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ORIGINAL ARTICLE

Sociodemographic Profile of Acute Myocardial Infarction in Rio De Janeiro, Brazil (2010-2019)

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Abstract

Background: Cardiovascular Diseases (CVDs) are the main cause of mortality in Brazil, which includes acute myocardial infarction (AMI). In 2017, 12% of deaths caused by infarction in Brazil occurred in the state of Rio de Janeiro, characterizing it as an important "hotspot" in the country.

Objectives: This study aimed to characterize the population affected by AMI over the past decade within the state so as to guide future public policies related to CVDs.

Methods: Secondary data of patients affected by AMI between 2010 and 2019 were obtained by DATASUS. In-hospital case-fatality rates, mortality rates, and proportional mortality were calculated using information gathered by the Mortality Information System (SIM) and demographic statistics produced by the Brazilian Institute of Geography and Statistics (IBGE).

Results: The main results showed that in-hospital case-fatality rates were higher in women, patients aged 60 years and over, the black color/race, and the state's Northwest region. The mortality rate was higher among men, especially in the South-central region and those over 50 years of age. People aged 40-49 years presented a considerable risk of death by infarction. The major categories of data classified as "ignored" in hospital admissions and death certificates were those related to race and education level.

Conclusions: Prevention should not only focus on the elderly, but also on people over 40, especially men. The incompleteness of electronic public data systems can affect the use of race/color or education level as epidemiological variables. New studies should be conducted to understand why the South-central region is so heavily affected by infarction.

Keywords: Descriptive Epidemiology; Socioeconomic Factors, Vital Statistics; Morbidity; Hospital Mortality.

Introduction

Cardiovascular Diseases (CVDs) affect millions of people worldwide, leading to a lower quality of life and productivity. According to the World Health Organization (WHO), around 18 million people died in 2019 from some type of pathology within this group, which represented 32% of all deaths in that year.[1] In Brazil, CVD has also been the leading cause of mortality since the 1960s, contributing to a substantial burden of disease in Brazil.[2] Our study found that acute myocardial infarction (AMI) was common in the CVD groups. This is a condition characterized by cardiac tissue death attributed to prolonged ischemia, that is, inadequate oxygen supply to the myocardium. It is estimated that in 2017 there were approximately 170,000 deaths caused by AMI in Brazil. Of these, 12% occurred only in the state of Rio de Janeiro.[3] In addition, recent studies have found evidence of an upward trend in mortality from Ischemic Heart Disease in some groups in the state.[4] These numbers highlight the importance of characterizing the population affected by this disease and establish the state of Rio de Janeiro as a "hotspot" for heart attacks in the country.

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The knowledge about risk factors (such as age, gender, color/race) for CVD has become the foundation of cardiology. Despite this, data in the literature is scarce concerning the sociodemographic profile of the groups affected by these diseases in each state, which is highly relevant considering that a large country like Brazil, with a profound racial diversity and many different social realities can show varying profiles depending on the region analyzed. Therefore, a detailed analysis of the population affected by a certain disease is crucial for the elaboration of public policies focused on groups at higher risk of exposure.

In this sense, the present study aims to describe the sociodemographic profile of hospitalizations and deaths related to AMI in the state of Rio de Janeiro over the last decade. The results of this work can help the state's health system managers to understand the profile of the population affected by the disease in order to plan access and treatment with a subsequent decrease in total mortality, as well as encourage other authors to delve deeper into the search for new risk factors related to infarction.

Materials and methods

This descriptive study was carried out with secondary data from an electronic website under the responsibility of the Informatics Department of the Unified Health System (SUS)[5] and accessed by the author between August 2 and September 5, 2021. Data regarding hospital morbidity/mortality were provided by the Hospital Admission System (SIH) and information regarding deaths by the Mortality Information System (SIM). As inclusion criteria, this study considered people of all ages who live in the state of Rio de Janeiro; who, between 2010 and 2019, were hospitalized for AMI (in the case of SIH); or who died during this period for the same cause (in the case of SIM, the correspondent code for AMI is I21). This period was chosen because the obligation to update the system occurred in Brazil in 2007, through ordinance No. 311; however, the data flow had still not been stabilized before 2010. The variables investigated were:

a) Age group (in years)
b) Sex;
c) Race / skin color;
d) Administrative Division of the State of Rio de Janeiro;
e) Education (in years studied).

Since SIM may present poor-quality data, some corrections were implemented following the methodology described by Santos et al.[6] The relative frequencies of the variables of interest were calculated, as were:

a) in-hospital case-fatality rate: given by dividing the number of in-hospital deaths by the number of admissions during the period multiplied by 100. This data indicates how many patients admitted to hospitals due to a heart attacks progressed to death.
b) mortality rate: given by the number of deaths in a group during the period, divided by the number of inhabitants in the middle of the period, multiplied by 100,000. This coefficient adapts the number of deaths to the size of the groups.
c) proportional mortality: given by the number of deaths from a given cause, divided by the number of total deaths during the period, multiplied by 100. This indicates the impact of the cause on deaths in a given group.
d) age-adjusted mortality rate: this was calculated using the direct method with a WHO standard population.[7] This rate is important to compare regions with different age structures.

The information concerning the number of inhabitants was provided by the Brazilian Institute of Geography and Statistics (IBGE), and the data were calculated and analyzed using Microsoft Office Excel 2016. Since our research only used secondary data available in the public domain, ethical approval was not necessary.

Results

In the period analyzed, there were 73,541 hospitalizations related to AMI, of which 10,264 evolved to death, accounting for an in-hospital case-fatality rate of 13.95. When this population was stratified by gender, males represented the majority in the two categories (63.91% in hospitalizations and 56.53% in “in-hospital” deaths). While patients aged 60 to 69 years were the most common age group in hospitalizations (31.19%), people aged 70 to 79 years were the majority (28.91%) in deaths in hospitals. In terms of color/race, our study showed a predominance of white people hospitalized with a heart attack (29.24%) and who progressed to death

(27.91%). Regarding the region, a predominance of hospitalizations and deaths was found in the metropolitan region of the state (60.78% and 64.86% respectively) . These results can be found in Table 1.

Regarding general deaths (meaning, deaths by infarction that occurred inside and outside of hospitals), 105,273 occurred between 2010 and 2019. These were concentrated in the age group of 80 years or over (26.13%), white (57.81%), with 1 to 3 years of education (28.32%), and from the metropolitan region (74.68%). In addition, most deaths were of males (56.38%). These results are shown in Tables 2, 3 and 4.

Discussion

Although men were the majority of hospitalizations and deaths due to infarction inside the hospital, the intra-hospital lethality rate was higher among women (Table 1). This strengthens previous studies that also concluded that sex is a variable that increases the risk of death in patients hospitalized for a heart attack in the city of Rio de Janeiro[8] and other regions.[9-17] However, the explanation for this data remains unknown. While some authors suggest that this difference is due to other risk factors,[18,19] a study by Pimenta et al. showed that even after normalizing the data relating sex to known risk factors, the differences in hospital mortality between women and men still exists.[8] The data found in the present study raise two hypotheses: The first is that there is some biological characteristic intrinsic to female patients that interferes in the prognosis. The second is that there is still an unknown risk factor that acts as a confounding element and causes this difference between men and women. Nevertheless, more studies should be carried out to elucidate this relationship between sex and in-hospital mortality of people who suffer infarctions.

Regarding mortality data (Table 2), men had the highest number of deaths from infarction (56.38%), with a proportional mortality and a higher mortality rate than women. This corroborates data shown by other authors in recent years in the country.[20-24] The explanation for this fact is that men have more risk factors, such as smoking, obesity, hypertension and hyperlipidemia.[25,26]

Regarding age, people over 50 years of age accounted for 86.04% of hospital admissions, 93.25% of deaths from in-hospital infarction, and 90.78% of deaths from general infarction (Tables 1 and 2). This data was expected, since age is a risk factor for CVD, which corroborated with the findings from other authors in other Brazilian states.[27,28] Regarding in-hospital case-fatality rates, a higher rate was observed among patients over 60 years of age. This result is to the fact that elderly people are more susceptible to developing risk factors, such as hypertension, hyperlipidemia, among others. Because of these conditions, diagnostic and therapeutic intervention strategies are limited.[29,30] However, when analyzing mortality rates, we observed that people aged 40-49 years also had a considerable risk of infarction (Table 2), which alerts us to the importance of also focusing on prevention strategies for adults in this age group and not only for the elderly.

Black people were the only racial group defined with a higher-than-average hospital case-fatality rate (13,95) (Table 1). Unfortunately, concerning hospital lethality by race in the case of infarctions, information to make valid comparisons was scarce, which reveals the need for further studies in this regard. The lack of these studies may well be due to the fact that, unlike risk factors, such as age, sex, and hypertension, in which there is a consensus, race/ethnicity always brings an anthropological debate to biology,[31,32] which is even considered an analysis with a racial bias by some authors.[33-35] However, despite recent knowledge that race or color is a social construct,[36] and despite the lack of scientific evidence to show that variations in skin color and phenotype imply biological or genetic differences that justify the differentiation of individuals,[37] discrimination and exploitation based on skin color made this variable a socioeconomic determinant[38] and an objective condition of inequality in living, health, and death conditions in Brazil.[36,39,40] The importance of this variable is shown by the fact that it was recognized by the Ministry of Health itself.[41] However, even after this demonstration of relevance, it is important to note that nearly 35% of the patients admitted to the hospital during the period had their race/color ignored (Table 1). This most likely occurred because, before the publication of ordinance No. 344, on February 1, 2017, the filling in of race information in hospital admission documents was not mandatory, which demonstrates the disregard for this tool before publication. Furthermore, considering the literature, few studies seek to analyze the quality of information regarding race/color contained in public databases. Those that exist are limited to a specific age group,[42,43]

Table 1 – Hospitalizations and deaths caused by infarction and in-hospital case-fatality rate. The last column on the right shows the in-hospital case-fatality rate in each situation analyzed. *The value calculated was very low and was thus was rounded down to zero.

	Hospitalizations	In-hospital deaths	
Variable	Relative Frequency	Relative Frequency	In-hospital case-fatality rate (per 100 hospitalizations by infarction)
Gender			
Male	63.91%	56.53%	12.34
Female	36.08%	43.46%	16.80
Age (in years)			
Less than 1	0.18%	0.16%	12.78
1 to 4	0.01%	*0.00%	10
5 to 9	0.01%	0%	0
10 to 14	0.01%	*0.00%	9.09
15 to 19	0.13%	0.08%	9.47
20 to 29	0.66%	0.30%	6.37
30 to 39	2.61%	1.34%	7.17
40 to 49	10.34%	4.80%	6.48
50 to 59	26.60%	15.02%	7.88
60 to 69	31.17%	28.08%	12.57
70 to 79	19.34%	28.91%	20.86
80 or over	8.90%	21.25%	33.29
Race/color			
White	29.14%	27.85%	13.34
Black	6.52%	6.62%	14.17
Brown	27.88%	27.01%	13.52
Yellow	1.09%	0.97%	12.45
Indigenous	*0%	-	-
Ignored	35.34%	37.53%	14.81
Region			
Metropolitan	60.85%	64.95%	14.89
Northwest	2.96%	3.46%	16.33
North	7.48%	7.13%	13.29
Mountainous region	8.67%	6.54%	10.54
Coastal Lowlands	7.70%	6.81%	12.33
Mid-Paraíba	7.86%	7.42%	13.17
South-central	2.44%	1.94%	11.09
Green Coast	2.02%	1.72%	11.91

Source: DATASUS

Table 2 – Mortality data by gender and age. *The number calculated was very low and was thus was rounded down to zero. **To calculate the specific mortality rate of the specific class, it was necessary to group these into two classes.

	Deaths by infarction		
Variable	Relative Frequency	Proportional mortality	Mortality rate (per 100,000 inhabitants)
Gender			
Masculine	56,67%	9,09%	808,24
Feminine	43,32%	7,82%	580,15
Age (in years)			
Less than 1	*0.00%	0%*	0.38**
1 - 4	*0.00%	0.04%	
5 - 9	*0.00%	0.11%	0.27
10 - 14	*0.00%	0.07%	0.24
15 - 19	0.09%	0.50%	9.36
20 - 29	0.46%	0.98%	22.83
30 - 39	1.81%	3.44%	82.04
40 - 49	6.51%	7.77%	329.34
50 - 59	16.16%	9.92%	919.44
60 - 69	24.00%	10.30%	2059.65
70 - 79	24.49%	9.11%	4142.82
80 or more	26.13%	7.12%	8494.93

Source: DATASUS (adapted).

Table 3 – Mortality data by region: Relative Frequency, proportional mortality and age-adjusted mortality rate.

Deaths by infarction			
Variable	Relative Frequency	Proportional mortality	Age-adjusted mortality rate (per 100,000 inhabitants)
Region			
Metropolitan	74.68%	7.92%	361.64
Northwest	2.14%	8.18%	608.16
North	3.91%	6.31%	529.95
Mountainous region	5.52%	8.30%	649.23
Coastal Lowlands	5.00%	8.42%	660.24
Mid-Paraíba	4.92%	7.71%	583.33
South-central	2.29%	10.13%	819.77
Green Coast	1.08%	7.38%	598.19

Source: DATASUS (adapted).

Table 4 – Mortality data by race/color and education: relative frequency and proportional mortality

Deaths by infarction		
Variable	Relative Frequency	Proportional mortality
Race/Color		
White	57.81%	8.44%
Black	13.33%	7.24%
Brown	27.55%	7.25%
Yellow	0.20%	8.08%
Indigenous	0.04%	7.25%
Ignored	1.06%	5.40%
Education (In years studied)		
None	8.74%	7.19%
1 to 3	28.32%	7.90%
4 to 7	22.18%	7.90%
8 to 11	18.53%	8.37%
12 years or more	8.05%	8.50%
Ignored	14.17%	7.28%

Source: DATASUS (adapted)

to specific regions,[44-49] and in deaths from groups of specific causes.[45,47-50] The lethality within this undefined race group was higher than the average (14.81%), which makes the epidemiological analysis by ethnic-racial groups much more complicated, since the distribution of these patients in the correct categories could give us a better view of the profile of the population affected by infarction. Therefore, authors should value race/color more as another tool to guide public policies, and further study should be carried out to assess the quality of this type of information in public databases.

The metropolitan region concentrated the highest number of admissions and the second highest hospital mortality (Table 1). This was expected, since it is a highly populated region, concentrating about 75% of the population of the state.[51] Due to the large demand in the region, the health service can become overloaded, increasing intra-hospital mortality. In 2016, it was seen that the Structure Efficiency Index (IEE) of the health systems of several metropolitan cities was not enough to supply the demand[52]. From the region, only Niterói had a satisfactory index.

The Northwest region showed the highest in-hospital case-fatality rate (Table 1). This can be explained as a result of the age of the patients. As the proportion of elderly people in this region is higher than in the others, more elderly patients over 70 years of age were hospitalized. For reasons already discussed in this article, which are related to the frailty of elderly health, this resulted in a higher rate of intra-hospital lethality. Furthermore, it was also observed that in 2016 most municipalities that form the Northwest region presented an IEE ranging from regular to very low.[52]

The South-central region had the highest mortality rate and the highest proportional mortality (Table 3), indicating that actions focused on prevention and strengthening the health structure of this region should be carried out to try to prevent deaths from infarction. No clear data was found in the literature that could explain why this region has such higher rates than others. Thus, new studies should be conducted to understand why this region is so heavily affected by infarction and how it can be prevented.

Regarding education, infarction showed an increasing impact on deaths as the level of education increased. (Table 4). In the literature, no similar data regarding deaths due to infarction in Brazil was found; therefore, it was impossible to formulate clear comparison parameters to assess whether the numbers found are a particular case of the state of Rio, or if this is repeated in other regions. However, a possible hypothesis for this result is the fact that low education is a known risk factor for many diseases in Brazil. Thus, deaths from infarction may be losing space to other causes of death, causing proportionally low mortality in this group. It would be interesting, in this case, to calculate the mortality rate, however, it was impossible to retrieve the IBGE projections of education level for the population of the state in this period.

It is important to highlight that although the secondary data provided by DATASUS and IBGE were extremely important for this study, the information gaps hindered a more complete analysis, making efforts to reduce these gaps even more necessary so that articles can make use of more complete information in the future. It is also interesting that although CVDs are the main cause of death in the country, we still do not have satisfactory sources of information concerning risk factors. Currently, the only source of serial data that fulfills this role is Vigitel, which, in addition to covering only capital cities, also offers data with a risk of bias, since it is a telephone survey where the interviewee himself provides the information.[53] Therefore, to correctly correlate the data from this study with risk factors to develop prevention strategies, more accurate information systems need to be created.

Conclusions

The majority of hospitalizations referred to men (63.91%), above 50 years of age (86.04%), from the Metropolitan region (60.85%), and white (29.14%). In-hospital case-fatality rates were larger in women, over 60 years of age, in black people, and in the northwest region.

Regarding mortality data the majority were men (56,67%), over 50 years of age (90.78%), white (57.81%), with 1 to 3 years of study (28.32%), from the metropolitan region (74.68%). However, age-adjusted mortality rates and proportional mortality showed that the South-central is the region with the highest risk of death by infarction. Since there is no previous study to investigate why this region is so heavily by this disease, we suggest that new studies should be conducted to try to understand this situation and find a way to prevent it. We also noticed that people aged 40 to 49 years showed a high risk of death by infarction, which shows a warning sign for the importance of focusing on prevention strategies in this age group.

Other noteworthy data was the incompleteness of the electronic public data system concerning some aspects like race and education level. We encourage future studies to value these variables and to assess the quality of this type of information in public databases, as they can help to guide future public policies.

Author Contributions

Conception and design of the research, acquisition of data, analysis and interpretation of the data, statistical analysis, obtaining financing, writing of the manuscript and ritical revision of the manuscript for intellectual content: De Carvalho LA.

Potential Conflict of Interest

No potential conflict of interest relevant to this article was reported.

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Ethics Approval and Consent to Participate

This article does not contain any studies with human participants or animals performed by any of the authors.

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