

Research article

Improving the care of patients with acute myocardial infarction in Latin America through the creation of centers of excellence

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Abstract

Cardiovascular disease is a public health problem and the leading cause of death worldwide; its associated risk factors are widely identified and described. To standardize care processes and clinical outcomes for patients with Acute Myocardial Infarction, the Fundación Santa Fe de Bogotá (FSFB) established the first Clinical Care Center in Colombia. A systematic search of the literature was performed to establish rigorous standards of medical assistance, translating compliance into 15 quality indicators. Subsequently, a comparison with the processes in the FSFB was developed. A significant decrease in the rate of in-hospital complications was evidenced in more than 50% of the patients after the creation of the Center. Also, the requirement for thrombolysis and the number of patients with percutaneous coronary intervention were reduced. A readmission and mortality rate of less than 2 and 5%, respectively, were observed. These results were comparable with those of international reference centers. Implementing a Clinical Care Center makes it possible to guarantee homogeneous care, optimize care processes, and improve clinical outcomes in patients with Acute Myocardial Infarction.

AIMS

1. Introduction:

1.1 Understanding the relevance of the problem

Acute myocardial infarction (AMI) is the most severe manifestation of coronary disease and requires timely care (1). The treatment of AMI has considerably improved adverse outcomes during the last thirty years (2). Management of ST-segment elevation myocardial infarction (STEMI) involves reestablishing coronary blood flow as soon as possible. Therefore, percutaneous coronary intervention (PCI) is the strategy of choice. Fibrinolytic therapy is the optional therapy in cases where PCI is not possible. Subsequently, the patient should be taken for arteriography since, in most cases, there is residual stenosis requiring additional intervention (1). The establishment of this reperfusion strategy has made it possible to reduce mortality and morbidity in patients with AMI if it is administered within the first hours after the onset of symptoms and during the first minutes of contact with medical personnel (3)(4). Although current evidence indicates that PCI is the preferred reperfusion strategy for most STEMI patients, only a minority of patients receive this first-line treatment, and few patients are treated within

90 minutes after hospital arrival (5).

The evaluation of safe and effective care with high quality and value is the ultimate goal of clinical care centers. International institutions such as The Joint Commission, founded in 1951, seek to improve standards in the field of medical care, and consequently, each certified institution must continuously undergo evaluation processes that allow for maintaining the highest standards of care. Indeed, the Fundación la Santa Fe de Bogotá, in collaboration with the cardiology services, has managed to stand out by complying with these standards, being the first clinical care center certified by The Joint Commission in Colombia for care of acute myocardial infarction.

This publication highlights the role of clinical care centers in priority pathologies such as AMI. In addition, it summarizes the process of setting up a center and shows our experience, showing the immediate impact on the population and reinforcing the idea that it is a worthwhile bet for health institutions.

2. Methods and Results

A systematic search of the literature was performed in PubMed and Embase with the following keywords (MeSH): cardiology; quality; efficiency; center of excellence; acute myocardial infarction and quality indicators (Figure 1). Subsequently, the RECODEC information collection system of the Hospital Universitario Fundación Santa Fe de Bogotá was used to obtain data corresponding to the rate of AMI events after the creation of the Clinical Care Center for Acute Myocardial Infarction, including the number of admissions, in-hospital mortality, and the proportion of patients with ST-elevation AMI undergoing percutaneous coronary intervention versus those who received thrombolysis. Data on admission, hospital-level mortality, and the proportion of patients with ST-segment elevation myocardial infarction undergoing thrombolysis versus PCI were collected.

2.1 What is a center of excellence and what is its importance?

One of the frequent concerns for the directors of healthcare institutions is to maintain the quality of care and, at the same time, remain efficient. These two concepts are often mistakenly considered to be incompatible. Quality assessment is an integral part of contemporary health care. However, it is a difficult, multifactorial, and multidimensional process that cannot be estimated only by the clinical outcomes that occurred in the patient (6).

In the competition of health markets, it should be considered that most users do not know how to use information that allows them to choose between one hospital or another. Porte and Teisberg proposed that competition should be carried out by diagnosis and/or the number of procedures to facilitate the patient's decision-making based on indicators of results for a specific procedure or diagnosis. This model allows for a continuous improvement in the quality of care (an ideal scenario for the creation of clinical care centers) (7). This applies to health systems, in which patients have no limitation in choosing the institutions for the treatment and monitoring of their illness. This, however, cannot be applied to any context of health-care systems with limited resource capacity.

A center of excellence (CoE) is a specialized team whose mission is to provide the organization they work for with outstanding medical care and to promote the development of research and training with high levels of efficiency and effectiveness (8). Excellence is based on the high quality and productivity of research, attractiveness, concentration of resources, international visibility, and organizational solidity (Figure 2) (9). In a clinical care center, health professionals are in continuous improvement, which allows for accelerating and maintaining the learning curve. This model shows that as the staff gains experience, the occurrence of errors in attention progressively decreases (8). The three pillars of a center of excellence are its volume, a culture of continuous improvement, and a favorable professional culture (10). Regarding the contribution to higher education, a CoE gener-

ates environments conducive to research, with high-quality professors, favorable working conditions, job security, adequate facilities, financing, academic freedom, and an atmosphere of intellectual competition and self-government (11).

CoEs can improve health care services in communities. On the other hand, institutions committed to these programs are more capable of attracting new patients. The insurer can encourage patients to use the services of specific hospitals providing centers of excellence in special procedures (e.g. joint replacements, interventional cardiology, or cardiac surgery) (13). The CoE strategy is a winning bet that allows for improving the quality, efficiency, and effectiveness indices in health care. Institutions achieve goals that are difficult to equal by competitors. It also allows organizations to obtain a competitive and sustainable advantage in the long term (10).

2.2 AMI Centers of Excellence

There is a considerable gap between the optimal treatment of AMI and the one offered to patients around the world. To reduce this gap and improve the quality of care, it is necessary to establish measurable quality indicators in centers and care networks, conduct regular audits of processes, and implement strategies ensuring optimal care for patients with AMI, according to the accepted standards and with the best possible results (4). These initiatives led to the formation of a CoE for the attention of AMI.

Measuring the quality of care in patients with acute myocardial infarction (AMI) has always been a challenge that requires a multifactorial and multidimensional evaluation that cannot be made based on clinical symptoms alone. Indeed, the use of quality indicators (QI) has made it possible to make the evaluation of clinical care centers objective and find opportunities for improvement. The different scientific societies of cardiology have established different quality indicators (Table 1) (14)(6).

An inverse relationship between quality of care and 30-day mortality in patients with AMI has been documented (4). Traditionally, performance measures in AMI care are related to management guidelines established by scientific societies, which define the minimum standard of care for all patients who meet certain specific criteria and have no contraindications for its application (4)(15)(14).

In AMI care centers, in addition to reperfusion therapy, the measurement of other quality indicators is required, including the number of patients who correctly receive anti-thrombotic drugs during hospitalization. As well as complementary therapy at the time of discharge, such as a statin, beta-blocker, and angiotensin-converting enzyme inhibitor, as indicated. Even more relevant is the participation of complementary services such as cardiac rehabilitation, psychology, nutrition, and intervention for the cessation of smoking in the outpatient follow-up of patients. Indeed, the main measurable indicators of the quality of care are mortality at 30 days and readmissions in this period. However, other measurements during follow-up are relevant, such as quality

of life and the evolution of the psychological state of patients after an AMI (4).

There is a direct relationship between the annual volume of cardiovascular procedures (surgical revascularization and PCI) and the quality of care. Including short-term survival, physicians who perform more procedures have better results (16). The out-of-hospital phase of STEMI is critical; performing an electrocardiogram immediately after the patient's contact with health personnel has been shown to reduce delays in care times, reperfusion, and consequently mortality (16).

Clinics and local networks must optimize the available resources to guarantee rapid and effective care for patients with AMI. Clear protocols that are easily accessible to all the personnel involved are necessary, such as for the performance of electrocardiograms at the pre-hospital level with the ability to activate the hemodynamic laboratories when required, as well as for the optimization of patient transport time. One of the main concerns related to the strategy to optimize care networks for patients with AMI is related to the lack of consensus on the regionalization of care and the economic impact of these strategies (16). The American Heart Association published a document with recommendations for the development of strategies to increase the number of STEMI patients with early access to PCI; as the main strategy, it recommends the creation of specialized local centers and networks (5).

In previous years, the relationship between higher mortality and non-working hours (weekends and nights) in which STEMI patients attend hospitals was published (17). In highly specialized centers with AMI care networks, patients seen during and after business hours receive the same treatments with similar one-year outcomes (18). The success of STEMI treatment is directly related to time in care and to the patient's ability to recognize symptoms of AMI, as well as to the time needed to transfer the patient to the hospital, to access or transfer to centers with PCI capacity, and to time in detecting AMI in the emergency room and in establishing reperfusion therapy (5).

The CoE and specialized hospitals use care pathways in which a multidisciplinary team oversees patient care and decision-making. These care routes have improved the rates of adverse reactions, the length of hospital stay, and patient as well as caregiver satisfaction (10). The AMI care center at Fundación Santa Fe is aligned with these objectives of AMI care, from the very admission and diagnosis of the patient, including safe care during hospitalization, offering a multidisciplinary intervention, a continuous process of patient and family education as well as outpatient monitoring and accompaniment once the patient is at home.

According to the AHA (American Heart Association), an integrated system for the care of patients with STEMI must have the following components (5).

- Patient-centered care is the number one priority.
- High quality of care: safe, effective, and timely.
- Stakeholder consensus on system infrastructure.
- Increased operational efficiency.
- Quality incentives (pay for value)
- Measurement of patient outcomes.
- Evaluation mechanism to ensure measures of quality of care and evidence-based changes, including treatment guidelines
- A role for local community hospitals to avoid a negative impact.
- Reduction in disparities in the provision of health services to economic, educational, racial/ethnic, and geographic sectors.

2.3 Phases for the creation of a center of excellence

An adequate configuration is fundamental to achieving the total value of a center of excellence. First, a detailed description of the care model is required as well as a joint analysis between the care and administrative staff to coordinate the effort and increase the level of quality in attention (12). The experience of the Willis-Knighton health system began in 1980, demonstrating the viability of the service model, which led to the development of the other centers, reaching a total number of 11 in different areas of medicine. The organization has established three phases for the creation of a center of excellence (Table 3)(12).

The organizational design refers to the distribution of responsibilities and resources, ensuring coordination and performance and allowing the fulfillment of the center's mission. Unlike traditional conformation care is patient-centered; for example, if a cancer patient comes for treatment, they can have all the services required in one place, articulating areas of diagnosis and medical care, support services, and administrative procedures. In the traditional model, it is the patient who has to move to each of the required areas.

3. Results with impact

Figure 4 allows us to observe the behavior of the number of patients admitted to the AMI clinical care center at Fundación Santa Fe de Bogotá between November 2019 and December 2020. It was observed that even in the period of the SARS-COV pandemic -2, there was a growing trend in the number of patients with AMI who met the inclusion criteria for the center of excellence. An important piece of information was the impact of the formation of the center on the type of reperfusion strategy performed in STEMI (Figure 5) since -as a significant result- the number of patients undergoing thrombolysis progressively decreased to a minimum, aligning this indicator with the recommendation of the international guidelines for the management of AMI (23)(24).

Despite the SARS-COV-2 pandemic, the influx of patients admitted to the Clinical Care Center with a diagnosis of AMI meeting inclusion criteria between November 2019 and December 2021 shows an exponential growth (Figure 4) and with time a decrease in the proportion of patients taken for

thrombolysis can be observed, as well as a significant increase in those who underwent percutaneous intervention according to updated clinical recommendations (Figure 5). Indeed, in the first half of 2020, 80% of patients admitted to the Clinical Care Center with a diagnosis of STEMI underwent PCI vs. 20% who received thrombolytic treatment, and in the second semester of the same year, 100% of the patients underwent percutaneous surgery.

The proportion of in-hospital mortality was 2.5% in 2020 versus 5.1% in 2019. This shows that, since the creation of the acute myocardial infarction center in November 2019, there has been a reduction of in-hospital patient mortality. On the other hand, compared with international registers such as FAST-MI (2015), ACTION (2014), CAMI (2015), JAMIR (2018), KRAMI-RCC (2021), and SWEDE-HEAT (2019), the acute heart attack center of Fundación Santa Fe myocardium shares similar values with mortality rates of less than 5% per year (Figure 6). In addition to this, retrospectively reviewing the proportion of readmissions for cardiovascular causes in patients with Acute Myocardial Infarction at 30 days, we can observe that the annual proportion is less than 2% for 2020 and 7% for 2021 (Figure 7).

One of the limitations of our center lies in the lack of integration with other institutions inside and outside the city to expand the beneficiary population and generate a local integrated network that impacts the health of the country's population.

4. Discussio

4.1 How to do it in Latin America?

The 153 low-and middle-income countries constitute 80% of the world's population, where approximately 5.86 billion people present a wide variation in geography, culture, literacy, financial resources, access to health care, and regulation of health care. However, the burden of cardiovascular disease, including STEMI, is increasing at an unprecedented rate (19). The challenges for health institutions are manifold and include obtaining economic resources, competition in local settings, the acquisition of new technologies, and the presence of oversight entities that demand greater responsibility. In addition, patients currently have more information about the existing management and treatment standards (12).

The care of patients with AMI implies the application of integrated networks between high-complexity hospitals and hospitals in rural areas without specialized cardiovascular care services. In Latin America, resources and availability of intensive care units specialized in patients with cardiovascular disease are limited. In populations with low economic resources, without a properly structured and integrated health system, the quality of AMI care is variable and not always aligned with international care guidelines. A report in Trinidad and Tobago included 1106 patients with AMI, and the percentage of individuals who received pharmacological management was higher than 80%. However, in the reperfu-

sion strategy of the 505 patients with STEMI, thrombolysis was performed in 70% of the patients. None of the patients received primary angioplasty, and among the thrombolysis patients, 57% received the therapy within the first 30 minutes (20). This information reveals the difficulty of having human resources and the catheterization laboratory available to perform primary angioplasties 24 hours a day, 7 days a week, especially in rural areas.

If an institution does not have the possibility of primary angioplasty and does not have a nearby center for transferring patients and performing PCI, the process of the available resources should be optimized. In this case, thrombolysis must be administered quickly in patients who do not have contraindications. Previous initiatives in Latin America indicate that the implementation and accreditation of centers of excellence for specific pathologies facilitate access and improve the quality of care, allow for the control of chronic diseases, improve the quality of life, and reduce long-term complications (21).

An example of these initiatives was the LATIN project carried out in Colombia, in which a telemedicine network included 113 medical centers, allowing specialized centers with angioplasty availability to connect with rural areas. Of 1014 patients diagnosed with STEMI, 46% received reperfusion promptly and 68% through primary angioplasty. In addition, some of the most frequent problems in AMI care, such as the availability of intensive care, chest pain lasting more than 12 hours of evolution, and administrative problems with the patient's insurer, were reported (22).

4.2 Our experience

At the Fundación Santa Fe de Bogotá, the process of creating the AMI clinical care center began in 2015. Initially, a multidisciplinary group was formed with representatives from all areas involved in AMI patient care. In the process, the application of guidelines by Joint Commission International and joint work with other clinical care centers with more experience, such as the joint replacement center and the stroke center, were of fundamental importance. The process was completed by updating the care protocol for patients with AMI, based on international guidelines for AMI management (23)(24) and making clear the patient care route (Figure 3), and the functions of each of the participants. It is important to highlight that throughout the stay, the patient receives transversal support through psychology, nutrition, and cardiac rehabilitation, which complements the comprehensive management for the stabilization of the disease and the prevention of complications and recurrences. It is also important to highlight patient education and the education of their family members in nursing during hospitalization and through telephone follow-up after discharge.

Quality indicators were determined to evaluate the processes and outcomes of the treatment of ST-segment elevation myocardial infarction (STEMI) and non-ST-segment elevation myocardial infarction (NSTEMI). They were selected ac-

ording to the recommendations given by the main scientific societies (Table 3). The inclusion criterion was defined as any patient older than 18 years with a diagnosis of acute myocardial infarction with STEMI or NSTEMI, without any exclusion criteria (Table 4). They were backed up by periodic meetings to detect opportunities for continuous improvement and correction, as well as verification of compliance with the indicators and documentation of their periodic measurement (Figure 5). We received the official visit from the JCI evaluation group, and in November 2019, we obtained certification by JCI as the first clinical care center for patients with AMI in Colombia.

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Conflict of Interest

None declared

Data Availability Statements

The data underlying this article will be shared on reasonable request to the corresponding author.

5. CONCLUSIONS

The continuous evaluation of health care and the creation of specialized units allow for improving the quality of care for patients with AMI. The creation and organization of clinical care centers for AMI in Latin America is feasible and has an impact on the outcomes and quality of life of patients. In addition, it allows for the optimization of care and the identification of available resources. As coronary disease is the main cause of death in the world, the creation, standardization, and certification of specialized centers in AMI care should be encouraged.

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Table 1. Quality indicators in AMI care.

European society of cardiology 2017	American Heart Association (AHA) 2017
The center is part of an organizational network	Aspirin on admission
STEMI patients with symptom onset before 12 hours	Aspirin at discharge
Coronary angiography in patients with AMI and high ischemic risk, without contraindications.	Beta-blockers at discharge
Ischemic risk assessment in NSTEMI using the GRACE scale	High-intensity statin at discharge
Evaluation of the risk of bleeding in AMI using the CRU-SADE scale	Evaluation of the ejection fraction
Evolution of the ejection fraction of the left ventricle before discharge	ACE inhibitors or ARBs for left ventricular dysfunction
Low-dose aspirin prescription	Time for fibrinolytic therapy
Appropriate prescription of P2Y12 inhibitor	Time for primary angioplasty
ACEI or ARB before discharge without LVEF <40%	reperfusion therapy
Beta-blocker in patients with heart failure or LVEF <40%	Transfer time for PCI in patients with STEMI
Prescription of these high-intensity tubs.	In-Hospital Cardiac Rehabilitation
Evaluation and feedback of the patient experience and quality of care.	P2Y12 inhibitor at discharge
	Immediate post- out-of-hospital cardiac arrest arteriography in STEMI
	Non-invasive test at discharge in patients with conservative management.
	Troponin measurement within the first 6 hours of admission
	NSTEMI Stratification According to Risk

	Invasive strategy (<24 hours) in high-risk NSTEMI
	Therapeutic hypothermia in a patient with STEMI after out-of-hospital cardiac arrest
	aldosterone receptor antagonist egress
	Inappropriate use of NSAIDs in hospitalization
	Inappropriate prescription of Prasugrel at discharge
	Inappropriate prescription of high doses of Aspirin with Ticagrelor at discharge.

LVEF: left ventricular ejection fraction ACE inhibitor: angiotensin-converting enzyme inhibitor AIIIRAs: angiotensin II receptor antagonist, NSAIDs: non-steroidal analgesics

Table 2. Phases and steps to follow for the creation of a center of excellence (12)

1. Vision and validation	
a.	Appoint an interdisciplinary committee in charge of envisioning the future of the center of excellence
b.	Assess the availability of the resources needed for success (financial, organizational culture, and leadership)
c.	Statements of mission and vision of work for the future center
d.	Carry out a feasibility study taking into account the needs of the local community, the services that will be offered, the volume of patients, and financial viability.
2. Design and development	
a.	Organizational design
	Prepare a complete organization chart that describes the necessary services and the relationships between them for the comprehensive treatment of a specific medical condition in one place
	Design government mechanisms and processes to guarantee transparency and accountability.
b.	Service scenario design
	Through field visits to other centers of excellence already established, advice from internal and external experts, and designing a personalized service environment for the needs of patients facing the medical condition of interest.
	Determine the assets that will be part of the center, taking into account the estimated volume of patients, the adaptations required by the staff, and the physical requirements to provide the entire continuum of care within the service environment.
	Identify an appropriate site to locate the center of excellence, work hand in hand with architects, engineers, and designers
Staff	Determine staffing requirements and specific qualifications (credentials, skills, experience) needed to fulfill the center's mission.
	Design a recruitment plan to acquire highly qualified personnel.
Medical care	Formulate plans to ensure that the service environment and workforce assets are carefully integrated to deliver outstanding health care.
	Incorporate organizational learning principles to facilitate best practices, continuous improvement, and innovation.

	Visualize which areas outside the control of the center can be involved in patient care, in a way that guarantees excellence throughout the patient experience.
Marketing	Select the name of the center, and design the brand elements such as logos and slogans. Establish a communications and marketing plan.
	Visualize potential opportunities for cross-selling services to patients.
Financing	Investigate opportunities to maximize efficiencies, strengthen reimbursement, and integrate clinical with administrative processes to improve revenue.
	Ensure synergies between the specific areas of the center to allow better financial performance.
Stage 3: Finalization and commercialization	
Once the design and development plans are approved, the construction stage of the project is carried out, and finally its launch.	

Table 3. Quality indicators of the acute myocardial infarction center of the AMI Clinical Care Center Fundación Santa Fe de Bogotá

PROCESS INDICATORS	RESULT INDICATORS
Door-to-needle time	hospital mortality
Door-to-balloon time	Readmission for cardiovascular causes within 30 days
Aspirin on admission	Evaluation by 5Q-5D-5L 3 months after discharge
The first phase of cardiac rehabilitation	
Aspirin at discharge	
Beta-blocker at discharge	
ACEI/ARA-II at discharge	
High-intensity statin at discharge	
Second antiaggregant at discharge	
Time of taking and interpretation of the electrocardiogram.	
Invasive stratification in patients with NSTEMI	

Table 4. Inclusion and exclusion criteria for patients admitted to the clinical care center for acute myocardial infarction of the Fundación Santa Fe de Bogotá.

Inclusion criteria
Patients over 18 years of age with a diagnosis of ST-segment elevation acute myocardial infarction (STEMI) or non-ST-segment elevation myocardial infarction (NSTEMI) at Hospital Universitario Fundación Santa Fe de Bogotá, and who benefit from intervention by the clinical care center.
Exclusion criteria
<ul style="list-style-type: none"> • Patients with stable angina, unstable angina, non-ischemic cardiac chest pain, or non-cardiac chest pain. • Patients are referred to another institution during their care process. • Patients who present a diagnosis of AMI while hospitalized in the institution for another admission diagnosis. • Patients with Type 2 and Type 5 acute myocardial infarction. • Patients in palliative care management. • Patients undergoing cardiovascular surgery.

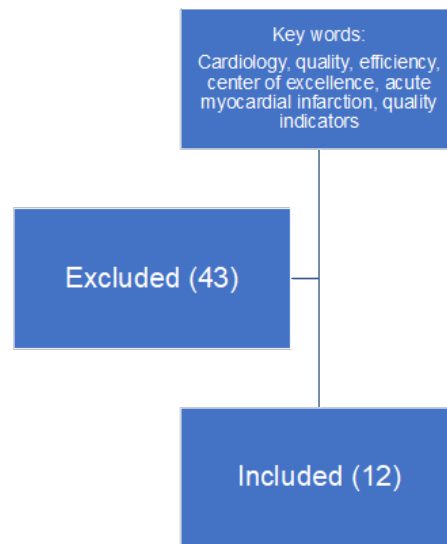


Figure 1: Information source.



Figure 2: Essential foundations of a center of excellence, modified from Manyazewa et al.

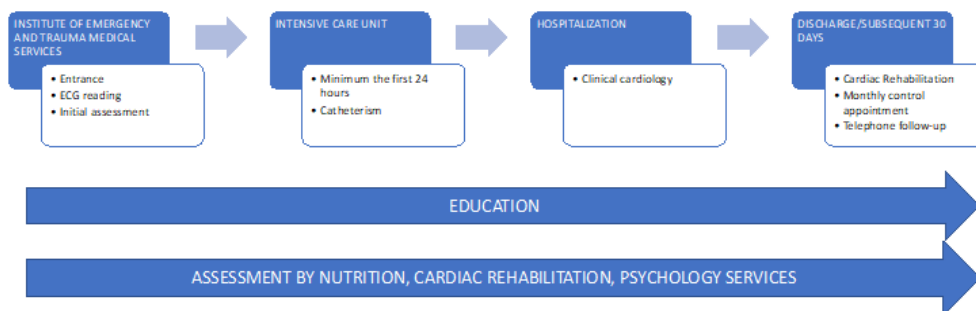


Figure 3: Flowchart of AMI center care.

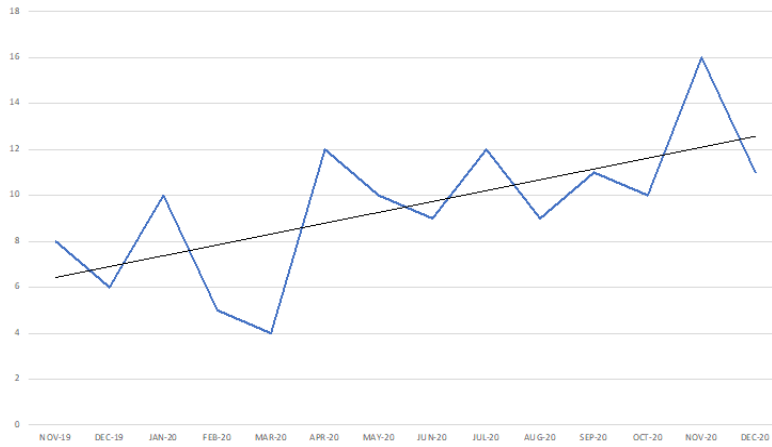


Figure 4: Number of patients in the AMI center.

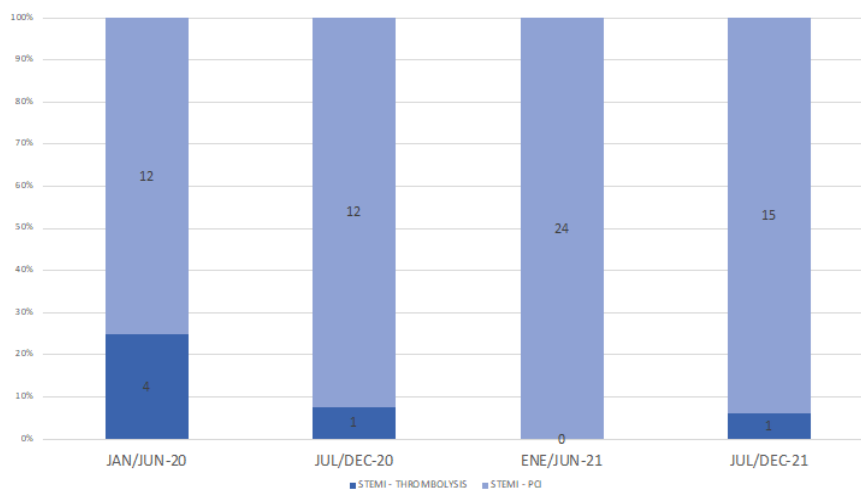


Figure 5: The proportion of patients with STEMI undergoing thrombolysis versus PCI.

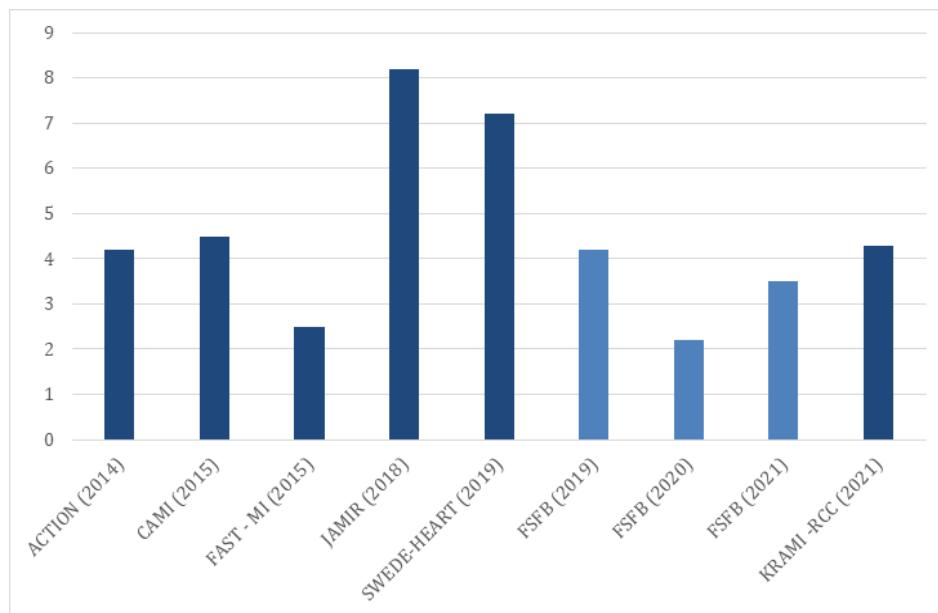


Figure 6: The mortality rate of patients with acute myocardial infarction during hospitalization.

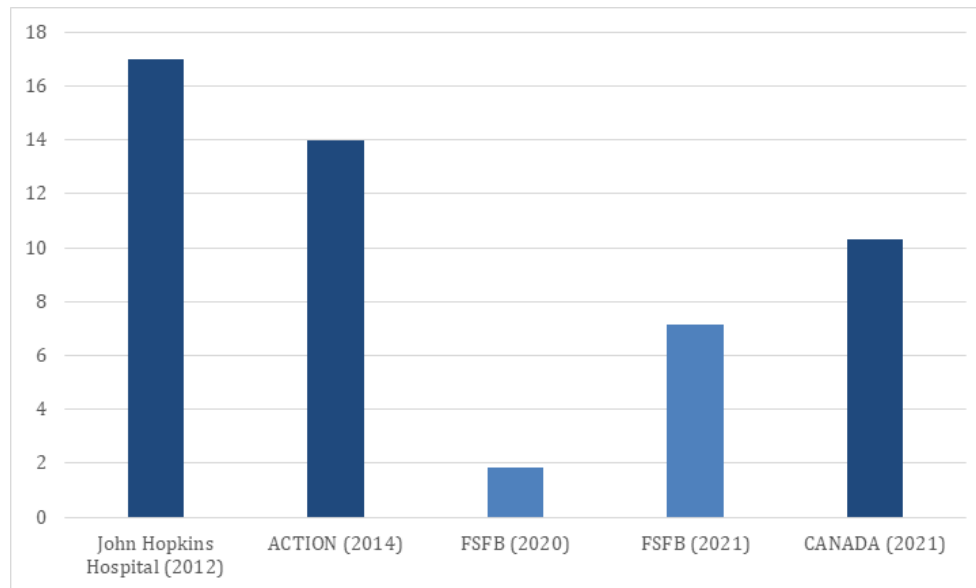


Figure 6: Readmissions for cardiovascular causes in patients with Acute Myocardial Infarction at 30 days.