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ORIGINAL ARTICLE

Presentation, care, and outcomes of patients with NSTEMI according to World Bank country income classification: the ACVC-EAPCI EORP NSTEMI Registry of the European Society of Cardiology

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Background The majority of NSTEMI burden resides outside high-income countries (HICs). We describe presentation, care, and outcomes of NSTEMI by country income classification.

Methods and results Prospective cohort study including 2947 patients with NSTEMI from 287 centres in 59 countries, stratified by World Bank country income classification. Quality of care was evaluated based on 12 guideline-recommended care interventions. The all-or-none scoring composite performance measure was used to define receipt of optimal care. Outcomes included in-hospital acute heart failure, stroke/transient ischaemic attack, and death, and 30-day mortality. Patients admitted with NSTEMI in low to lower-middle-income countries (LLMICs), compared with patients in HICs, were younger, more commonly diabetic, and current smokers, but with a lower burden of other comorbidities, and 76.7% met very high risk criteria for an immediate invasive strategy. Invasive coronary angiography use increased with ascending income classification (LLMICs, 79.2%; upper middle income countries [UMICs], 83.7%; HICs, 91.0%), but overall care quality did not (≥80% of eligible interventions achieved: LLMICS, 64.8%; UMICs 69.6%; HICs 55.1%). Rates of acute heart failure (LLMICS, 21.3%; UMICs, 12.1%; HICs, 6.8%; $P < 0.001$), stroke/transient ischaemic attack (LLMICS: 2.5%; UMICs: 1.5%; HICs: 0.9%; $P = 0.04$), in-hospital mortality (LLMICS, 3.6%; UMICs: 2.8%; HICs: 1.0%; $P < 0.001$) and 30-day mortality (LLMICs, 4.9%; UMICs, 3.9%; HICs, 1.5%; $P < 0.001$) exhibited an inverse economic gradient.

Conclusion Patients with NSTEMI in LLMICs present with fewer comorbidities but a more advanced stage of acute disease, and have worse outcomes compared with HICs. A cardiovascular health narrative is needed to address this inequity across economic boundaries.

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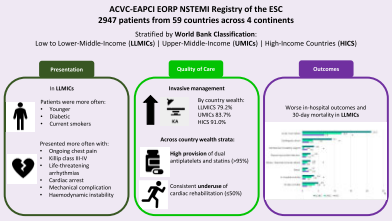
Graphical Abstract

Analysis of the ACVC-EAPCI EORP NSTEMI registry stratified by country income classification.



Keywords NSTEMI • Registry • Country income • Quality indicators • Mortality

Introduction

The prevalence of acute coronary syndromes in low to middle-income countries is rising rapidly, accounting for ∼80% of burden and 85% of disability worldwide.[1] Care for non-ST-segment elevation myocardial infarction (NSTEMI) that conforms to the European Society of Cardiology (ESC) guidelines has been demonstrated to improve outcomes,[2–6] but places a financial burden on health-care systems as it requires a network of specialist healthcare professionals, provision of interventional procedures, and the prescription of several different medications.[7,8] Accordingly, there may be variation in the delivery of treatment between economically advantaged and disadvantaged countries and associated disparities in outcomes.

Previous studies have reported variation in care and outcomes for NSTEMI within and between countries,[2,6,9–11] as well as across regions,[12,13] but the relationship across income classification is unknown. Furthermore, some reports with wide representation have focussed primarily on the provision of in-hospital revascularisation,[14] and so do not adequately describe the wider pathway of NSTEMI care.

This registry was designed and implemented to identify patterns in the care of patients presenting with NSTEMI and their outcomes across the heterogeneous context of ESC country members and affiliated countries. Here we report the results of the registry stratified by World Bank country income classification.[15]

Methods

Study design

This registry is an international prospective, multicentre, observational study of patients presenting to hospitals in ESC member, and affiliated countries. The study design has been published previously.[16]

Study organisation and selection of centres

This registry is a joint initiative of the Association for Acute Cardiovascular Care (ACVC) and the European Association of Percutaneous Cardiovascular Interventions (EAPCI) under the umbrella of the EURObservational Research Programme (EORP). A feasibility survey was sent to potential sites, and selection based upon their responses. Consecutive consenting participants hospitalised with confirmed diagnosis of NSTEMI within a two-week period at each centre were recorded.

Patients

Inclusion criteria were the patients aged ≥18 years with a final diagnosis of NSTEMI, that is, patients with Universal Definition acute myocardial infarction, type 1 myocardial infarction, and who did not have persistent ST-segment elevation.[17,18] Patients unwilling or unable to consent were excluded. Centre enrolment took place between 11 March 2019 and 6 March 2021. Characteristics of the recruiting centres were recorded. For each patient, demographic features, mode of admission, therapeutic methods, time delays to reperfusion, risk stratification, and medication prescription during admission and on discharge were also recorded on an electronic case report form. Follow-up for clinical events and life status was recorded at 30 days.

Quality of care

Quality of care was evaluated based on 12 ESC guideline-recommended NSTEMI care interventions.[7] These included: electrocardiogram (ECG) pre- or in-hospital, pre-hospitalization receipt of aspirin, echocardiography, invasive coronary angiography, medication at discharge to include aspirin, $P2Y_{12}$ inhibition, angiotensin converting ezyme inhibitor (ACEi)/angiotensin receptor blocker (ARB), beta-blocker and statin, referral to cardiac rehabilitation, smoking cessation advice, and dietary advice. The study period traversed two publications of ESC quality indicators for acute myocardial infarction, but the indicators we collected and analysed were consistent across both.[19,20] We included two additions lifestyle interventions—smoking cessation advice and dietary advice—because both are associated with a reduction in mortality and cardiovascular events,[21,22] and can be provided even in the absence of a full cardiac rehabilitation programme.

For each intervention, patients were considered ineligible if they were recorded as having a contra-indication or the data field recorded as not applicable. The all-or-none scoring composite performance measure was used as an aggregation method to define receipt of optimal care, i.e. patients who received all 12 of the care interventions for which they were eligible were considered to have received optimal care, but patients missing one or more interventions were considered to have received sub-optimal care.[2] If the data were missing, the patient was assumed not to have received the intervention. Overall, receipt of optimal care was split into four categories: no interventions received, <40% of eligible interventions received, ≥40%–<80% of eligible intervention received, and ≥80% of interventions received.[2]

To further distinguish patterns in care provision, guideline recommendations were also grouped as follows: pharmacological therapies (pre-hospitalization receipt of aspirin and prescription on discharge of each of aspirin, $P2Y_{12}$ inhibitor, ACEi/ARB, beta-blocker, and statin), investigative and invasive coronary strategies (electrocardiogram pre- or in-hospital, echocardiography, invasive coronary angiography) and lifestyle care interventions (referral to cardiac rehabilitation, smoking cessation advice, and dietary advice). This categorisation has been shown to offer higher resolution insights into the impact of care delivery on survival according to the GRACE risk score.[5]

Recorded outcomes included in-hospital episodes of acute heart failure, cardiogenic shock, use of mechanical circulatory support, bleed (BARC Type ≥ 3),[23] stroke/transient ischaemic attack, repeat myocardial infarction, and death from any cause, as well as 30 day-all-cause mortality.

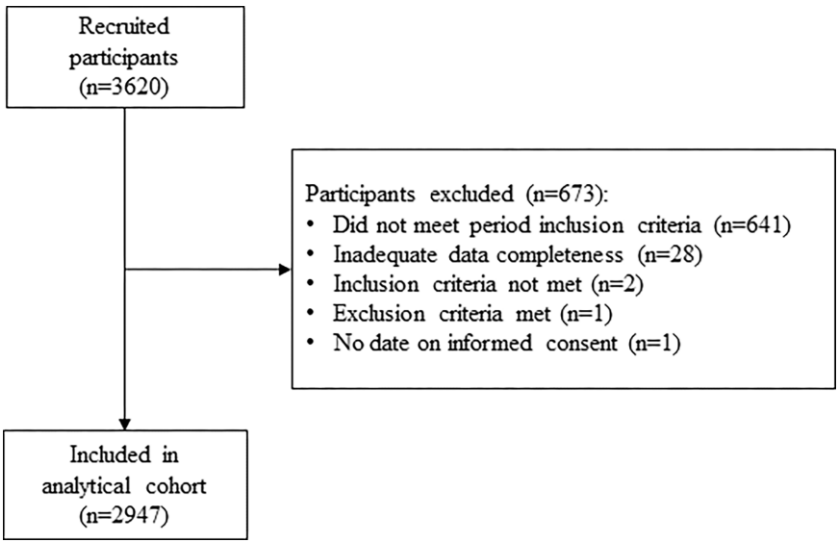


Figure 1 STROBE diagram for the EORP NSTEMI registry analytical cohort.

Statistics

Categorical data were described using numbers and percentages for non-missing data, and continuous data were described using medians, interquartile range (IQR), means, and standard deviations (SD). Comparison between groups was performed using the Kruskal–Wallis test or using Pearson's χ^2 test or Fisher's exact test if any count was <5.

To explore for differences in NSTEMI care quality by country wealth, we stratified the cohort into low (LICs), lower-middle (LMICs), upper-middle (UMICs), and high-income countries (HICs) according to the World Bank classification of the 2021 fiscal year.[15] Given the numbers of countries in the study, the LICs and LMICs were combined to form a single larger group of low to lower-middle-income countries (LLMICs). All analyses were conducted using SAS version 9.4, with statistical significance determined at 5%. Findings are reported in accordance with the Strengthening the reporting of observational studies in epidemiology (STROBE) statement.[24]

Ethics

Favourable ethics approval for the study was granted at the local and/or regional ethics committees or Institutional Review Boards in each country, according to local regulations. National coordinators, in conjunction with local centres, or participating centres managed the approvals of national or regional ethics committees or Institutional Review Boards, according to local regulations.

Results

Study population

From the recruited cohort of 3620 participants, 2947 formed the analytical cohort from 59 countries, across four continents and 287 centres (*Figure 1*, Supplementary material online, *Table S1*). Most participating centres were teaching research hospitals (45.0%) followed by general hospitals (41.1%) and 58.2% of hospitals had cardiac surgery onsite (Supplementary material online, *Table S2*). The majority of patients (1761, 59.8%) and participating centres (192, 66.9%) were from HICs. The median (IQR) age and proportion of women was 66 (57–75) years and 30.8%, with NTSEMI patients in HICs being older and more commonly men and Caucasian (*Table 1*).

Overall, the comorbidity burden of the cohort was high (*Table 1*). Each of hypertension, hypercholesterolaemia, or ever smoking was prevalent in over half of the patients at time of diagnosis, more than a third had diabetes mellitus and over a quarter had a previous myocardial infarction. Notably, the patients admitted with NSTEMI in HICs were older than those from LLMICs, and had a higher burden of comorbidity, with a three-fold increased prevalence of atrial fibrillation, peripheral vascular disease, prior percutaneous coronary intervention or coronary artery bypass graft surgery and a two-fold increased prevalence of chronic kidney disease and treatment with dialysis. In HIC countries, patients with NSTEMI also had higher rates of heart failure, COPD, hypercholesterolaemia, and cancer, but lower rates of diabetes.

Presenting characteristics

Patients admitted in LLMICs, compared with patients in UMICs or HICS, had a longer delay to presentation at hospital following their symptom onset and showed signs of more severe disease at time of their presentation (*Table 2*). That is, the proportion of patients presenting in Killip Class III or IV was three-fold higher in LLMICs than HICs and ongoing chest pain, life-threatening arrhythmias (or cardiac arrest), and haemodynamic instability were at least twice as common. More than three-quarters of patients presenting with NSTEMI in LLMICs met very high risk criteria for an invasive coronary strategy, whereas only a third of patients did so in HICs (*Table 2*).

Quality of care

There was geographic variation in the attainment of the 12 measured quality indicators for NSTEMI care (*Figure 2*). Whilst all patients were recorded as having received an ECG at baseline, only 45% and 46% received aspirin pre-hospitalization and referral for cardiac rehabilitation, respectively. Across the 12 quality indicators 98.3% of patients received at least 40% of the assessed interventions (60.3% of patients received ≥80% of interventions, 38.0% received ≥40% to <80% of eligible interventions). By care grouping, 80.2% received ≥80% of eligible interventions related to investigation and invasive coronary strategies, but only 31.2% for lifestyle care interventions.

Table 1 Baseline characteristics of NSTEMI patients in analytical cohort by country income classification

	Total (*n* = 2947)	LLMICs (*n* = 361)	UMICs (*n* = 825)	HICs (*n* = 1761)	Missing data, *n* (%)
Patient characteristics					
Age (years), median (IQR)	66 (57–75)	58 (51–65)	64 (56–73)	68 (59–77)	0
>= 75 years	761 (25.8)	31 (8.6)	177 (21.5)	553 (31.4)	0
>= 80 years	447 (15.2)	16 (4.4)	93 (11.3)	338 (19.2)	0
Women	907 (30.8)	122 (33.8)	259 (31.4)	526 (29.9)	0
Ethnic origin					107 (3.6)
Caucasian	2252 (79.3)	142 (43.2)	553 (69.6)	1557 (90.7)	
Black	41 (1.4)	31 (9.4)	0/795	10 (0.6)	
Asian	278 (9.8)	129 (39.2)	88 (11.1)	61 (3.6)	
Other	269 (9.5)	27 (8.2)	154 (19.4)	88 (5.1)	
Cardiovascular risk factors					
Hypertension	2023 (69.0)	235 (65.3)	597 (72.9)	1191 (67.9)	15 (0.5)
Ever smoker	1591 (56.9)	159 (45.6)	456 (56.6)	976 (59.4)	151 (5.1)
Current smoker	857 (30.7)	128 (36.7)	297 (36.9)	432 (26.3)	
Former smoker	734 (26.3)	31 (8.9)	159 (19.8)	544 (33.1)	
Diabetes Mellitus	1104 (37.7)	174 (48.6)	332 (40.5)	598 (34.2)	19 (0.6)
Hypercholesterolaemia	1427 (51.9)	125 (39.4)	324 (45.3)	978 (57.0)	200 (6.8)
Cardiovascular comorbidities					
Atrial fibrillation	302 (10.3)	13 (3.6)	82 (10.0)	207 (11.8)	17 (0.6)
Heart failure	464 (15.9)	41 (11.5)	163 (20.0)	260 (14.9)	30 (1.0)
Prior myocardial infarction	759 (26.1)	49 (13.7)	277 (34.5)	433 (24.8)	41 (1.4)
Prior PCI	649 (22.1)	31 (8.6)	209 (25.5)	409 (23.3)	14 (0.5)
Prior CABG surgery	217 (7.4)	9 (2.5)	79 (9.6)	129 (7.3)	5 (0.2)
Peripheral vascular disease	243 (8.6)	12 (3.6)	51 (6.6)	180 (10.4)	115 (3.9)
Stroke	204 (6.9)	19 (5.3)	55 (6.7)	130 (7.4)	6 (0.2)
Relevant comorbidities					
Active malignancy	82 (2.8)	8 (2.2)	9 (1.1)	65 (3.7)	37 (1.3)
COPD	234 (8.0)	27 (7.5)	50 (6.1)	157 (9.0)	30 (1.0)
Chronic kidney disease	367 (12.5)	23 (6.4)	108 (13.2)	236 (13.5)	16 (0.5)

CABG, coronary artery bypass grafting; COPD, chronic obstructive pulmonary disease; HICs, high-income countries, LLMICs, low to lower-middle-income countries; PCI, percutaneous coronary intervention; UMICs, upper-middle-income countries.

Across the spectrum of country income classification 100% of patients received an ECG at baseline, and ≥90% each of aspirin, P2Y12 inhibitors and statins at discharge (*Figure 2*). In contrast, pre-hospitalisation use of aspirin varied substantially (LLMICs, 39.4%; UMICs, 55.6%; HICs, 41.4%). The use of invasive coronary angiography increased with increasing country economic prosperity (LLMICs, 79.2%; UMICs, 83.7%; HICs, 91.0%). A greater proportion of NSTEMI patients in HICs received referral for cardiac rehabilitation than their counterparts in LLMICs (52.0% vs. 39.9%), but a smaller proportion received dietary advice (79.5% vs. 95.0%)

Overall, attainment of the measured quality indicators was higher in LLMICs and UMICs than HICs (≥80% of eligible interventions achieved: LLMICS, 64.8%; UMICs 69.6%; HICs 55.1%). Whilst the proportion of patients who received ≥80% of eligible interventions related to investigation and invasive coronary strategies was high and increased with ascending income classification (LLMICs, 74.8%; UMICs, 80.1%; HICs, 81.3%), the proportion of patients who received ≥80% of eligible lifestyle care interventions (LLMICS, 33.5%; UMICs, 30.8%; HICs, 30.9%) was uniformly low (*Figure 3*).

In-hospital outcomes and 30-day mortality

Adverse outcomes for patients admitted for NSTEMI were more frequent in less economically developed countries, in spite of their younger age at presentation (*Figure 4*). The rate of acute heart failure (LLMICS, 21.3%; UMICs, 12.1%; HICs, 6.8%; $P < 0.001$), cardiogenic shock (LLMICS, 9.1%; UMICs, 3.2%; HICs, 2.1%; $P < 0.001$), and stroke/transient ischaemic attack (LLMICS: 2.5%; UMICs: 1.5%; HICs: 0.9%; $P = 0.04$) increased down the income classification economic gradient. Crude in-hospital and 30-day mortality were low (1.8% and 2.5%, respectively) but increased with declining country wealth (in-hospital mortality: LLMICS, 3.6%; UMICs: 2.8%; HICs: 1.0%; $P < 0.001$; 30 day mortality: LLMICs, 4.9%; UMICs, 3.9%; HICs, 1.5%; $P < 0.001$).

Discussion

This prospective international study of 2947 patients with NSTEMI presenting to 1 of 247 recruiting centres from 59 ESC member countries and affiliates provides novel and high resolution insights

Table 2 Presenting characteristics of NSTEMI patients in analytical cohort by country income classification

	Total (*n* = 2947)	LLMICs (*n* = 361)	UMICs (*n* = 825)	HICs (*n* = 1761)	Missing data, *n* (%)
Clinical presentation					
Symptom onset to hospital admission, median (IQR)	6.3 (2.4–26.6)	8.0 (4.0–44.5)	7.5 (2.3–29.8)	5.6 (2.1–23.7)	11 (0.4)
Heart rate (bpm), median (IQR)	77 (67–90)	86 (76–98)	80 (70–90)	75 (65–86)	7 (0.2)
Systolic Blood pressure (mmHg), median (IQR)	139 (120–155)	130 (110–140)	136 (120–151)	140 (124–158)	7 (0.2)
Cardiac arrest	41 (1.4)	8 (2.2)	14 (1.7)	19 (1.1)	12 (0.4)
Killip class					12 (0.4)
Class I	2351 (80.1)	247 (68.4)	653 (79.2)	1451 (82.9)	
Class II	400 (13.6)	65 (18.0)	120 (14.6)	215 (12.3)	
Class III	151 (5.1)	40 (11.1)	41 (5.0)	70 (4.0)	
Class IV	33 (1.1)	9 (2.5)	10 (1.2)	14 (0.8)	
Ongoing chest pain	1150 (39.3)	248 (69.9)	382 (46.4)	520 (29.8)	23 (0.8)
Life threatening arrhythmia or cardiac arrest	91 (3.1)	20 (5.5)	31 (3.8)	40 (2.3)	3 (0.1)
Acute heart failure	336 (11.5)	78 (21.7)	127 (15.4)	131 (7.5)	13 (0.4)
Mechanical complication of MI	28 (1.0)	11 (3.1)	9 (1.1)	8 (0.5)	9 (0.3)
Haemodynamic instability	147 (5.0)	27 (7.5)	57 (6.9)	63 (3.6)	7 (0.2)
ST segment deviation indicative of ischaemia	1502 (51.1)	239 (66.2)	514 (62.4)	749 (42.6)	5 (0.2)
Laboratory results					
Peak troponin I/Upper reference, median (IQR)	21 (4–100)	39 (6–100)	12 (2–86)	22 (6–111)	1183 (40.1)
Peak troponin T/Upper reference, median (IQR)	11 (4–32)	6 (3–19)	16 (6–39)	10 (3–30)	1842 (62.5)
Haemoglobin (g/L), median (IQR)	138 (123–150)	125 (112–138)	139 (123–150)	140 (126–150)	69 (2.3)
eGFR CG (ml/min/1.73 m^2), median (IQR)	77 (57–93)	76 (55–95)	75 (56–92)	77 (58–93)	51 (1.7)
Risk assessment					
GRACE, median (IQR)	135 (113–161)	136 (119–163)	139 (116–163)	133 (111–160)	116 (3.9)
Very-high risk for invasive strategy criterion met	1358 (46.3)	276 (76.7)	450 (54.6)	632 (36.1)	
In-hospital revascularisation (of those eligible)					
Diagnostic coronary angiography	2578 (87.5)	286 (79.2)	690 (83.7)	1602 (91.0)	1 (0.0)
PCI	1791 (60.9)	225 (62.5)	462 (56.2)	1104 (62.7)	
CABG surgery	328 (11.1)	33 (9.2)	110 (13.4)	185 (10.5)	

CABG, coronary artery bypass grafting; HICs, high-income countries, LLMICs, low to lower-middle-income countries; PCI, percutaneous coronary intervention; UMICs, upper-middle-income countries.

into variation in presentation, care, and early outcomes by World Bank country income classification. Our main finding is that patients admitted with NSTEMI in LLMICs, compared with patients in HICs, are younger, have fewer comorbidities, present with a more advanced manifestation of acute disease, and have worse early clinical outcomes. Furthermore, invasive coronary angiography was used less often for patients with NSTEMI in LLMICs than HICs. A cardiovascular health narrative is needed to address this inequity across international economic boundaries.

Disparities in NSTEMI care delivery and outcomes by country income classification are insufficiently characterized in the literature. Previous reports have provided comparisons between countries within the same income classification,[9,11,13] or not stratified by economic prosperity even when including a wide representation of countries.[12,14] The Global Burden of Disease Study and ESC cardiovascular disease statistics have demonstrated divergent burden of disability-adjusted life-years as a result of ischaemic heart disease by country wealth,[8,25] but they do not specifically address NSTEMI or provide high resolution patient-level clinical data. The EORP Acute Coronary Syndrome (ACS) STEMI registry and EUROASPIRE (European Action on Secondary and Primary Prevention by Intervention to Reduce Events) registries have delivered important insights on geographical variation in care delivery across ESC member countries, for ST-segment elevation myocardial infarction (STEMI) care and coronary artery disease primary and secondary prevention, respectively.[26,27]

Patients in LLMICs presented with NSTEMI a decade earlier and with fewer comorbidities than their counterparts in HICs. The earlier manifestation of NSTEMI in LLMICs compared with HICs is likely because key risk factors for development and acute presentation of ischaemic heart disease—such as smoking, blood pressure control, and air pollution—are significantly more burdensome.[8] The adoption of western lifestyles has also contributed to an increasing burden of diabetes mellitus, such that 80% people who have diabetes mellitus live in low- and middle-income countries;[28] and in our cohort almost half of the patients presenting with NSTEMI in LLMICs were diabetic. Furthermore low educational levels in low income countries have been found to be particularly correlated with adverse cardiovascular events, and this may be because medical care (e.g. management of hypertension, diabetes, and secondary prevention) is likely to be poorer in people with the lowest levels of education compared with those with higher levels of education in low-income

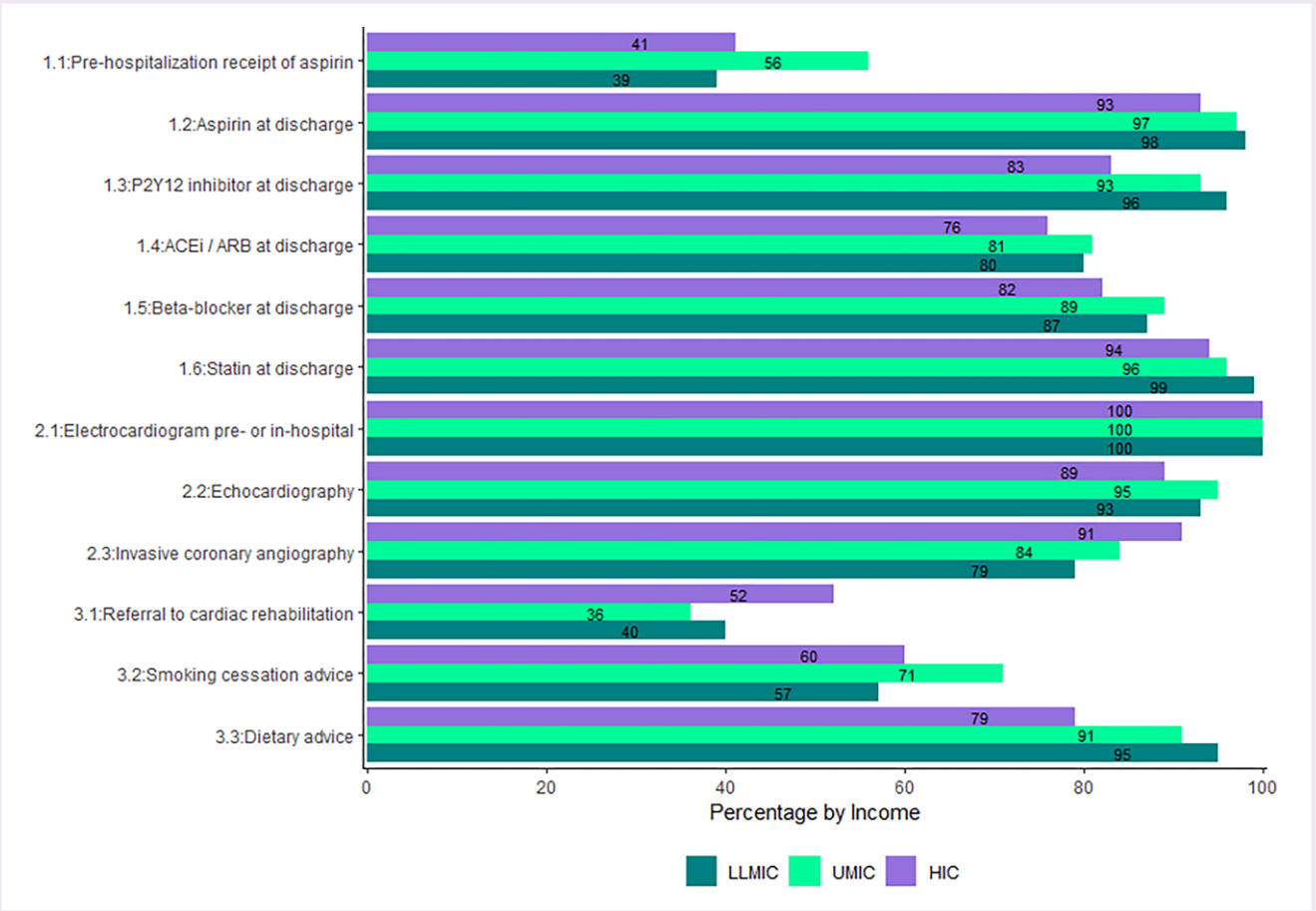


Figure 2 Guideline-recommended for treatment for NSTEMI by World Bank country income classification.

countries.[29] Comorbidity burden was higher in patients in HICs and this reflects the notion that additional life years constitute an additional risk for acquiring chronic conditions;[30] that is, amongst ESC member countries and affiliates, premature death is more common and life expectancy shorter in low- and middle-income countries and so individuals may not have the chance to accumulate multiple conditions.[8]

Three-quarters of patients with NSTEMI in LLMICs were defined as very high-risk. Time from symptom onset to hospital admission varied substantially in LLMICs, but a quarter of patients had delays in excess of 45 h. Though we do not have data for the reason for delay, a previous systematic review has demonstrated that pre-hospital emergency services are underdeveloped in low- and middle-income countries, and that use of an ambulance can be cost-prohibitive for most patients who are required to pay out of pocket in countries that lack a national insurance programme.[1] Thus many patients with acute myocardial infarction travel to hospital by public transport and private cars,[31,32] which can be particularly disadvantageous in rural areas.[33] Furthermore, lack of knowledge of symptoms consistent with myocardial ischaemia has been reported as a prominent reason for treatment delay,[34] especially amongst older and illiterate patients.[35]

An invasive strategy was more likely to be employed for NSTEMI patients in more prosperous economies. Observational data has demonstrated that rates of coronary angiography and revascularization during index hospitalization are inversely related to mortality rates in patients admitted for NSTEMI at 28 days, 6 months and one year after comprehensive adjustment.[11,14,36] Accordingly, interventional technologies have come to dominate cardiology practice for NSTEMI and this creates a financial burden on cardiovascular healthcare delivery.[8] In middle income countries, compared with high income countries, the number of interventional cardiologists is lower by nearly a half and 24/7 catheter laboratory facilities lower by a third.[8] The structural deficit affecting person power and facilities in less wealthy countries inevitably translates into the procedural deficit we observed.

We also observed underuse of cardiac rehabilitation, with only 36 and 40% of NSTEMI patients in UMICs and LLMICS, respectively, being referred. Though cardiac rehabilitation can reduce mortality, morbidity, and hospital re-admissions,[37] it is only available in approximately one-quarter of low-to-middle income countries,[38] and the costs of a typical supervised cardiac rehabilitation model employed in HICs are prohibitive in a low-income country setting.[39] Conversely, provision of guideline-recommended pharmacological treatments on discharge was very high with >95% of patents with NSTEMI in LLMICs receiving dual antiplatelet therapy and statins. This shows that factors such as a skilled workforce,[2] high levels of knowledge transfer from scientific studies to healthcare professionals,[40] and greater uniformity of recommendations from guidelines of national and regional societies,[13] can overcome economic conditions to achieve guideline-recommended care. The ACVC-EAPCI EORP STEMI registry also documented excellent provision of these medications in Europe and the Middle East,[26] demonstrating the widespread acceptance of the importance of these pharmacological therapies for patients with an acute myocardial infarction.

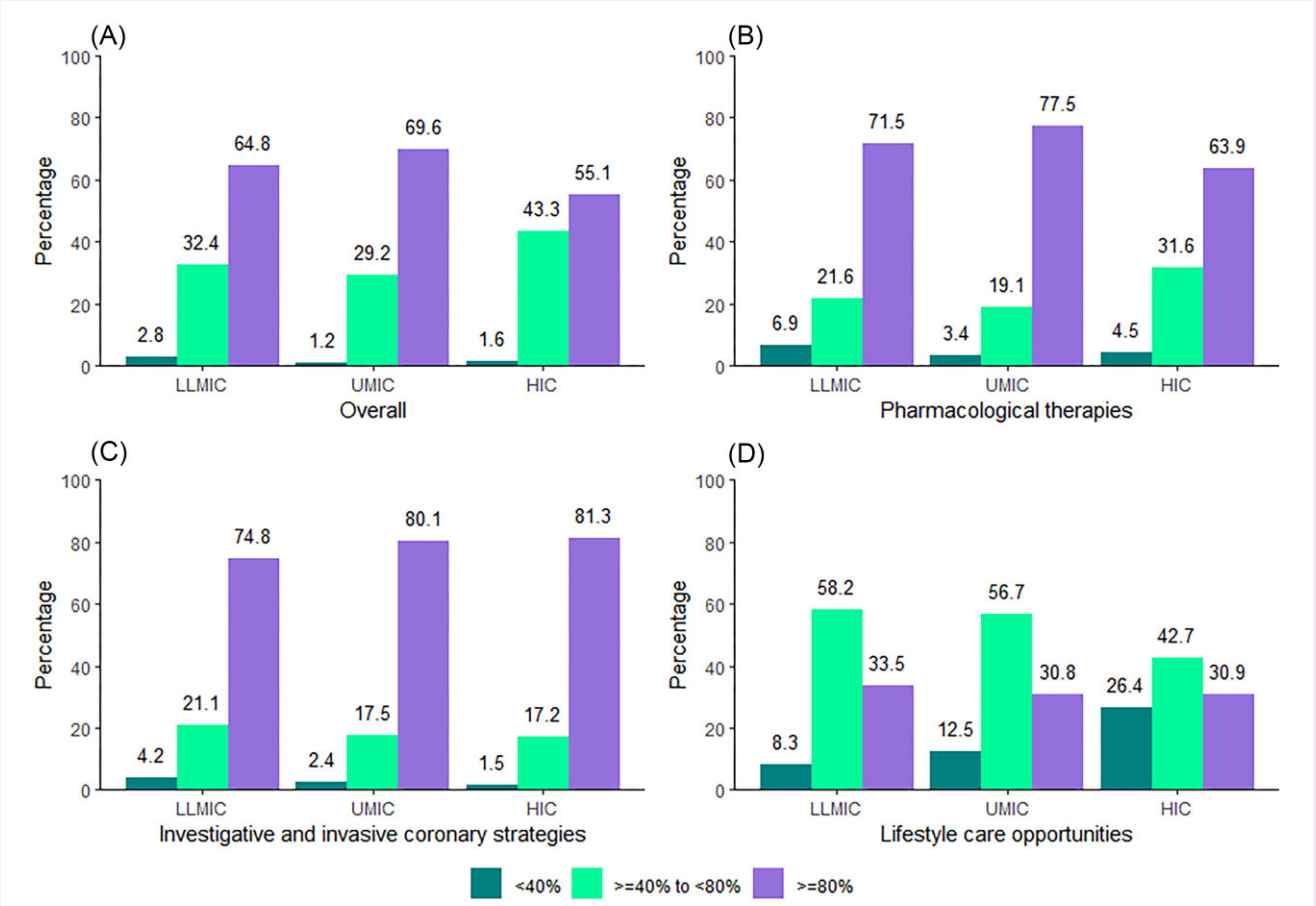


Figure 3 Performance by quality indicator grouping stratified by receipt of optimal care and country income classification. (*A*) Overall, (*B*) Pharmacological therapies, (*C*) Investigative and invasive coronary strategies, (*D*) Lifestyle care opportunities.

Limitations

First, because of the observational nature of the data, the study design cannot show a causal relationship, but only an association between country wealth and differences in presentation, care, and outcomes for NSTEMI. Second, the minority of patients were from LLMICs. Third, a greater proportion of participating centres in LLMICs, compared with HICs, were specialty or teaching research hospitals (73% vs. 50%), had PCI capability (89.3% vs. 82.5%), and had cardiac surgery on site (71% vs. 51%) (Supplementary material online, *Table S2*); thus, the selected sites in LLMICs are not truly representative of all centres in those countries, and the disparities in interventional care by income classification may be wider than we report. Fourth, the majority of participants from HICs were Caucasian (91%), whereas only 43% of participants in LLMICs were Caucasian (with 39% Asian and 9% Black), so biological determinants may have influenced the adverse event rates we observed in different income classifications. Fifth, we assessed for variation by country income classification but did not additionally investigate for an effect of income inequality amongst a country's residents, which has been associated with worse cardiovascular outcomes.[41,42] Sixth, the majority of patients included in the study were men, consequently the results cannot be automatically translated to women. Seventh, the representation of low-income countries within the LLMIC stratification was relatively small (Supplementary material online, *Table S1*), so the disparities in care and outcomes for NSTEMI in these countries may be greater than we observed. Eighth, despite its wide representation, this is not a global study as not all regions are included. Ninth, the number of outcomes was insufficient to allow adjustment of crude rates by baseline differences and confounders.

Actions to be taken

The findings of this registry imply further steps to be taken into consideration to achieve equity in NSTEMI outcomes across country income classification. All efforts should be made to increase the availability and use of coronary intervention for NSTEMI in LLMICs. An initiative could follow the example of the highly successful 'Stent for Life', which aimed to drive equal access to primary PCI across 19 countries in Europe, and coincided with increasing rates of primary PCI across ESC member states.[26,43] Cardiac rehabilitation could also be made more widely available in LLMICs through the adaptation of models tailored to low resource settings.[39] Policy strategies to reduce the population burden of ischaemic heart disease are required in LLMICs, where there is a trend towards widening disparities in the prevalence of key risk factors—such as smoking, blood pressure, and diabetes mellitus—compared with HICs.[8] The European Association of Preventative Cardiology 'Prevention in your country' initiative provides a comprehensive resource of exemplar initiatives for risk factor modification.[44] Both the ESC and the World Health Organization must continue to advocate to raise the priority accorded to prevention of disease, create health-promoting environments, and

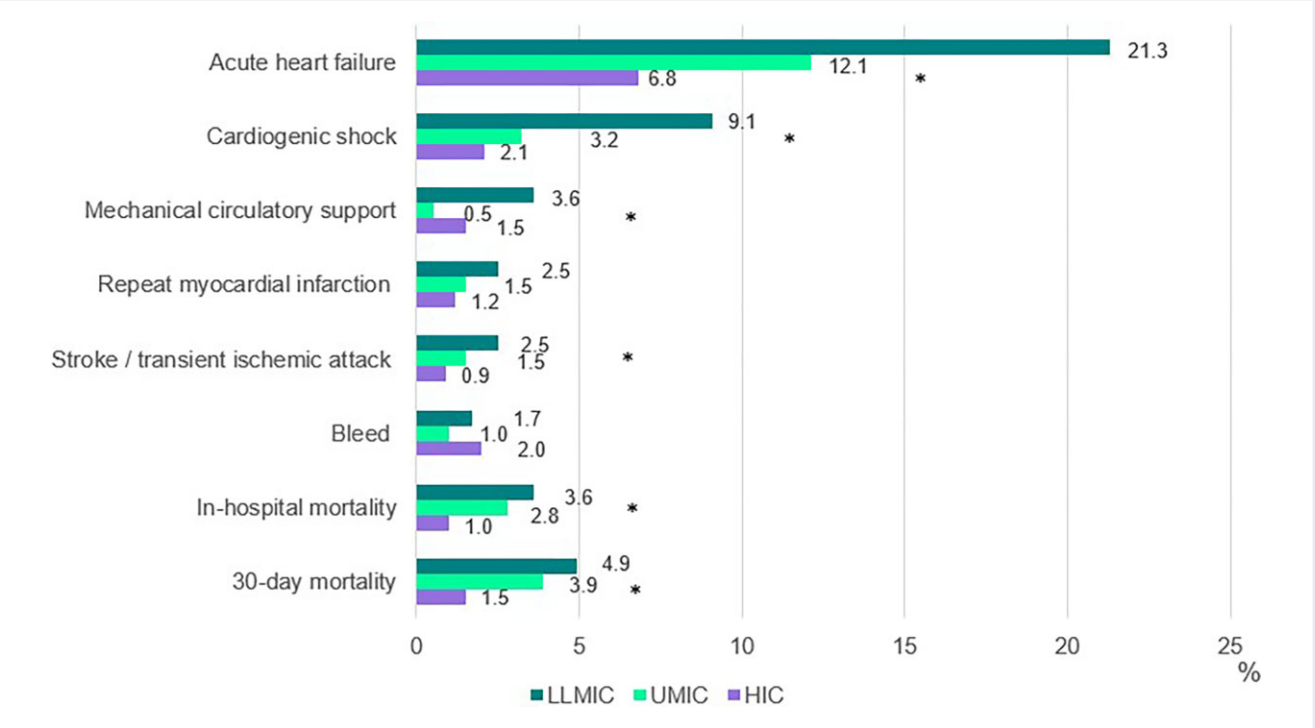


Figure 4 In-hospital outcomes and 30 day mortality by country income classification. * indicates statistical significance ($P < 0.05$).

strengthen national capacity, leadership, and governance for disease prevention.[8,45]

Supplementary material

Supplementary material is available at *European Heart Journal—Quality of Care and Clinical Outcomes* online.

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Data availability

The data underlying this article are subject to an embargo of 12 months from the publication date of the article. Once the embargo expires, the data will be available upon reasonable request to the EORP NSTEMI Executive Committee Chair, with the approval of the EORP Oversight Committee.

Appendix—ESC EURObservational Research Programme Non-ST-segment elevation myocardial infraction (NSTEMI) Registry Investigator Group

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