

ORIGINAL ARTICLE

Epidemiological Profile and Comparison of Mortality Due to Stroke and Atrial Fibrillation in Brazil Over the Past 26 Years

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Abstract

Background: Atrial fibrillation (AF) stands out as the most prevalent arrhythmia, and its incidence increases with age. Stroke ranks as the second leading cause of mortality in Brazil and represents the primary contributor to global disability.

Objective: Considering the severity of these conditions, this study seeks to elucidate the epidemiological landscape of AF and stroke-related deaths in Brazil from 1996 to 2022.

Methods: The following variables were analyzed in the study - geographic region, federative state, age demographics, gender distribution, year of mortality, race/ethnicity, educational attainment, and place of death. This research adopted a descriptive approach through a retrospective, exploratory, epidemiological analysis of data sourced from the Mortality Information System (SIM) accessible through the Department of Health Informatics of the Brazilian Unified Health System (DATASUS) website.

Results: Over the 26-year period, 1,201,327 deaths from AF and stroke were registered in Brazil. These deaths were mostly caused by stroke (94.5%) and were more concentrated in the southeast region, where the highest number of doctors capable of identifying and notifying these deaths are also concentrated.

Conclusion: This study claims for a paradigm shift in disease control strategies and underscores the imperative of bolstering the efficacy of public health policies to address the huge impact of stroke and AF-related mortality on population health.

Keywords: Atrial Fibrillation; Stroke; Mortality.

Introduction

Characterized by a complete disorganization of atrial electrical activity, atrial fibrillation (AF) results in a loss of atrial systole, with a typical electrocardiographic pattern. This abnormal atrial electrical activity may be caused by several mechanisms including hemodynamic, electrophysiological, autonomic and structural factors, atrial tachycardias, ectopic beats, along with genetic polymorphism¹⁻¹² AF is the most common sustained arrhythmia in clinical practice, and patients may vary from asymptomatic to fleeting symptoms, which complicates the diagnosis. Consequently, thrombotic

phenomena and even atherosclerotic processes occur, leading to a fourfold increase in the risk of developing a stroke associated with AF.¹

Stroke can manifest in two forms: hemorrhagic, with blood extravasation within or around parenchymal and subarachnoid structures, respectively, and ischemic, with vessel occlusion and subsequent difficulty in nutrient and oxygen supply. Regarding risk factors, both diseases share modifiable and non-modifiable ones. Non-modifiable factors include age, sex, and race, while modifiable factors encompass systemic arterial hypertension, smoking, diabetes mellitus, and obesity.^{2,7}

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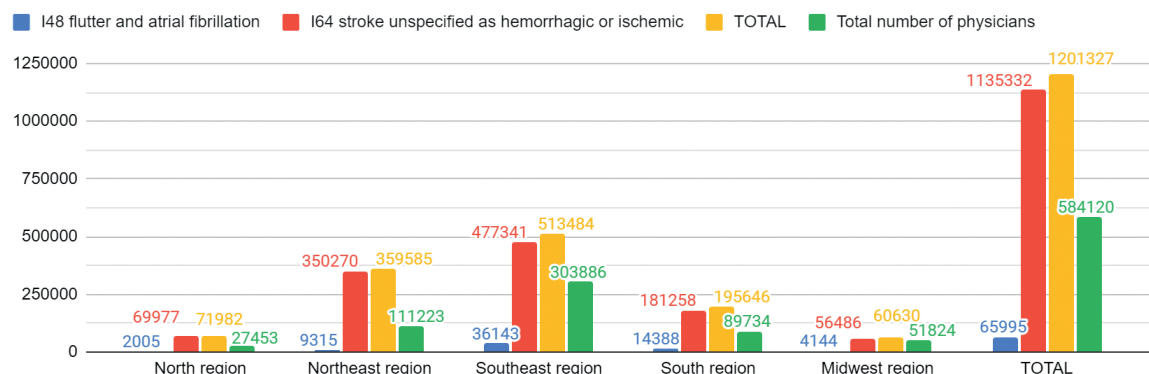
Editor responsible for the review: Ricardo Alkmim Teixeira

DOI: <https://doi.org/10.36660/ijcs.20240155>

Manuscript received August 15, 2024; revised manuscript August 19, 2024; accepted October 14, 2024.

Central Illustration: Epidemiological Profile and Comparison of Mortality Due to Stroke and Atrial Fibrillation in Brazil Over the Past 26 Years

INTERNATIONAL JOURNAL OF
Cardiovascular
SCIENCES



Int J Cardiovasc Sci. 2024; 37:e20240155

Distribution of deaths from atrial flutter and AF and stroke (not specified as hemorrhage or infarction) by geographic region in Brazil from 1996 to 2022 and comparison with the number of physicians per region in 2022; *Data for the year 2022 taken from Scheffer M. et al.¹¹ Source: MS/SVS/CGIAE - Mortality Information System – SIM.

According to the Brazilian Stroke Society (SBAVC), stroke, which until the mid-2010s was the second leading cause of death in Brazil, has held the first position for the past five years. The disease has surpassed heart attack as the leading cause of death in the country, a reversal of the situation observed in the Western world.⁴

Therefore, attention to the five characteristic signs and symptoms of stroke - such as numbness or weakness of the face, leg, or arm muscles; dizziness, difficulty walking, or loss of balance; headache without apparent cause; sudden changes in vision in one or both eyes; and sudden onset of confusion - is essential for early diagnosis.⁸ Similarly, symptoms such as palpitations, dizziness, dyspnea, and chest pain, confirmed by an altered electrocardiogram, assist in the early detection of stroke, especially in elderly and cardiac patients with AF.¹⁰

In summary, given the global and national relevance of both conditions, the objective of our study is to evaluate the correlation between the epidemiological profile of AF and stroke in Brazil from 1996 to 2022. This aims to assist in the remodeling of disease control actions, improvement of population quality of life, and formulation of scientific parameters regarding the main affected regions of Brazil.

Objective

This study aims to delineate the epidemiological profile of deaths due to AF and stroke in Brazil from 1996 to 2022 in terms of geographical region, federative state, age group, sex, year of death, race/ethnicity, education level, and place of occurrence in order to characterize the trend and magnitude of these diseases in the country.

Methods

This was an exploratory, retrospective, epidemiological study of descriptive nature, utilizing data obtained from the Mortality Information System (SIM) available on the website of the Department of Health Informatics of the Brazilian Unified Health System (DATASUS). Notifications of deaths due to atrial flutter and fibrillation and unspecified stroke (hemorrhagic and ischemic) in Brazil between 1996 and 2022 were selected. Descriptive and analytical analyses of the data were performed, and results were organized into tables. The variables studied included geographic region, federative state, age group, sex, year of death, race/ethnicity, ICD-10 category, and place of occurrence (e.g. in the hospital, at home, others).

The following variables were excluded from the study: region/federative unit, ICD-10 chapters, ICD-10 groups, cause-ICD-BR-10, ill-defined cause, year/month of death,

month of death, education level, OPS age group, detailed age group, age group under one year, and marital status.

Information was collected on April 17, 2024. Since the data are available in the public domain, this study did not require analysis by the Ethics Committee. The authors declare no conflicts of interest.

Limitations include possible underreporting and incomplete/incorrect filling of data (database).

Results

Upon examining the data between 1996 and 2022, we observed a steady increase in the number of deaths due to flutter and AF each year (Table 1). In 1996, 686 cases were recorded, while in 2022, 5688 cases were recorded, representing an increase of 729.2%. Conversely, there was a non-linear decrease in the number of deaths from stroke over the years. However, it is noteworthy that in 1996, there were 48,055 cases recorded compared to 35,982 in 2022, corresponding to a decrease of 25.1%.

Over the 26-year period there were a total of 1,201,327 deaths from the I48 (atrial flutter) and I64 (stroke) categories, with deaths due to stroke accounting for 1,135,332 (94.5%) of the total.

In terms of deaths attributed to atrial flutter and AF, Table 2 indicates a higher incidence in the Southeast region (36,143 cases), followed by the south (14,388 cases), northeast (9,315 cases), midwest (4,144 cases), and north regions (2,005 cases). Regarding deaths due to stroke, the Southeast region also exhibited a higher incidence (477,341 cases), followed by the northeast (350,270 cases), south (181,258 cases), north (69,977 cases), and midwest regions (56,486 cases). It is of note that the concentration of physicians was the highest in the southeast region of Brazil - 303,886 physicians (52%) in 2022 – as illustrated in the Central Illustration.

Regarding mortality due to atrial flutter and AF by federative state, the state of São Paulo leads with 17,512 cases, followed by the states of Minas Gerais (8,864), Rio de Janeiro (8,510), Rio Grande do Sul (6,363 cases), and Paraná (5,460 cases). São Paulo is also the number one state in mortality due to stroke, with 199,410 cases, followed by Rio de Janeiro (133,926 cases), Minas Gerais (122,466 cases), Bahia (96,576 cases), and Paraná (76,973 cases).

Concerning gender, it is possible to observe in Table 4 that most cases of deaths due to atrial flutter/AF occurred among women (57.4%, n=37,868).

Table 1 – Distribution of the number of deaths from atrial flutter and AF and stroke (not specified as hemorrhage or infarction) by year of death from 1996 to 2022 in Brazil

Year of Death	I48 atrial flutter and AF	I64 unspecified stroke	TOTAL
1996	686	48,055	48,741
1997	759	47,410	48,169
1998	799	47,208	48,007
1999	840	44,770	45,610
2000	859	43,685	44,544
2001	1,030	43,672	44,702
2002	1,063	43,602	44,665
2003	1,192	43,117	44,309
2004	1,289	42,904	44,193
2005	1,417	41,459	42,876
2006	1,578	45,982	47,560
2007	1,846	45,157	47,003
2008	1,951	45,793	47,744
2009	2,063	44,937	47,000
2010	2,403	44,891	47,294
2011	2,579	44,916	47,495
2012	2,635	42,815	45,450
2013	2,918	42,145	45,063
2014	2,983	40,419	43,402
2015	3,364	40,668	44,032
2016	3,488	41,019	44,507
2017	4,029	36,206	40,235
2018	4,468	33,635	38,103
2019	4,715	33,895	38,610
2020	4,526	35,182	39,708
2021	4,827	35,808	40,635
2022	5,688	35,982	41,670
TOTAL	65,995	1,135,332	1,201,327

Source: MS/SVS/CGIAE - Mortality Information System – SIM.
AF: atrial fibrillation.

Similarly to what was observed for mortality due to the ICD-10 category (atrial flutter and AF and unspecified stroke), the predominant age group in both cases is the elderly. Thus, mortality due to atrial flutter/AF in individuals aged above 60 years accounts for 91.7% of cases in this category (Table 5). Concerning mortality due to stroke, the elderly group (≥60 years) accounted for 84.1% – when summing the age intervals of 60 to 69 years (209,414), 70 to 79 years (328,197), and 80 years or older (417,583) of the total cases.

Table 2 – Distribution of deaths from atrial flutter and AF and unspecified stroke (not specified as hemorrhage or infarction) by region of Brazil from 1996 to 2022 and comparison with the number of physicians per region of Brazil in 2022

Regions of Brazil	I48 atrial flutter and AF	I64 unspecified stroke	TOTAL	Total number of physicians
North region	2,005	69,977	71,982	27,453*
Northeast region	9,315	350,270	359,585	111,223*
Southeast region	36,143	477,341	513,484	303,886*
South region	14,388	181,258	195,646	89,734*
Midwest region	4,144	56,486	60,630	51,824*
TOTAL	65,995	1,135,332	1,201,327	584,120*

*Data for the year 2022 taken from Scheffer M. et al.¹¹ Source: MS/SVS/CGIAE - Mortality Information System – SIM. AF: atrial fibrillation.

In relation to the race/ethnicity criterion, deaths from atrial flutter and AF and unspecified stroke (ICD-10) occurred, in decreasing order, among whites, browns/mixed race, blacks, yellows, and indigenous people. White race accounted for 64.8% (42,748 cases) of deaths from atrial flutter/AF, and 44.5% (505,455 cases) of deaths from unspecified stroke (Table 6).

Finally, upon analyzing the place of occurrence of the deaths from atrial flutter, AF and stroke, the location of the highest incidence of deaths from these conditions was the hospital (73.6%; 884,302 cases), followed by domicile (20.9%; 251,501 cases) (Table 7). The number of cases declared as unknown corresponded to 5,835 cases (0.5%).

Conclusion

This study describes the epidemiological profile of people who died from AF and stroke over between 1996 and 2022 in Brazil. Based on the analysis of data obtained from SIM 94.5% were caused by stroke and 5.5% of deaths by atrial flutter and AF. However, there was an increase in the number of deaths from atrial flutter or AF and a slight decrease in the number of deaths due to stroke during this

Table 3 – Distribution of deaths from atrial flutter and AF and stroke (not specified as hemorrhage or infarction) by federative state of Brazil, from 1996 to 2022

States of Brazil	I48 atrial flutter and AF	I64 stroke unspecified as hemorrhagic or ischemic	TOTAL
RO	325	6,827	7,152
AC	121	2,511	2,632
AM	458	8,464	8,922
RR	78	1,197	1,275
PA	701	40,329	41,030
AP	38	2,629	2,667
TO	284	8,020	8,304
MA	433	43,264	43,697
PI	335	25,234	25,569
CE	1,474	57,143	58,617
RN	648	13,454	14,102
PB	483	27,924	28,407
PE	1,539	49,157	50,696
AL	362	27,203	27,565
SE	513	10,315	10,828
BA	3,528	96,576	100,104
MG	8,864	122,466	131,330
ES	1,257	21,539	22,796
RJ	8,510	133,926	142,436
SP	17,512	199,410	216,922
PR	5,460	76,973	82,433
SC	2,565	35,167	37,732
RS	6,363	69,118	75,481
MS	900	12,423	13,323
MT	888	12,982	13,870
GO	1,625	21,804	23,429
DF	731	9,277	10,008
TOTAL	65,995	1,135,332	1,201,327

Source: MS/SVS/CGIAE - Mortality Information System – SIM. AF: atrial fibrillation.

Table 4 – Distribution of deaths from atrial flutter and AF and stroke (not specified as hemorrhage or infarction) by gender, from 1996 to 2022 in Brazil			
Gender	I48 atrial flutter and AF	I64 unspecified stroke	TOTAL
Male	28,122	579,266	607,388
Female	37868	555,713	593,581
Unknown	5	353	358
TOTAL	65,995	1,135,332	1,201,327
Source: MS/SVS/CGIAE - Mortality Information System – SIM. AF: atrial fibrillation.			

Table 5 – Distribution of deaths from atrial flutter and AF and stroke (not specified as hemorrhage or infarction) by age, from 1996 to 2022 in Brazil			
Age	I48 flutter and AF	I64 unspecified stroke	TOTAL
< 1 year old	7	71	78
1 to 4 years old	2	139	141
5 to 9 years old	4	166	170
10 to 14 years old	8	346	354
15 to 19 years old	27	775	802
20 to 29 years old	139	3,845	3,984
30 to 39 years old	409	13,879	14,288
40 to 49 years old	1,236	48,913	50,149
50 to 59 years old	3,614	110,340	113,954
60 to 69 years old	8,911	209,414	218,325
70 to 79 years old	18,729	328,197	346,926
80 years or older	32,890	417,583	450,473
Unknown	19	1,664	1,683
TOTAL	65,995	1,135,332	1,201,327
Source: MS/SVS/CGIAE - Mortality Information System – SIM. AF: atrial fibrillation.			

Table 6 – Distribution of deaths from atrial flutter and AF, and stroke (not specified as hemorrhage or infarction) by race/ethnicity, from 1996 to 2022 in Brazil			
Race/ethnicity	I48 flutter and AF	I64 stroke unspecified as hemorrhagic or ischemic	TOTAL
White	42,748	505,455	548,203
Black	4,135	97,752	101,887
Yellow	460	7,836	8,296
Brown/mixed	14,176	348,267	362,443
Indigenous	78	2,159	2,237
Unknown	4,398	173,863	178,261
TOTAL	65,995	1,135,332	1.201,327
Source: MS/SVS/CGIAE - Mortality Information System – SIM. AF: atrial fibrillation.			

Table 7 – Distribution of deaths from atrial flutter and AF, and unspecified stroke as hemorrhagic and ischemic by location of occurrence, from 1996 to 2022 in Brazil.			
Location of occurrence	I48 flutter and AF	I64 stroke unspecified as hemorrhagic or ischemic	TOTAL
Hospital	57,493	826,809	884,302
Another healthcare facility	2,987	35,585	38,572
Domicile	4,643	246,858	251,501
Public thoroughfare	103	5,509	5,612
Others	675	14,830	15,505
Unknown	94	5,741	5,835
TOTAL	65,995	1,135,332	1,201,327
Source: MS/SVS/CGIAE - Mortality Information System – SIM. AF: atrial fibrillation.			

period in Brazil. It is worth noting that the prevalence of AF was accompanied by an increase in morbidity and mortality attributed to the disease, with a notable increased risk of stroke in patients with the arrhythmia.

Furthermore, the southeast region had the highest number of deaths for both diagnoses, and the state of São Paulo was the most affected. Regarding the epidemiological profile of the victims, most of them were white, and older. Females outnumbered males in cases of atrial flutter and AF, while males outnumbered females in cases of stroke.

This study provides epidemiological characteristics, as well as geographic distribution and risk factors deaths from AF and stroke over the past 26 years in Brazil, contributin to remodeling of public policies.

Author Contributions

Conception and design of the research: Silva LCS, Salim MDS, Rebouças ORPS, Viegas RFM; acquisition of data: Silva LCS, Castanheira LYFA, Salim MDS; analysis and

interpretation of the data: Silva LCS, Castanheira LYFA, Viegas RFM; statistical analysis: Silva LCS, Castanheira LYFA; writing of the manuscript: Silva LCS, Castanheira LYFA, Salim MDS, Rebouças ORPS; critical revision of the manuscript for intellectual content: Silva LCS, Viegas RFM.

Potential Conflict of Interest

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

Sources of Funding

There were no external funding sources for this study.

Study Association

This study is not associated with any thesis or dissertation work.

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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