

Acute myocardial infarction (AMI) hospitalization and death in rio de janeiro state (BRAZIL)

Abstract

The Rio de Janeiro State and the Southeast region of Brazil cover 4 states that are among the most developed in the country (GDP, HDI, Income Per Capita, etc.) in this way presenting indicators close to those of the most developed countries. Thus, it is to be expected the presence of some diseases typical of developed countries (obesity, heart disease, hypertension, etc.). The objective of the present study is to identify the prevalence of acute myocardial infarction (AMI) in the region and the interconnecting states, as well as to compare it with other regions of the country.

Keywords: heart, prognostic, life expectancy, treatment

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Abbreviations: AMI, Acute myocardial infarction; SUS, Unified Health System; (DATASUS, Department of Informatics of the Unified Health System in Brazil, cTn, cardiac troponin

Acute myocardial infarction (AMI)

Acute Myocardial Infarction (AMI), defined as ischemic necrosis of the heart muscle, is an important cardiovascular disease given its great epidemiological relevance in the world and in Brazil, where it represents the first cause of proportional mortality since the 1960s.^{1,2} The disease results from the formation of clots or atheromatous plaques that are capable of occluding the coronary artery, reducing blood flow, and causing part of the myocardium to undergo necrosis.³

In 2009, cardiovascular diseases were responsible for 29% of deaths in Brazil and represented the third leading cause of hospitalization in the Unified Health System (SUS), with more than 1 million hospitalizations and total expenses of around 1.9 billion reais.¹ Such information demonstrates the impact that IAM and the procedures carried out to treat it have in the country.

Such consequences are also observed, in a more limited geographical perspective, in cities in the South and Southeast regions, as Escosteguy et al.² state that AMI is the main component of mortality in these cities. In addition, it is an acute event, always requiring hospitalization, which demonstrates the relevance of analyzing the panorama of hospitalizations in these regions. In this context, the following guiding question arose: what are the clinical, diagnostic, and epidemiological characteristics of hospitalized patients with Acute Myocardial Infarction? Based on this question, the general objective of the work is to describe the profile of hospitalizations for the treatment of AMI in the Southeast Region of Brazil compared to the Rio de Janeiro State in the last 10 years (2011-2020).

An ecological, retrospective and quantitative study was carried out, using data obtained from the Department of Informatics of the Unified Health System in Brazil (DATASUS), which was sought in the Health Information segment – epidemiological and morbidity – the hospital morbidity of the SUS. In general, by place of residence, the search was based on the number of deaths and hospitalizations of Acute Myocardial Infarction in the Southeast region of Brazil and the Rio de Janeiro State in the last 10 years, including sex, age group, and Ethnicity.

The proposal cited in the present work is justified, reinforcing the fact that Acute Myocardial Infarction has great implications in

our country, lacking measures to improve its early identification, as well as its adequate conduct to reduce the incidence of deaths and hospitalizations. However, it is necessary to highlight the relevance of the science of regional epidemiological data, as they help to understand the pathology, the risk factors, and which part of the population is most affected. It is necessary to reflect, rationally and based on evidence, on why the rates of Acute Myocardial Infarction are still so high with so much knowledge provided today.

Definitions and clinical manifestations

Acute Myocardial Infarction is an area of myocardial necrosis resulting from intense ischemia, caused by sudden occlusion of the main branch of one of the coronary arteries.⁴

Pain is the main clinical manifestation, which it can also be called chest pain or chest pain. Generally, the patient places his hand flat in the middle of the precordial region, characterizing Levine's sign. In addition, symptoms such as dyspnea, cold sweating, nausea, and vomiting may accompany chest pain, pain detailed as tightness, in an oppressive, very intense way, which radiates to the upper limbs, jaw, back, or epigastrium.⁵

Its semiological characteristics are similar to those of angina, differing from it in that it usually appears with the patient at rest, has a prolonged duration (several hours, usually), does not relieve with sublingual nitrites, requiring opiates to be relieved. In addition, the patient's facial expression can be of intense suffering.⁶

During cardiac auscultation, the patient may be tachycardic, indicating a worse prognosis; with the presence of valvular murmurs, due to ischemic valve dysfunction; and with the presence of a third heart sound, related to the acute ventricular failure. It is worth mentioning that cardiac auscultation is a parameter that compares probable changes in the future triggered by mechanical complications, such as septum rupture, and mitral regurgitation, among others. In addition, it is necessary to pay attention to hypotensive patients, as hypotension can be an initiating symptom of cardiogenic shock, and to dyspneic patients with auscultation of pulmonary rales, as it is a sign that the ventricles are entering a state of failure, characterizing high risk.⁷

The recognition of clinical conditions that increase the possibility of sudden death is of paramount importance, especially for patients who have risk factors - arterial hypertension, dyslipidemia, obesity,

smoking, diabetes, physical inactivity, stress - or who are in the age groups in which the ischemic heart disease is more prevalent.¹

Within a series of probabilities associated with evolutionary time, areas of ischemia, injury and necrosis represent, in a sequential manner, progressive aggressions suffered by the myocardium. In the areas of ischemia, injury, and necrosis, electrolyte disturbances, reversible morphological changes, and definitive damage prevail respectively in each. Therefore, it is because of this that Acute Myocardial Infarction is conducted in such a way that its diagnosis is given as soon as possible so that the injured coronary artery is immediately cleared. Clinical examination is the initial step. Recognizing a clinical syndrome or raising a consistent diagnostic hypothesis is essential to choosing the most appropriate complementary exams for each case, as well as instituting correct therapeutic approaches and making the prognosis.⁷

Diagnosis and treatment

To diagnose Acute Myocardial Infarction and differentiate the possible causes of chest pain, it is necessary to carry out a quick and well-done anamnesis, a specific and centralized clinical examination, and verify the patient's vital signs. To make the diagnosis more accurate, serum markers of myocardial injury (troponin I and CK-MB) are measured and an electrocardiogram is performed.⁸

The electrocardiogram, according to most chest pain protocols used in health institutions, should be performed at a time interval of fewer than 10 minutes so that the confirmation of the diagnosis is as brief as possible so that the treatment can be performed. is carried out.⁹ The electrocardiogram shows characteristic changes represented by the appearance of Q waves, indicative of necrosis, ST-segment unevenness, and ischemic T waves.⁶

In patients with suggestive symptoms, ST-segment elevation has a specificity of 91% and a sensitivity of 46% for the diagnosis of AMI, however, it appears in only 50% of patients, as does the development of a Q wave.¹⁰ However, they should be stratified according to the presence of other evidence of ischemia on the electrocardiogram. Results with ST-segment depression ≥ 0.05 mm in two contiguous leads or T wave inversion ≥ 0.2 mm confer a moderate risk of the ischemic syndrome and increased morbidity and mortality. The electrocardiographic examination should be repeated after the initial therapy, 12 hours after admission, and daily until discharge from the Coronary Care Unit.¹¹

For the most accurate diagnosis in the detection of myocardial injury, it should take into account: characteristic increase and gradual decrease in troponin or faster increase and decrease for CK MB fraction (CK-MB), with at least one of the following criteria: a) ischemic symptoms; b) development of pathological Q waves on the electrocardiogram; or c) electrocardiographic changes indicative of ischemia (ST segment elevation or depression).

The treatment of Acute Myocardial Infarction aims at early recanalization of the obstructed coronary artery so that the necrosis found in the myocardium is limited, thus reducing the mortality of patients with AMI. Therefore, the use of fibrinolytic drugs, primary balloon angioplasty, or stent implantation treatment options promotes myocardial reperfusion, thus improving the patient's clinical condition.⁹

Therefore, there is a wide variety of therapeutic options that aim to reduce the damage that can be caused to the left ventricle. Among the options, surgical revascularization becomes a choice after attempting reperfusion with the use of thrombolytics or due to complications found in angioplasty.³

As a way to prevent and reduce the incidence and mortality from Acute Myocardial Infarction, it is extremely important to establish policies in preventive cardiology that address the effective control of the main risk factors, in addition to implementing health promotion strategies that direct the population to change their life habits, seeking a healthy diet and lifestyle, suspending the use of tobacco, alcohol, and illicit drugs, and performing physical exercises, which contribute to the reduction of a sedentary lifestyle, obesity, and stress, very frequent in the days current.¹²

In this context, changing lifestyle habits, both for people who have never had a heart attack and for people who have already had a heart attack, is the best choice to live with quality, as there is a reduction in the risk of heart attack and also of reinfarction, contributing to a good prognosis. In addition, it is worth highlighting the importance of qualified care in post-AMI patients, as a good recovery allows the patient to have a quality of life in the future, reducing the recurrence of infarction.³ Finally, the planning of actions in health education based on the profile of citizens and the epidemiological indicators of each region, addressing care, self-care, and change/reeducation in life habits, contributes to reducing the emergence of coronary artery disease. However, the health team must adapt to the reality experienced by each local population and develop bonds so that care is extended and the prevention of Acute Myocardial Infarction and other diseases is practiced.¹³

Pathophysiology of the disease: the "death" of the myocardium by ischemia

Acute Myocardial Infarction is detected from the moment there is the presence of serum/cardiac markers in the serum due to myocardial injury caused by ischemia. The presence of these biomarkers differentiates acute myocardial infarction without ST-segment elevation from unstable angina, which has the same pathophysiology.¹⁴

Thus, the pathophysiology of unstable angina/AMI without ST-segment elevation is composed of five stages, described below: (1) There is a rupture of the unstable plaque that was formed or the plaque with superimposed non-obstructive thrombosis undergoes an erosion process; (2) Activities such as spasm, constriction, dysfunction, or adrenergic stimuli cause coronary artery obstruction; (3) The coronary artery undergoes a severe decrease in its internal diameter; (4) There is an inflammation process, in which cytokines are released, capable of thinning the fibrous covering and making it more susceptible to rupture or erosion, generating plaque instability; (5) Decreased blood supply to the heart muscle is capable of causing ischemia due to the physiological conditions present at the time, even fever or hypotension.¹⁴

The pathophysiology of Acute Myocardial Infarction with ST-segment elevation is characterized by the modification of aerobic by anaerobic metabolism, as the ATP that the myocardium consumes reaches it through the coronary artery, which is obstructed. As a consequence, there is lactic acid production and myocardial dysfunction due to reduced energy generation, with suppression of the heart's contractility function in the initial 60s of the infarction and changes in the cellular structure in the initial minutes. When blood flow resumes within 40 to 60 minutes, these changes that occur early in the infarction can be reversed.

Furthermore, within a few minutes, the ischemic area ceases to exert its function and, if perfusion is not re-established, the cells suffer irreversible damage, with possible causes being intense ATP depletion, increased extracellular calcium concentration, and formation of lactic acidosis and free radicals. After 20 to 40 minutes of severe ischemia, cardiac muscle necrosis occurs, and after one hour

and after necrosis, the microcirculation is injured. When the infarction is large enough, it depresses the overall function of the left ventricle and causes heart failure.^{14,15}

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Regarding biomarkers, pathological conditions present in cardiovascular diseases, such as necrosis, inflammation, hemodynamic stress, and thrombosis, stimulate a greater release of intracellular components in the blood. Thus, we have cardiac troponin (cTn) as the main biomarker for the diagnosis of AMI, in addition to providing good prognostic bases in this pathology. Even without revealing the underlying etiology and pathophysiological mechanism, its sensitivity and specificity are very high.¹⁶

From this perspective, when reflecting on the importance of professionals and academics being always up to date on the subject, it is necessary to disseminate information that addresses Acute Myocardial Infarction, taking into account the consequences generated in the quality of life of affected patients and the expenses public directed to the complications of this pathology.¹⁷

Acute myocardial infarction: comparison between the rio de janeiro state and the southeast region of brazil. The analysis of the results shows the epidemiological profile of higher prevalence in hospitalized patients and deaths from Acute Myocardial Infarction, considering national, regional, and state values in the period from 2011 to 2020. Several studies report that cardiovascular diseases play a leading role in the indicators of morbidity and mortality in Brazil, being the first cause of proportional mortality in the country since the 60s of the 20th century.

According to data from the Mortality Information System (SIM) - DATASUS, from 2011 to 2020, there were a total of 1,048,067 hospitalizations for Acute Myocardial Infarction (AMI) in Brazil. Of this total, 116,650 (11.13%) individuals died (Table 1). In general, the 11.3% lethality observed in the sample, considering all Brazilian regions, is very close to the figures found in similar studies.

There is an increasing number of hospitalizations and, consequently, an increase in the number of deaths from 2011 to 2020. Acute myocardial infarction (AMI) is a serious cardiovascular event that can lead to death if not diagnosed and treated promptly. In Brazil, studies already predicted that AMI would become the main isolated cause of death in 2020.¹⁸

Changes in the evolution of mortality rates reflect changes in exposure to risk factors (environmental and lifestyle), as well as improvements in the diagnosis, treatment, verification, and certification of deaths.¹⁹

Among the regions of the country, the ones that showed the highest frequency of records were the Southeast region, with 525,631 (50.15%) cases of hospitalizations and 57,048 (10.85%) cases of deaths, and the South region, with 206,511 cases of hospitalizations and 21,538 cases of deaths in the period from 2011 to 2020. Escosteguy et al.² also obtained a similar result, in which they demonstrated that ischemic heart disease, including Acute Myocardial Infarction, is the main component of mortality in the cities of the South and Southeast region.

On the other hand, we have the North region with the lowest number of cases, 42,687 (4.07%) (Table 2), a fact that is explained by the total number of inhabitants and access to hospital services, as well as greater registration in the databases. used data.

This massive prevalence of AMI in the Southeast region compared to the rest of the country is justified due to the influence of stress as a behavioral risk factor for cardiovascular diseases since the most industrialized region of the country has intrinsic stress factors for development.

Rio de Janeiro state has one of the highest mortality rates from acute myocardial infarction in the country.²⁰ Corroborating these studies already published, in response to our guiding question and outlining the epidemiological profile, we can verify that Rio de Janeiro State also has the highest mortality rate when compared to other states in the Southeast region, even though it does not have the highest number of hospitalizations and deaths (Table 3).

The identification of individual characteristics, such as sex and age, is part of the classic model of analysis of the distribution of health problems that occur in populations since the first studies that used mortality data.²¹

Table 1 Hospital admissions and deaths from Acute Myocardial Infarction (AMI) in Brazil (Source: the Ministry of Health/SVS - Mortality Information System and IBGE)

Year	Hospitalization	Death
2011	80.632	10.365
2012	84.833	10.517
2013	86.559	10.823
2014	94.399	11.072
2015	101.208	11.941
2016	107.616	12.242
2017	112.444	11.986
2018	119.006	12.422
2019	131.199	12.908
2020	130.171	12.374
TOTAL	1.048.067	116.650

Table 2 Hospital admissions and deaths from Acute Myocardial Infarction (AMI) in the regions of Brazil from 2011 to 2020 (Source: the Ministry of Health/SVS - Mortality Information System and IBGE)

Region	Hospitalization	Deaths
Northern region	42.687	5.521
Northeast Region	204.452	25.300
Southeast Region	525.631	57.048
Southern region	206.511	21.538
Midwest region	68.786	7.513

Table 3 Hospital admissions, deaths, and mortality rate due to Acute Myocardial Infarction (AMI) in the states of the Southeast region from 2011 to 2020 (Source: the Ministry of Health/SVS - Mortality Information System and IBGE)

State	Hospitalization	Deaths	Death Rate (%)
MINAS GERAIS	124.920	11.661	9.33
ESPÍRITO SANTO	21.407	1.832	8.56
RIO DE JANEIRO	77.021	10.470	13.59
SÃO PAULO	302.328	33.091	10.95

Regarding sex, predominantly in hospitalizations and deaths, what stood out the most, both in the Southeast region and in the Rio de Janeiro State, was the male sex. The mean found was 1.8 and 1.3 times higher than in females, respectively (Tables 4 & 5). The magnitude of mortality rates in our study was higher in men than in women,

according to results obtained by Santos et al.⁹ who found a rate of 1.78 for men in relatiaboutith a great approximation to the result of the present study. study.

This reality may be due to unequal exposure, in both sexes, to known risk factors for the aforementioned disease. Furthermore, it may be related to the fact that women are more careful with their health than men due to sociocultural issues related to the construction of masculinity.⁹

Regarding the age group, there is a progressive increase in mortality rates with advancing age, in both sexes, especially in individuals over 50 years of age, both in the Southeast region and in the Rio de Janeiro State (Table 6). In comparison with the results obtained by Costa et al.¹⁸ we observed a slight difference regarding the age group most affected; while the mean found was 56 years, in the present study, a higher prevalence was found in the age group from 60 to 69years.

This reality is expected because it is a chronic-degenerative disease, which is directly related to the accumulation of exposure to risk factors throughout life, increasing the incidence in older age groups.¹⁹

Ethnicity has been described as a factor that provides different risk rates for cardiovascular events, demonstrating that, according to the

country (including female and male gender), these rates vary from less than 50/100,000 to above 50. 900/100,000. In the United States, the greatest negative impact of AMI was found in black individuals, with higher mortality rates in men than women.²² In addition, according to Moreira et al.,²³ black descendants are more prone to arterial hypertension and have a greater chance of cardiovascular diseases.

The DATASUS findings differ from the studies observed in the literature, as 44.88% of the consultations in the Southeast region were performed with white people and only 4.49% with black people in the period from 2011 to 2020 (Table 7). However, this fact is relatively imprecise, as the race criterion is defined personally, by the individual interviewed, who calls himself or herself of that color, and also by the high number of records where the ethnicity was not informed.

Public health policies must be implemented that aim at universality, equity, and integrality of patients. Primary prevention measures must be instituted to control risk factors, such as arterial hypertension, diabetes, smoking, dyslipidemia, alcohol abuse, obesity, and excessive stress, through information campaigns, programs, and norms. Lectures must be held at Social Assistance Reference Centers (CRAS) and Public and Private Schools in partnership with the Unified Health System. Health Education should be valued in our country.

Table 4 Hospital admissions and deaths from Acute Myocardial Infarction (AMI) in the Southeast region of Brazil (Source: the Ministry of Health/SVS - Mortality Information System and IBGE)

Year	Male		Female	
	Hospitalization	Death	Hospitalization	Death
2011	27.070	3.032	14.854	2.273
2012	28.376	2.943	15.326	2.252
2013	28.648	3.042	15.834	2.329
2014	30.576	3.067	17.147	2.350
2015	32.397	3.289	18.150	2.582
2016	34.697	3.360	19.252	2.614
2017	35.355	3.218	19.856	2.530
2018	37.905	3.304	20.977	2.644
2019	41.558	3.487	23.291	2.671
2020	41.318	3.512	23.044	2.549

Table 5 Hospital admissions and deaths from Acute Myocardial Infarction (AMI) in the Rio de Janeiro State (Source: the Ministry of Health/SVS - Mortality Information System and IBGE)

Year	Male		Female	
	Hospitalization	Death	Hospitalization	Death
2011	4.212	537	2.275	395
2012	4.101	501	2.232	397
2013	3.883	540	2.357	422
2014	4.425	556	2.673	440
2015	4.749	620	2.828	514
2016	4.894	650	2.795	486
2017	5.099	546	2.842	439
2018	5.654	666	3.104	510
2019	6.307	686	3.478	508
2020	5.892	578	3.215	477

Table 6 Hospital admissions and deaths from Acute Myocardial Infarction (AMI) by age group comparing the Southeast region with the Rio de Janeiro State in the period from 2011 to 2020 (Source: the Ministry of Health/SVS - Mortality Information System and IBGE)

Age Group (Years)	Southeast		Rio De Janeiro State	
	Hospitalization	Death	Hospitalization	Death
<1	386	28	128	13
1 A 4	84	5	11	1
5 A 9	35	1	11	-
10 A 14	67	7	13	1

Table Continued...

Age Group (Years)	Southeast		Rio De Janeiro State	
	Hospitalization	Death	Hospitalization	Death
15 A 19	532	31	90	7
20 A 29	3.325	166	478	33
30 A 39	14.571	669	2.015	136
40 A 49	58.232	2.805	7.867	487
50 A 59	137.853	8.721	20.230	1.562
60 A 69	159.690	15.612	24.382	2.965
70 A 79	109.965	16.395	14.998	3.023
>80	47.891	12.608	6.792	2.240

Table 7 Hospital admissions and deaths from Acute Myocardial Infarction (AMI) by ethnicity comparing the Southeast region with the Rio de Janeiro State from 2011 to 2020 (Source: the Ministry of Health/SVS - Mortality Information System and IBGE)

	Southeast		Rio de Janeiro	
	Hospitalization	Death	Hospitalization	Death
Caucasian	235.909	26.053	22.441	2.912
Afro-American	23.602	2.581	5.654	798
Mixed (Pardo)*	145.995	13.908	22.032	2.885
Asian	4.764	583	978	132
Indigenous	50	4	2	-
No information	115.311	13.919	25.908	3.741

*Brazilian questionnaires use "pardo" to describe mixed people

Conclusion

The major contribution of this study was to trace the epidemiological profile represented by a random sample of all hospitalizations and deaths recorded in DATASUS with the diagnosis of Acute Myocardial Infarction, establishing a portrait with the least possible bias of what occurred in the Rio de Janeiro State, compared to the Southeast region of Brazil in the period studied.

Answering the problem question and the objectives outlined, it is concluded that the total number of hospitalizations and deaths, throughout Brazil, due to Acute Myocardial Infarction was 1,048,067 and 116,650, respectively, and that the Southeast region has the highest rate of hospitalizations and deaths compared to other regions of the country.

It was possible to identify that the state of São Paulo has the highest number of hospitalizations and deaths among the states of the Southeast Region. However, the mortality rate was higher in Rio de Janeiro State.

This study showed that, in the Southeast region and the Rio de Janeiro State, males had the highest prevalence of hospitalizations and deaths from Acute Myocardial Infarction and that the predominant age of hospitalization was 60 to 69 years and of deaths was 70 to 79 years.

In the Southeast region, according to hospitalizations and deaths, the color that stood out was white. In the Rio de Janeiro State, the option without information had the highest number.

In this way, the present research can contribute as a source of updated knowledge and serve as a subsidy for the development of health policies and actions, given the urgency to intensify efforts to improve living conditions and prevent and control risk factors for this disease, pathology, as well as access to health services, from primary to tertiary care.

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