Evaluation Of Acute Myocardial Infarction Care in Patients Admitted in A Non-PCI Capable Tertiary Hospital Using Validated Quality Indicator: A Retrospective Cohort Study

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Abstract

Introduction. This retrospective cohort study investigated the quality of care provided to patients with acute myocardial infarction (AMI) at a non-PCI capable tertiary hospital. We employed validated quality indicators (QIs) endorsed by the European Society of Cardiology (ESC) to assess adherence to evidence-based guidelines for AMI care.

Objectives. This retrospective cohort study aims to comprehensively evaluate the quality of acute myocardial infarction (AMI) care provided at a non-PCI capable tertiary hospital by utilizing validated quality indicators (QIs). The study assesses adherence to evidence-based guidelines, identifies areas of improvement, and explores the association between care processes and patient outcomes.

Methods. This retrospective cohort study analyzed patients admitted with acute myocardial infarction (AMI) to a non-percutaneous coronary intervention (PCI) capable tertiary hospital between January 2021 and December 2022. Data on quality indicators were systematically extracted from medical records to assess adherence to clinical guidelines and patient outcomes. Logistic regression was used to identify predictors of mortality, while controlling for potential confounders such as demographic and clinical characteristics. Ethical approval was granted, and patient data was anonymized in compliance with national regulations.

Results. The study identified a patient population consistent with established cardiovascular risk factors. Adherence rates to QIs varied across different domains. Notably, the risk-adjusted 30-day mortality rate was 29.09%, highlighting the need for further investigation into factors influencing patient outcomes.

Conclusion. Our study highlights both strengths and gaps in adherence to AMI quality indicators at a non-PCI hospital. While key treatments such as P2Y12 inhibitor use and anticoagulation were well implemented, areas like reperfusion protocols, LVEF measurement, and data collection require improvement. These findings reinforce the importance of evidence-based practices and the need for targeted quality improvement initiatives to address disparities in care. Future efforts should focus on enhancing data collection and exploring the reasons behind regional variations to optimize outcomes for AMI patients in resource-limited settings.

Keywords. *Acute myocardial infarction, Quality indicators, Risk assessment*

Introduction

Myocardial Infarction (MI) is defined by severe chest discomfort occurring at rest, lasting >10 mins with onset of less than 2 weeks, described as progressive, prolonged, and becoming more frequent than previous episodes. It is caused by an imbalance of myocardial oxygen supply and demand brought about by various pathophysiologic mechanisms that ultimately lead to coronary artery thrombosis. Its diagnosis has increased over the past years due to a wider use of highly sensitive troponin assays, stepping up the diagnosis of unstable angina (UA) to a non-ST segment elevation MI (NSTEMI).[1] There is limited local data on the prevalence of MI in the Philippines, but in a tertiary hospital, around 1-2 patients are admitted per day. Moreover, some patients at the Wards develop significant morbidity from MI, increasing its prevalence in our local setting.

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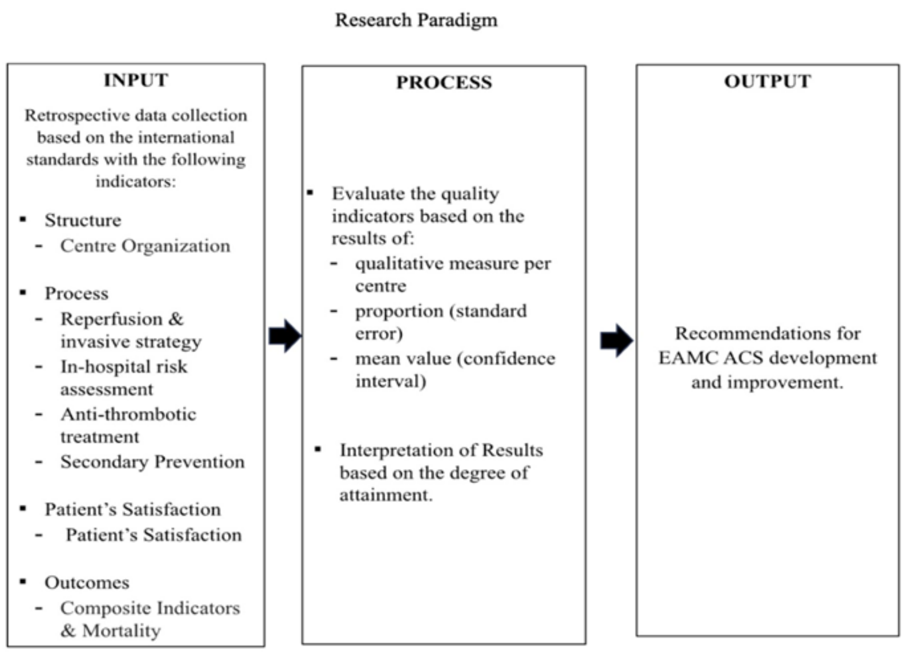

Figure 1. Study Flowchart

Based on this, the quality of health care for this population of patients has not yet been defined.

Quality of care is described as a measure by which health care services offered by an institution or group increase the probability of desired health outcomes as dictated by established evidence of medical management. Measuring quality of care is a complex interplay of several factors; thus, various frameworks have been formulated to evaluate quality of care. One of these frameworks describes a structure-process-outcome model ("Donabedian"), which may be an appropriate tool to describe a patient's demographics (structure) and relate it to the diagnostics, procedures, and therapeutics given (process), and how the latter affected the quality of life of the patient with a certain disease (outcome).[2]

In 2020, the European Society of Cardiology (ESC) and Association for Acute Cardiovascular Care (ACVC) has further improved this model by defining specific domains that have significant roles in patients that developed MI. These domains include center organization, reperfusion-invasive coronary strategy, risk assessment, antithrombotic, secondary prevention, and patient satisfaction.

Because of the sheer number of patients assessed to have MI, together with all the diagnostics and therapeutics available, quality of care given is yet to be established. This study will aim to establish the baseline assessment of the quality of care given by a tertiary hospital to its patients diagnosed with MI and explore the association between care processes and patient outcomes.

Methodology

Study Design. The study employed a retrospective cohort analysis, focusing on patients admitted to a non-percutaneous coronary intervention (PCI) capable tertiary hospital over a two-year period, from January 2021 to December 2022. Quality of care indicators were meticulously identified through an extensive review of existing literature. The methodology included the systematic extraction of pertinent data from medical records, which was then utilized to document and analyze the selected quality of care indicators.

Setting. The study was conducted in a tertiary general hospital, whose main goal is to provide quality medical care and treatment to patients across all populations. This hospital is designated as an apex hospital, as well as a training and teaching center, providing appropriate training programs, materials, and facilities to foster the development of its staff.

The core team managing patients admitted for acute myocardial infarction (AMI) works closely with teams from other specializations to deliver optimal quality care for all patients. Patient management is based on a tailored, interdisciplinary, patient-centered approach, adhering to published guidelines.

The study was carried out in a non-percutaneous coronary intervention (PCI) capable tertiary hospital. The patient recruitment period extended from January 2021 to December 2022. During this period, all eligible patients diagnosed with acute myocardial infarction upon admission were included. Data collection and follow-up spanned this two-year timeframe, allowing for a comprehensive retrospective cohort analysis.

*Population and Sampling Method. Sample Size***.** The study encompassed a total of 115 patients admitted with acute coronary syndrome between January 2021 and December 2022 (*Figure 1*). This sample size provides a robust foundation for evaluating acute myocardial infarction care at a non-PCI capable tertiary hospital. The substantial cohort allows for a comprehensive analysis of key quality indicators, ensuring a meaningful representation of the AMI patient population and enhancing the validity of the study findings.

Patients were further subclassified based on their electrocardiographic findings into ST-elevation myocardial infarction (STEMI) and non-ST-elevation myocardial infarction (NSTEMI) categories. STEMI was defined by persistent ST-segment elevation in two or more contiguous leads or new left bundle branch block on ECG with elevated troponins. NSTEMI included patients with elevated troponins without ST-segment elevation on ECG. This classification allowed subgroup analysis of care processes and quality indicators relevant to each type.

Inclusion Criteria

1. Patients aged ≥18 years admitted at a non-PCI capable tertiary hospital from January 2021 to December 2022; and
2. Fulfills the criteria set by the current (fourth) definition of myocardial infarction defined as, detection of a rise and/or fall of cTn with at least one value above the 99th percentile and with at least one of the following:
3. Symptoms of acute myocardial ischemia;
4. New ischemic electrocardiographic (ECG) changes;
5. Development of pathological Q waves;
6. Imaging evidence of new loss of viable myocardium or new regional wall motion abnormality in a pattern consistent with an ischemic etiology;
7. Identification of a coronary thrombus by angiography including intracoronary imaging or by autopsy.

Exclusion Criteria. Patients whose symptoms can be attributed to other diagnoses were excluded.

Data Gathering Procedures. Measurement of the indicators was performed using medical file data with a standardized method. The team identified eligible patients from their medical files and extracted the pertinent information into a spreadsheet.

*Outcomes***.** The primary outcome of the study was the quality of care provided to patients with acute myocardial infarction. This was assessed using various quality indicators identified through literature review and extracted from medical records. These indicators included adherence to clinical guidelines, timeliness of care, and patient outcomes such as mortality and morbidity rates.

*Exposures***.** The primary exposure was the admission to a non-PCI capable tertiary hospital with a diagnosis of acute myocardial infarction. The exposure was defined based on the clinical criteria outlined in the inclusion criteria.

Predictors. Predictors of interest included demographic factors, clinical characteristics (comorbidities, severity of myocardial infarction), and hospital-related factors (availability of specialized care teams, adherence to clinical guidelines).

*Potential Confounders***.** Potential confounders considered included pre-existing medical conditions, medication use. These factors were identified through literature review and expert consultation.

*Effect Modifiers***.** Effect modifiers that could influence the relationship between exposure and outcomes included patient age, comorbidities, and the presence of multidisciplinary care teams. These variables were examined for potential interactions with the primary exposure.

Data Sources and Methods of Assessment. The primary sources of data were patient medical records from the non-PCI capable tertiary hospital. The data extraction process involved reviewing medical files and transferring relevant information into a structured spreadsheet. The data collected included demographic information, treatment details, and outcome measures.

For each variable of interest, standardized methods of assessment were employed to ensure consistency and comparability.

Statistical Analysis. Quantitative variables were handled using advanced statistical methods to provide a comprehensive analysis of the quality of care at a non-PCI capable tertiary hospital and its relation to patient outcomes, specifically mortality. Quantitative variables were analyzed both as continuous variables.

Frequency tables and means were used to summarize demographic and clinical characteristics of the study population. Initial assessments of associations between individual variables and patient outcomes were conducted. Logistic regression modeling was employed to control for potential confounding variables and to identify independent predictors of patient mortality. Variables included in the multivariate model were selected based on clinical relevance and significant findings from the univariate analysis.

*Scope and Limitation***.** This study's retrospective design limited generalizability. Potential selection bias due to missed eligible patients and the reliance solely on medical records, excluding patient perspectives, could have influenced results. Future research incorporating

Table I. Baseline Characteristics of Patients

Characteristics	
Population, *n*	115
Age (years), *Mean (SD)*	63.9 (11.89)
Sex	
Male, *n (%)*	49 (42.61)
Female, *n (%)*	66 (57.39)
BMI, *Mean (SD)*	NR
Smokers, *n (%)*	42 (36.52)
Diabetes, *n (%)*	37 (32.17)
Stroke, *n (%)*	32 (27.83)
Peripheral artery disease, *n (%)*	6 (5.22)
AMI Subtype	
STEMI, *n (%)*	24 (20.9)
NSTEMI, *n (%)*	91 (79.1)

Table II. Quality Indicators Attainment Showing the Degree of Completeness and Compliance with QIs at an Individual-Level.

	Type of quality indicator	QI attainmanet
Structure	Written protocols for network	NR
	Hospital use of hs-cTn	NR
	Prehospital interpretation of ECG	NR
	Participation in regular registry	NR
	Assessment of times to reperfusion	NR
Process	% STEMI pts reperfused, proportion (SE)	0
	% STEMI pts timely reperfused, proportion (SE)	0
	%NSTEMI pts with coronary angiography <24h, proportion (SE)	NR
	Use of radial access if invasive strategy, proportion (SE)	NR
	FMC to arterial access time	NR
	% of pts with LVEF assessment, proportion (SE)	62.39 (10.73)
	% of pts with LDL - cholesterol evaluation, proportion (SE)	22.52 (5.68)
	% of pts with risk score assessment (Grace), proportion (SE)	56.62 (12.23)
	% of pts with risk score assessment (CRUSADE), proportion (SE)	53.04 (11.40)
	% pts with "adequate P2Y12 inhibition", proportion (SE)	77.57 (19.24)
	% pts with parenteral anticoagulant at admission, proportion (SE)	89.57 (31.41)
	% pts discharged on DAPT, proportion (SE)	75.24 (17.86)
	% pts with reported duration on DAPT, proportion (SE)	2.83 (1.76)
	% pts with high-intensity stains at discharge, proportion (SE)	88.79 (29.10)
	% pts with LVEF <40% on ACEI (or ARB), proportion (SE)	84.21 (10.07)
	% pts with LVEF <40% on beta blockers, proportion (SE)	84.21 (10.07)
Patient's Satisfaction	Systematic data collection on patient's experience, proportion (SE)	0.88 (1.00)
	Systematic evaluation of quality of life, proportion (SE)	0
	Discharge letter sent to patient, proportion (SE)	96.52 (56.49)
Outcomes	Opportunity-based composite QI, mean (CI)	52.23 (52.20 - 52.26)
	All-or-none composite QI, mean (CI)	57.89 (57.64 - 58.14)
	Risk adjusted 30-day mortality rate, proportion (SE)	29.09 (4.75)

NR – No record

Table III. Univariate and Multivariate Hazard Ratio Analysis of Select Quality Indicators

Dependent	HR (univariable)	HR (multivariable)
% of pts with risk score assessment (Grace)	0.68 (0.29-1.60, *p=0.376*)	0.72 (0.29-1.79, *p=0.480*)
% of pts with risk score assessment (Crusade)	0.91 (0.39-2.10, *p=0.822*)	0.85 (0.32-2.26, *p=0.751*)
% pts with "adequate P2Y12 inhibition"	0.43 (0.14-1.33, *p=0.143*)	0.16 (0.03-0.80, *p=0.026*)
% pts with parenteral anticoagulant at admission	0.24 (0.08-0.71, *p=0.010*)	0.21 (0.07-0.69, *p=0.010*)
% pts discharged on DAPT	0.89 (0.25-3.12, *p=0.852*)	4.77 (0.69-32.98, *p=0.113*)
% pts with reported duration on DAPT	2.78 (0.81-9.52, *p=0.103*)	4.20 (1.07-16.46, *p=0.040*)
% pts with high-intensity stains at discharge	0.59 (0.14-2.59, *p=0.485*)	0.46 (0.08-2.70, *p=0.390*)

patient-centered approaches may provide a more comprehensive evaluation of care.

*Ethical Considerations***.** The study was approved by the Institutional Review Board with a waiver of consent due to its retrospective design. All procedures adhered to data privacy regulations (Data Privacy Act, 2012) and national ethics guidelines (2017). Patient data was anonymized and securely stored. No conflicts of interest were declared. Data was collected and anonymized using Microsoft Excel on a password-protected MacBook Air M2 accessible only to investigators and advisors. Data will be disposed of after three years.

Results

This study aimed to evaluate the quality of AMI care at a non-PCI hospital using validated ESC/ACVC indicators. Data from medical records were reviewed for risk stratification (GRACE, CRUSADE scores), dual antiplatelet therapy use, anticoagulation, admission echocardiography for ejection fraction, and high-intensity statin use. Statistical analysis compared findings to international data.

Patient demographics and characteristics. Table I summarizes baseline characteristics of 115 AMI patients admitted between January 2021 and December 2022 (42.6% male, 57.4% female). Comorbidities included smoking (36.5%), diabetes (32.2%), stroke (27.8%), and peripheral artery disease (5.2%). Of the 115 patients, 24 (20.9%) were diagnosed with STEMI and 91 (79.1%) with NSTEMI.

Seven ESC/ACVC quality indicators were assessed across four categories: structure, process, patient satisfaction, and outcome. Structure indicators focused on the hospital's ability to provide advanced cardiac care if needed. Process indicators covered reperfusion strategies, risk assessment (including scoring systems

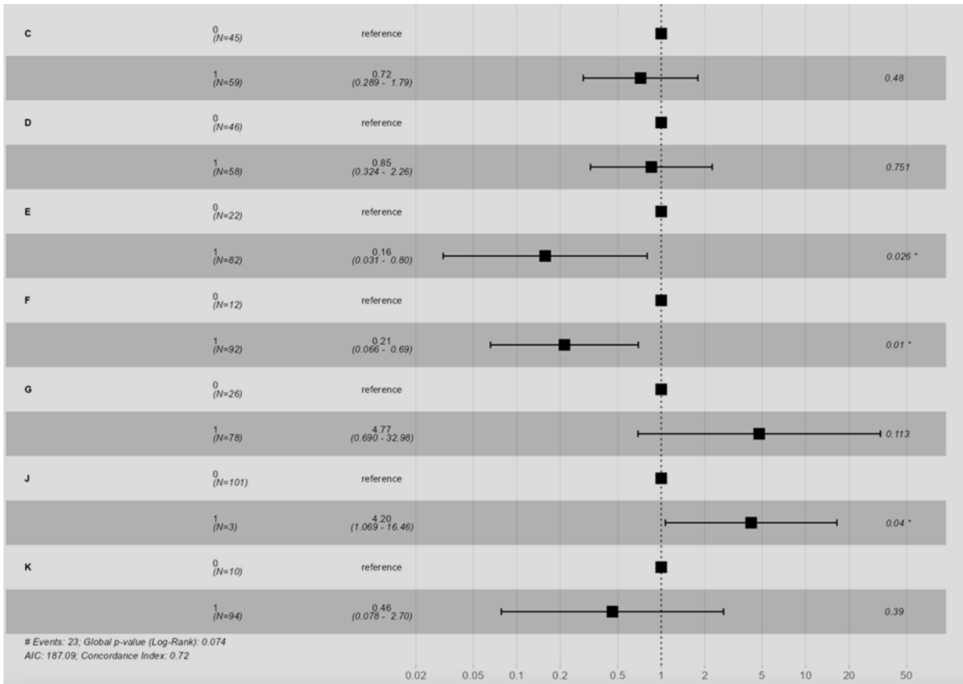

Figure 2. Forest Plot for the multivariate analysis showing the associations between quality indicators and 30-day mortality risk (Hazard Ratio). C – Patients with GRACE risk scoring; D – Patients with CRUSADE risk scoring; E – Patients with adequate P2Y12 inhibition; F – Patients with parenteral anticoagulation at admission; G – Patients discharged with DAPT; J – Patients with reported duration of DAPT; K – Patients with high-intensity statins at discharge.

and echocardiography), antithrombotic therapy, and secondary prevention medications.

Patient satisfaction was not directly measured in this study.

Quality indicators assessment. The study employed a subset of ESC's validated Quality Indicators (QIs) for AMI, focusing on reliable, practical measures aligned with current recommendations. These QIs assessed four key areas: structure (center organization), process (reperfusion, risk assessment, antithrombotic therapy, secondary prevention medication use), and outcomes, excluding patient satisfaction.

Among STEMI patients, no documentation was available on time-to-reperfusion, transfer for PCI, or fibrinolysis administration, reflecting the institutional limitation in delivering reperfusion therapy. In contrast, NSTEMI patients also lacked documentation regarding early angiography within 24 hours of diagnosis. These omissions highlight missed opportunities for subtype-specific interventions aligned with ESC guidelines.

Centre organization & reperfusion/invasive strategy. Data limitations precluded assessment of center organization and reperfusion/invasive strategy domains. No documentation was found for network protocols, hs-cTn utilization, prehospital ECG interpretation, registry participation, reperfusion timelines, NSTEMI angiography rates within 24 hours, radial access use, or FMC-to-arterial access times.

In-hospital risk assessment scores (GRACE, CRUSADE) were documented for a moderate proportion of patients (53-57%). LVEF assessment and LDL-C measurement rates were lower (62% and 23%, respectively).

Antithrombotic treatment data showed adequate use of P2Y12 inhibitors (78%) and parenteral anticoagulation (90%). Dual antiplatelet therapy was prescribed at discharge for 75% of patients, but documentation of duration was limited (3%).

Secondary prevention medication use was high: statins (89%), ACEi/ARBs or beta-blockers (84%) for eligible patients. Information on contraindications or intolerance was lacking.

Patient satisfaction data was limited to discharge letter documentation (97%). Systematic collection of patient experience and quality of life data was absent.

Composite Quality Indicators (QIs) indicated moderate adherence to recommended care processes

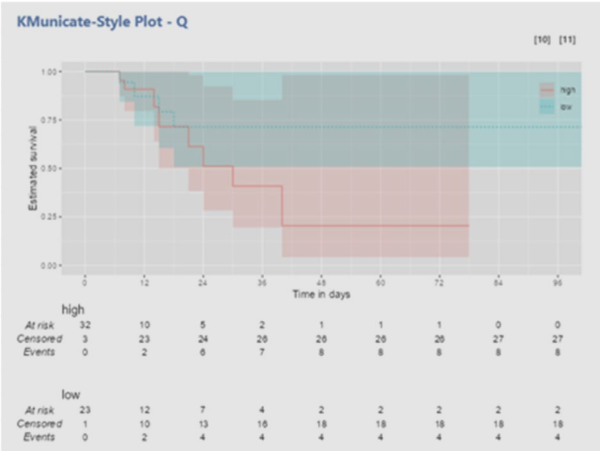

Figure 3. Kaplan-Meier curve plotting survival probability based on opportunity-based composite QI score against time in days. Red line represents the Q high; Blue line represents the Q low.

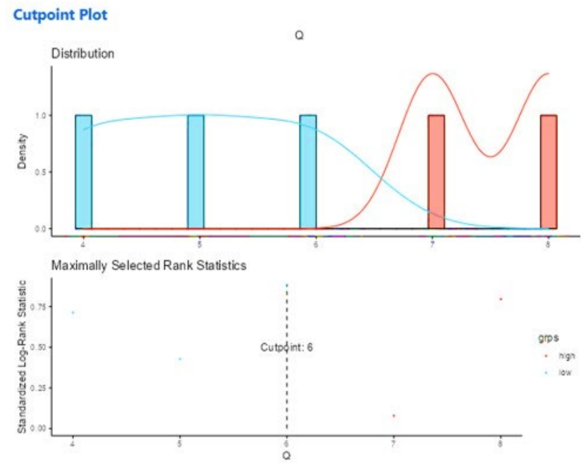

Figure 4. Cox proportional hazards model plotted with compliance with quality indicators against patient survival

(opportunity-based: 52%, all-or-none: 58%). The risk-adjusted 30-day mortality rate was 29%.

In conclusion, adherence to evidence-based practices varied across domains. While medication use was generally good, data collection on patient experience and some quality indicators was lacking. Further research is needed to explore the relationship between specific care processes, overall guideline adherence, and patient mortality.

Table IV. Compliance with opportunity-based quality indicators and 1,2-year survival, with mean confidence interval (CI).

Levels	Time (months)	Number at risk	Number of events	Survival (%)	95% confidence interval	
					Lower (%)	Upper (%)
Q high	12	12	1	95.5	87.1	100
Q high	24	6	3	61.4	36.5	100
Q low	12	12	2	87.2	71.9	100
Q low	24	7	2	71.3	50.8	100

Table V. Degree of Attainment of Quality Indicators

Type of quality indicator	South East Asia	Non-PCI Hospital	P-Value
% STEMI pts reperfused	65	0	*
% STEMI pts timely reperfused	9	0	*
% of pts with LVEF assessment	81	62	<0.001
% pts with "adequate P2Y12 inhibition"	95	78	<0.001
% pts discharged on DAPT	93	75	0.117
% pts with high-intensity stains at discharge	90	89	0.730
% pts with LVEF <40% on ACEI (or ARB)	64	84	0.070
Opportunity-based composite QI	83	52	<0.001
All-or-none composite QI	92	69	0.001

* p-value cannot be computed because sd is equal to zero

LEGEND

<50%
50%-59%
60%-69%
70%-79%
80%-89%
90%-100%

Source for SEA: https://academic.oup.com/ehjacc/article/9/8/911/6125648

Association of QI compliance and completeness with 30-day mortality. *Table III* explores the association between quality indicator (QI) compliance and 30-day mortality. Univariate analysis identified only parenteral anticoagulation on admission as statistically significant (HR = 0.24, *p=0.010*), suggesting higher mortality. Multivariate analysis revealed three significant QIs: adequate P2Y12 inhibition (HR = 0.16, *p=0.026*) and parenteral anticoagulation (HR = 0.21, *p=0.010*) associated with lower mortality, while documented duration of dual antiplatelet therapy (DAPT) showed a higher mortality risk (HR = 4.20, *p=0.040*). Other QIs were not statistically significant.

Figure 2 presents the Forest Plot for the multivariate analysis.

Kaplan-Meier curves (*Figure 3*) indicated a significant association between opportunity-based composite QI compliance and survival. Patients with high QI adherence had a notably lower mortality rate compared to those with low adherence.

A Cox proportional hazards model (*Figure 4*) further suggested that achieving at least six quality indicators was associated with improved survival.

Table IV summarizes survival rates based on QI compliance. High adherence corresponded with higher long-term survival (95.5% at 12 months, 61.4% at 24 months) compared to low adherence (87.2% at 12 months, 71.3% at 24 months).

Use of cQIs for benchmarking. *Table V* compares quality indicator (QI) attainment between Southeast Asia and the studied non-PCI hospital in the Philippines. Significant disparities were found in reperfusion rates for STEMI patients, LVEF assessment, and P2Y12 inhibitor use. These findings suggest potential gaps in timely interventions, cardiac function evaluation, and antiplatelet therapy optimization at the Philippine hospital.

Discussion

This study evaluated the quality of care for acute myocardial infarction (AMI) at a non-PCI-capable tertiary hospital, focusing on adherence to validated QIs. The patient population had a typical profile of cardiovascular risk factors, including smoking (36.52%), diabetes (32.17%), stroke (27.83%), and peripheral artery disease (5.22%). These characteristics reflect a broader AMI population, supporting the generalizability of our findings. Importantly, adherence to key QIs, such as P2Y12 inhibitors (77.6%), anticoagulation at admission (89.6%), and high-intensity statins at discharge (88.8%), was associated with favorable survival rates—95.5% at 12 months and 61.4% at 24 months.[7] This reinforces the importance of guideline-directed therapy in improving patient outcomes, even in settings where PCI is not available.

Despite these findings, several limitations must be acknowledged. First, the study hospital lacked PCI facilities and formalized protocols for referring patients for reperfusion therapy, relying instead on physician discretion for transfers to the nearby Philippine Heart Center. In addition, key diagnostic tools, such as high-sensitivity troponin assays, were unavailable, which may have delayed accurate diagnosis.[3-5] The absence of pre-hospital ECGs, a consequence of the limitations in the Philippine healthcare system, further complicated the early identification of AMI. Data collection was also hampered by missing information on key clinical measures, such as left ventricular ejection fraction (EF) and LDL-C testing, and incomplete documentation of risk stratification scores. Finally, data on DAPT duration and patient-reported outcomes, such as health-related quality of life (HRQoL), were not captured, largely due to a lack of standardized data collection processes.

In patients presenting with STEMI, documentation was notably lacking on key aspects such as time to reperfusion, transfer for PCI, or the use of fibrinolytic therapy—pointing to institutional challenges in delivering prompt and effective treatment. Likewise, NSTEMI cases showed no recorded evidence of early angiography within 24 hours of diagnosis. These omissions reflect both systemic gaps in care and missed opportunities to apply targeted interventions in line with ESC guidelines.

The results demonstrate that, despite the absence of PCI capabilities, adherence to evidence-based treatments such as P2Y12 inhibitors and anticoagulation was linked to improved survival outcomes. This underscores the potential for significant clinical benefits even in resource-limited settings. However, the relationship between reported DAPT duration and higher mortality was an unexpected finding that warrants further investigation. It is possible that variations in follow-up care or other unmeasured factors contributed to this outcome. The absence of systematic data collection on patient quality of life and post-discharge follow-up represents a notable gap in understanding the long-term impact of care. Overall, these results highlight the importance of adherence to AMI treatment guidelines but also underscore the need for more comprehensive data to better inform future care practices.

The findings of this study are relevant to other non-PCI-capable hospitals, particularly in settings with limited resources, where evidence-based medical management plays a critical role in improving AMI outcomes. However, the absence of a formal AMI registry and the incomplete collection of key prognostic indicators limit the broader applicability of some of our results. Future research should aim to address these gaps, particularly through the implementation of standardized data collection for patient outcomes, including health-related quality of life, to further inform the generalizability of findings across diverse healthcare environments.

Conclusion and Recommendations

Our study identified both similarities and differences in adherence to quality indicators for AMI care at a non-PCI hospital compared to existing literature. These findings highlight areas for improvement, particularly in patient experience and data collection. Further research can be done on exploring these disparities to formulate strategies and allocate resources more efficiently for better care. The link between quality indicators and mortality reinforces the importance of evidence-based practices in AMI management.

The observed differences in quality indicators between the studied hospital and Southeast Asia call for focused interventions. The disparities in antiplatelet therapy, reperfusion, LVEF measurement, and guideline adherence highlight areas for improvement. Further research and data collection are needed to understand regional variations and challenges, especially in the local settings, where more advanced facilities are lacking. These findings provide a basis for quality improvement initiatives to ensure optimal outcomes for AMI patients.

Based on these findings and inferences based on documented information, we recommend: (1) Implement quality improvement initiatives to address disparities and enhance AMI care, focusing on patient experience and data collection; (2) conduct further research to explore the reasons behind observed disparities, particularly in medication use and guideline adherence; and; (3) continue benchmarking against regional standards and use identified differences to guide targeted interventions.[6]

Future efforts to improve quality of care should focus on developing tailored care pathways for both STEMI and NSTEMI patients. This ensures that each patient receives treatments and interventions backed by solid evidence, specifically suited to the type of heart attack they've experienced.

By implementing these recommendations, the hospital can improve AMI care, align practices with evidence-based guidelines, and ultimately enhance patient outcomes.

Conflict of Interest. There is no conflict of interest in this study. No funding was obtained to conduct the study.

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