra, India.
5. Pharm D Intern, Department of Pharmacy Practice, Bharati Vidyapeeth (Deemed to be University), Poona College of Pharmacy, Pune, Maharashtra, India.
6. Professor, Department of Critical Care Medicine, Bharati Vidyapeeth (Deemed to be University), Medical College, Pune, Maharashtra, India; Deputy Medical Director of Clinical Governance, Bharati Hospital and Research Centre, Pune, Maharashtra, India.
7. Professor, Department of Pharmaceutics, Bharati Vidyapeeth (Deemed to be University), Poona College of Pharmacy, Pune, Maharashtra, India.

**NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:**
Vaibhav R. Suryawanshi,
Flat No. 1, A2 Building Kadam Plaza, Opposite to Bharati Hospital, Katraj,
Pune-43, Maharashtra, India.
E-mail: phdrvaibhav@gmail.com



**PLAGIARISM CHECKING METHODS:** [Jain H et al.]
- Plagiarism X-checker: Oct 28, 2025
- Manual Googling: Nov 22, 2025
- iThenticate Software: Nov 25, 2025 (3%)

**ETYMOLOGY:** Author Origin

**EMENDATIONS:** 7

**AUTHOR DECLARATION:**
- Financial or Other Competing Interests: None
- Was Ethics Committee Approval obtained for this study? Yes
- Was informed consent obtained from the subjects involved in the study? Yes
- For any images presented appropriate consent has been obtained from the subjects. NA

Date of Submission: **Oct 07, 2025**
Date of Peer Review: **Nov 07, 2025**
Date of Acceptance: **Nov 27, 2025**
Date of Publishing: **Mar 01, 2026**