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Overview of Morbidity and Mortality from Diabetes Mellitus and Systemic Arterial Hypertension in the State of Bahia, Brazil, between 2010-2022

Panorama da Morbimortalidade por Diabetes Mellitus e Hipertensão Arterial Sistêmica no estado da Bahia entre 2010-2022

Panorama de la Morbimortalidad por Diabetes Mellitus e Hipertensión Arterial Sistémica en el estado de Bahía entre 2010-2022

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Abstract

Introduction: Until the last century, the leading causes of mortality in Brazil and worldwide were infectious diseases and hunger. However, with changes in the epidemiological profile throughout the 21st century, noncommunicable chronic diseases, such as Diabetes Mellitus (DM) and Systemic Arterial Hypertension (SAH), have become predominant in terms of morbidity and mortality. Primary Health Care (PHC) plays a crucial role in the prevention, early detection, treatment, and follow-up of these conditions, although many patients still face severe complications such as cardiovascular and kidney diseases. **Objective:** The objective of this study was to describe the prevalence and epidemiological profile of hospitalizations and deaths due to DM and SAH in the state of Bahia, Brazil, between 2010 and 2022. **Methods:** An ecological and descriptive study was conducted based on data from the DataSUS Hospital Information and Mortality Systems. The target population included residents of the state of Bahia, with variables such as hospitalization and death described according to sex, skin color/ethnicity, age group, level of education, marital status, type of care, and place of death. As public domain data were used for this study, approval from the Research Ethics Committee was not required. **Results:** During the period, 164,176 hospitalizations due to DM were recorded, most of them involving women aged 60 years or older who self-identified as brown. For SAH, there were 127,080 hospitalizations, with the same prevalence profile: women aged 60 years or older who self-identified as brown. A total of 67,385 deaths attributed to DM and 55,485 to SAH were recorded, with a similar prevalence profile: women, over 70 years old, brown, and with low levels of education. The DM mortality rate ranged from 28.8 per 100 thousand inhabitants in 2010 to 46.5 in 2022. The SAH mortality rate ranged from 24.8 in 2010 to 43 in 2022. Furthermore, 97.7% of DM-related care and 98.8% of SAH-related care occurred in urgency situations. **Conclusions:** Our findings highlight the need to strengthen PHC, focusing on prevention, early diagnosis, appropriate treatment, and control of DM and SAH to prevent severe complications, hospitalizations, and deaths from these causes. Implementing health education programs aimed at promoting healthy lifestyles is crucial to reduce the incidence of these diseases. In addition, it is essential to ensure living and working conditions that promote healthy choices and equitable access to healthcare services, especially for the most vulnerable populations, in order to reduce health inequalities.

Keywords: Primary Health Care; Social determinants of health; Diabetes mellitus; Hypertension; Noncommunicable diseases.

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Resumo

Introdução: Até o século passado, as principais causas de mortalidade no Brasil e no mundo eram as doenças infecciosas e a fome. No entanto, com as mudanças no perfil epidemiológico ao longo do século XXI, as doenças crônicas não transmissíveis, como Diabetes Mellitus (DM) e Hipertensão Arterial Sistêmica (HAS), passaram a predominar na morbimortalidade. Nesse sentido, Atenção Primária à Saúde (APS) desempenha um papel crucial na prevenção, detecção precoce, tratamento e acompanhamento dessas condições, ainda que muitos pacientes continuem a enfrentar complicações graves, como doenças cardiovasculares e renais. **Objetivo:** O objetivo deste estudo foi descrever a prevalência e o perfil epidemiológico de internações e óbitos por DM e HAS no estado da Bahia entre 2010 e 2022. **Métodos:** Foi realizado um estudo ecológico e descritivo com base nos dados dos Sistemas de Informação Hospitalar e de Mortalidade do DataSUS. A população-alvo incluiu residentes do estado da Bahia, com descrição de variáveis como internação e óbito de acordo com sexo, cor/raça, faixa etária, escolaridade, estado civil, caráter e regime de atendimento e local do óbito. Por se tratar de dados de domínio público, não foi necessária a aprovação do Comitê de Ética em Pesquisa. **Resultados:** No período, foram registradas 164.176 internações por DM, sendo a maioria de pacientes mulheres, com 60 anos ou mais e que se autodeclararam pardas. Em relação à HAS, ocorreram 127.080 internações, com o mesmo perfil de prevalência: pacientes do sexo feminino, com 60 anos ou mais e que se autodeclararam pardas. Foram registrados 67.385 óbitos atribuídos ao DM e 55.485 à HAS, com perfil de prevalência semelhante: pessoas do sexo feminino, maiores de 70 anos, pardas e com baixa escolaridade. O coeficiente de mortalidade para DM variou de 28,8 por 100.000 habitantes em 2010 para 46,5 em 2022, e o para HAS variou de 24,8 em 2010 para 43 em 2022. Ademais, 97,7% dos atendimentos relacionados ao DM e 98,8% à HAS ocorreram em situações de urgência. **Conclusões:** Esses achados evidenciam a necessidade de fortalecer a APS, com foco na prevenção, no diagnóstico precoce, no tratamento adequado e no controle do DM e da HAS para evitar complicações graves, hospitalizações e óbitos por essas causas. A implementação de programas de educação em saúde, visando à promoção de estilos de vida saudáveis, é crucial para reduzir a incidência dessas doenças. Além disso, é fundamental garantir condições de vida e trabalho que promovam escolhas saudáveis e o acesso equitativo aos serviços de saúde, especialmente para as populações mais vulneráveis, a fim de reduzir as desigualdades em saúde.

Palavras-chave: Atenção Primária à Saúde; Determinantes sociais da saúde; Diabetes mellitus; Doenças crônicas não transmissíveis; Hipertensão arterial.

Resumen

Introducción: Hasta el siglo pasado, las principales causas de mortalidad en Brasil y en el mundo eran las enfermedades infecciosas y el hambre. Sin embargo, con los cambios en el perfil epidemiológico a lo largo del siglo XXI, las enfermedades crónicas no transmisibles, como la Diabetes Mellitus (DM) y la Hipertensión Arterial Sistémica (HAS), pasaron a predominar en la morbilidad y mortalidad. La Atención Primaria de Salud (APS) desempeña un papel crucial en la prevención, detección temprana, tratamiento y seguimiento de estas condiciones, aunque muchos pacientes siguen enfrentando complicaciones graves, como enfermedades cardiovasculares y renales. **Objetivo:** El objetivo de este estudio fue describir la prevalencia y el perfil epidemiológico de hospitalizaciones y muertes por DM y HAS en el estado de Bahía entre 2010 y 2022. **Métodos:** Se realizó un estudio ecológico y descriptivo basado en los datos de los Sistemas de Información Hospitalaria y de Mortalidad de DataSUS. La población objetivo incluyó residentes del estado de Bahía, con la descripción de variables como hospitalización y muerte según sexo, raza/etnia, grupo de edad, nivel educativo, estado civil, tipo de atención y lugar del fallecimiento. Al tratarse de datos de dominio público, no fue necesaria la aprobación del Comité de Ética en Investigación. **Resultados:** Durante el período, se registraron 164,176 hospitalizaciones por DM, siendo la mayoría mujeres, con 60 años o más y que se autodeclararon de raza mixta. Con relación a la HAS, ocurrieron 127,080 hospitalizaciones, con el mismo perfil de prevalencia: pacientes de sexo femenino, de 60 años o más y que se autodeclararon de raza mixta. Se registraron 67,385 muertes atribuidas a la DM y 55,485 a la HAS, con un perfil de prevalencia similar: personas de sexo femenino, mayores de 70 años, de raza mixta y con baja escolaridad. El coeficiente de mortalidad por DM varió de 28,8 por 100,000 habitantes en 2010 a 46,5 en 2022. El coeficiente de mortalidad por HAS varió de 24,8 en 2010 a 43 en 2022. Además, el 97,7% de las atenciones relacionadas con la DM y el 98,8% con la HAS ocurrieron en situaciones de urgencia. **Conclusiones:** Estos hallazgos evidencian la necesidad de fortalecer la APS, con un enfoque en la prevención, diagnóstico temprano, tratamiento adecuado y control de la DM y la HAS para evitar complicaciones graves, hospitalizaciones y muertes por estas causas. La implementación de programas de educación en salud, orientados a la promoción de estilos de vida saludables, es crucial para reducir la incidencia de estas enfermedades. Además, es fundamental garantizar condiciones de vida y trabajo que promuevan elecciones saludables y el acceso equitativo a los servicios de salud, especialmente para las poblaciones más vulnerables, con el fin de reducir las desigualdades en salud.

Palabras clave: Atención Primaria de Salud; Determinantes sociales de la salud; Diabetes mellitus; Enfermedades no transmisibles; Hipertensión.

INTRODUCTION

Until the end of the 19th century, the main causes of morbidity and mortality were hunger and infectious and parasitic diseases, associated with low socioeconomic status, precarious situations such as lack of sanitation, inadequate housing, and low level of education.[1] However, throughout the 20th century, significant advances in sanitation, nutrition, education, medical technology, and healthcare services have

promoted substantial improvements in quality of life, drastically reducing mortality rates from diseases such as diarrhea, smallpox, plague, cholera, and tuberculosis.[1]

In the 21st century, the health landscape has considerably changed. The so-called noncommunicable chronic diseases (NCDs) cause the death of 41 million people annually, representing 74% of the total deaths in the world, in which three quarters of these deaths occur in low- and middle-income countries such as Brazil.[2] Of this number of deaths, more than 15 million individuals died in the age group between 30 and 69 years, which is considered premature death by the World Health Organization (WHO).[2] NCDs include diseases that develop over time, resulting from the combination of genetic, physiological, environmental, and behavioral factors such as cardiovascular diseases, chronic respiratory diseases, diabetes mellitus (DM), and cancer.[3,4]

DM and Systemic Arterial Hypertension (SAH) are highly prevalent NCDs worldwide and, according to the third notebook of the 2006-2020 series of the *Vigitel Brasil* (Surveillance System of Risk and Protective Factors for Noncommunicable Chronic Diseases by Telephone Survey of the Brazilian Ministry of Health),[5] they are the major health risk factors in the country. It is worth emphasizing that unhealthy diet, lack of physical activity, and population aging are important conditions in the development of these diseases.[2] Social determinants, which include socioeconomic and environmental factors, such as employment, income, stress, access to health, public assets and services, and guarantee of rights, significantly influence the individual's ability to make healthier choices.[4,6] In Brazil, access to these factors is unequal, which aggravates the prevalence of these chronic diseases among different population groups.[6]

DM is a noncommunicable chronic disease characterized by persistent hyperglycemia. There are different types of DM, with type 1 being the most common among children and adolescents, manifesting abruptly due to pancreatic beta cell failure.[7] Conversely, type 2, which is more prevalent in adults and older people, is associated with aging and obesity, with a gradual onset caused by insulin resistance and partial deficiency in the secretion of this hormone.[7,8] According to the International Diabetes Federation (IDF),[9] Brazil ranks third in the global prevalence ranking of type 1 DM, with approximately 8.9 million children and adolescents affected by the disease. Regarding type 2, Brazil ranks sixth, with an estimated 20 million affected adults aged between 20 and 79 years.[9,10] In addition, it is estimated that 31.9% of individuals with DM are unaware of their condition,[10] which increases the risk of late diagnosis — which, in turn, can lead to the development of severe comorbidities, requiring hospitalization or even resulting in death.[11]

SAH is a noncommunicable chronic disease characterized by persistent elevation of blood pressure, with systolic values equal to or greater than 140 mmHg and/or diastolic values equal to or greater than 90 mmHg, measured on at least two different occasions.[12] According to the Cardiology Society of the State of São Paulo (*Sociedade de Cardiologia do Estado de São Paulo* – SOCESP),[13] about 30 million people over 18 years of age in Brazil are affected by the disease and only 10% adequately control it. SAH is a chronic disease that is often asymptomatic, but can cause damage to target organs, such as the brain, kidneys, heart, and blood vessels, in addition to increasing the risk of cardiovascular disease, chronic kidney disease, and premature death.[14] As in DM, early diagnosis, appropriate treatment, and control of hypertension are essential to prevent cardiovascular and kidney complications.[14] It is noteworthy that SAH is not limited to adulthood; Paiva et al.,[15] in a systematic review and meta-analysis, analyzed 15 studies with 43,227 adolescents and estimated the prevalence of hypertension at 10.3% among young Brazilians.

DM and SAH are chronic diseases of high prevalence in Brazil and worldwide, and although they can be prevented, diagnosed early, and treated at low cost, their adequate control is essential to avoid complications that result in morbidity and mortality. Primary Health Care (PHC) plays a fundamental role in

this process, being the main gateway to the public health system in Brazil, especially through programs — such as the Family Health Strategy, which is closer to communities. When prevention, early diagnosis, or treatment are not effective, patients face serious complications associated with these conditions. From this perspective, the importance of analyzing data on complications of DM and SAH in a population becomes evident, as such analysis is crucial to support preventive and control measures. Furthermore, this information is indispensable to guide the actions of healthcare managers and professionals, especially in the context of the state of Bahia, Brazil.

Therefore, we question what is the panorama of hospitalizations and deaths due to DM and SAH in the state of Bahia. The objective of this study is to verify the prevalence and epidemiological characteristics of hospitalizations and mortality due to DM and SAH in the population of the state of Bahia between 2010 and 2022.

METHODS

This is an ecological and descriptive study, with the use of secondary data from the Hospital Information System (*Sistema de Informação Hospitalar* – SIH) and the Mortality Information System (*Sistema de Informação de Mortalidade* – SIM) of the Department of Information and Informatics of the Brazilian Unified Health System (DataSUS). The study gathers information on SIH hospital admissions and mortality data, both in- and out-of-hospital, related to DM and SAH. The choice of different systems is due to the fact that SIH exclusively records deaths occurring in the in-hospital context.

For the research of diseases, the International Classification of Diseases – 10th revision (ICD-10) was used to define the codes for DM and SAH. Diagnoses for this study were: ICD E10-E14 (Type 1 Diabetes Mellitus, Type 2 Diabetes Mellitus, Malnutrition-Related Diabetes Mellitus, Other Specified Types of Diabetes Mellitus, and Unspecified Diabetes Mellitus) and ICD I10-I15 (Primary Essential Hypertension, Hypertensive Heart Disease, Hypertensive Kidney Disease, Hypertensive Heart and Kidney Disease, and Secondary Hypertension). Compared to the International Classification of Primary Care (ICPC), there is the equivalent of T89 – Insulin-dependent diabetes, T90 – Non-insulin-dependent diabetes, K86 – Hypertension without complications, and K87 – Hypertension with complications.

The study was conducted in the state of Bahia, located in the Northeast region of Brazil. In 2022, the state's population was 14,141,626 people, according to the Brazilian Institute of Geography and Statistics (IBGE),[16] being the fourth largest population in the country. The Human Development Index (HDI) of the state of Bahia is 0.691, and the monthly household per capita income is BRL 1,139.00 (IBGE data for 2021 and 2023, respectively).[16] In 2021, more than half of the state's population (57.7%) lived in conditions of poverty or extreme poverty.[17] Of this group, 17.6% people were in extreme poverty, with a per capita income of less than USD 2.15 per day, according to data from the National Household Sample Survey (*Pesquisa Nacional por Amostra de Domicílios* – PNAD).[17] These rates place the state of Bahia in the fifth worst position in the Northeast region and in the eighth worst in Brazil.[17]

The study focused on hospitalizations in the state of Bahia related to DM and SAH, covering all age groups, both elective and urgent. The analysis period comprises January 2010 to December 2022, including services registered in public and private facilities. The considered variables were: sex (man and woman), skin color/race (white, black, brown, Indigenous, Asian), age group (for hospitalizations: 0–19 years; 20–59 years; and 60 years or over; for deaths: 0–19 years; 20–29 years; 30–69 years; 70 years or over), years of schooling (none, 1–3 years, 4–7 years, 8–11 years, and 12 years or over), marital status (single,

married, widowed, legally separated, or other), place of death (hospital, other health facility, household, public pathway or other), care nature (elective or urgent), and care regime (public or private).

Electronic data collection took place between July and August 2023, and the form of search is detailed in the flowchart presented in Figures 1 and 2. The data were entered into spreadsheets of the Microsoft Office Excel Professional Plus 2019® software and underwent descriptive statistical treatment, in which the mortality frequencies, percentages, and rates were calculated according to the year of occurrence. As this study used a public domain database, it was not necessary to submit it to the Research Ethics Committee, according to Resolution No. 510/2016 of the National Health Council (*Conselho Nacional de Saúde* – CNS).

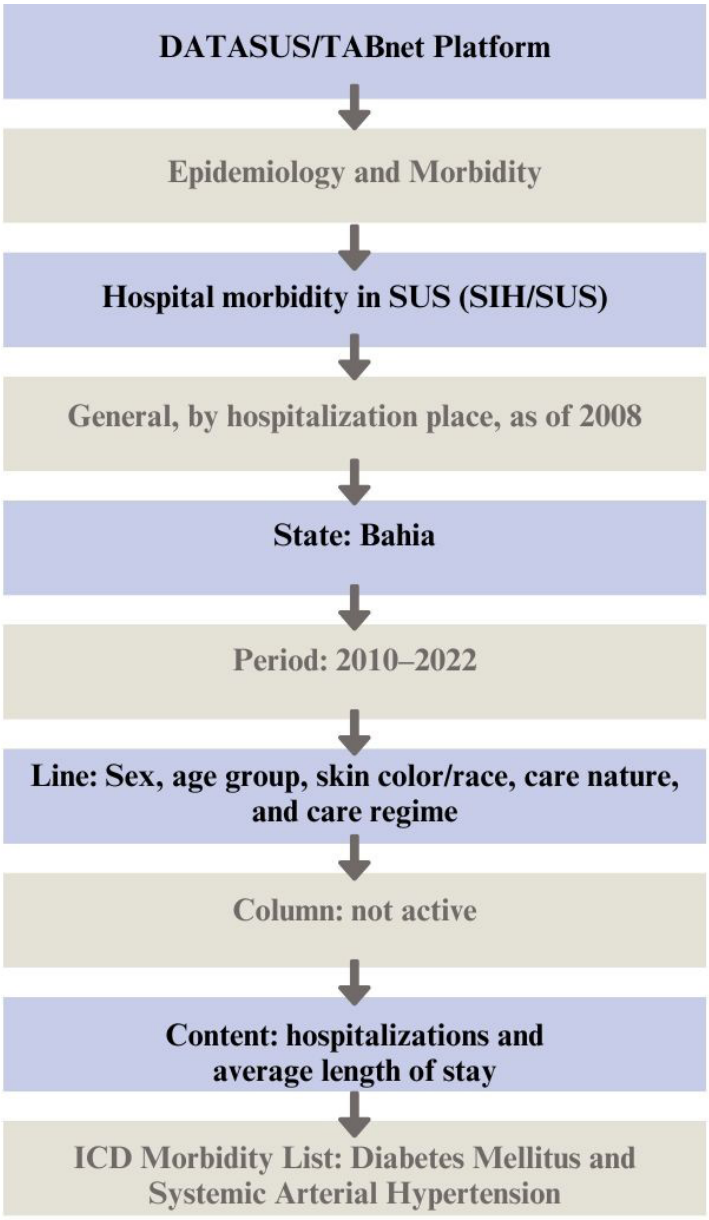


Figure 1. Flowchart of data consulted for the study on the Department of Information and Informatics platform of the Brazilian Unified Health System in the Hospital Information System.

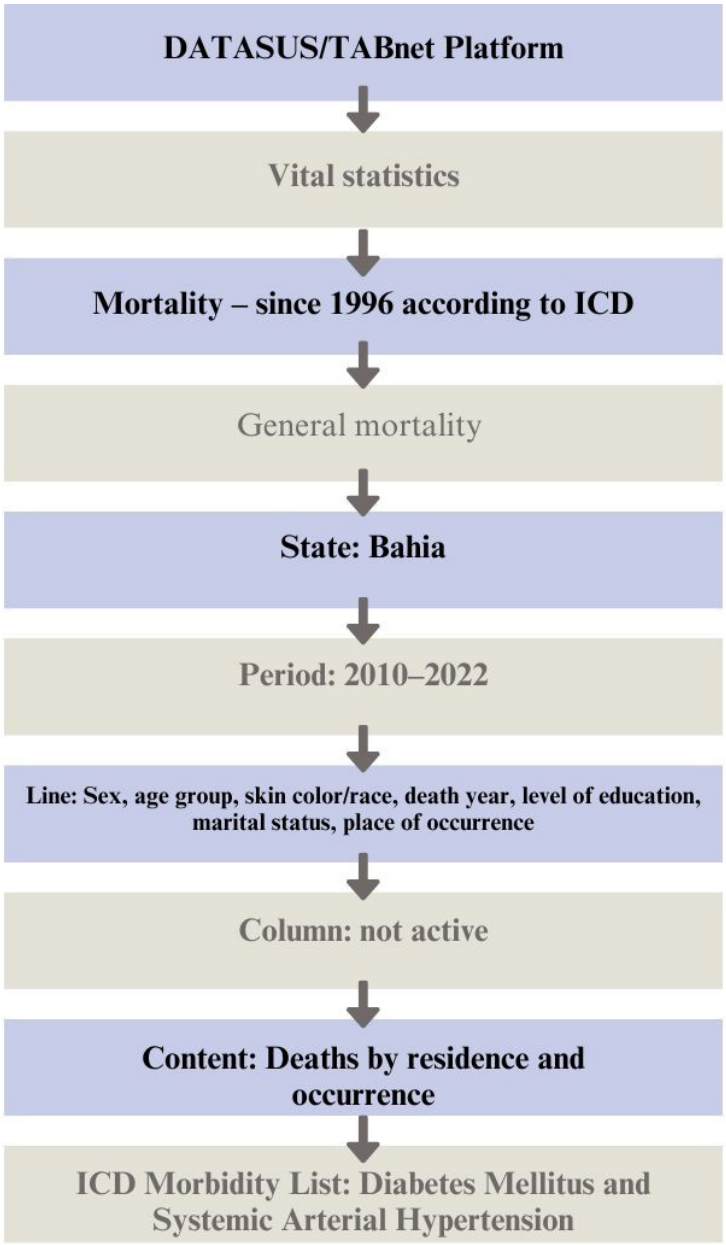


Figure 2. Flowchart of data consulted for the study on the Department of Information and Informatics platform of the Brazilian Unified Health System in the Mortality Information System.

RESULTS

As shown in Table 1, between 2010 and 2022, in the state of Bahia, 164,176 hospitalizations due to DM were recorded, with an average length of hospital stay of 5.9 days. Of these hospitalizations, 55.2% (n=90,615) were women and, in relation to age, patients aged 60 years or over accounted for 59% (n=96,844) of the occurrences. As for skin color/race, 81.9% (n=86,639) of hospitalized patients with this information recorded self-reported to be brown.

In the same period, regarding SAH, 127,080 hospitalizations were recorded, with an average length of hospital stay of 6.6 days. Of these hospitalizations, 62.3% (n=79,823) were women. Regarding age

Table 1. Hospitalizations for Diabetes Mellitus and Systemic Arterial Hypertension in the State of Bahia, Brazil, between 2010 and 2022.

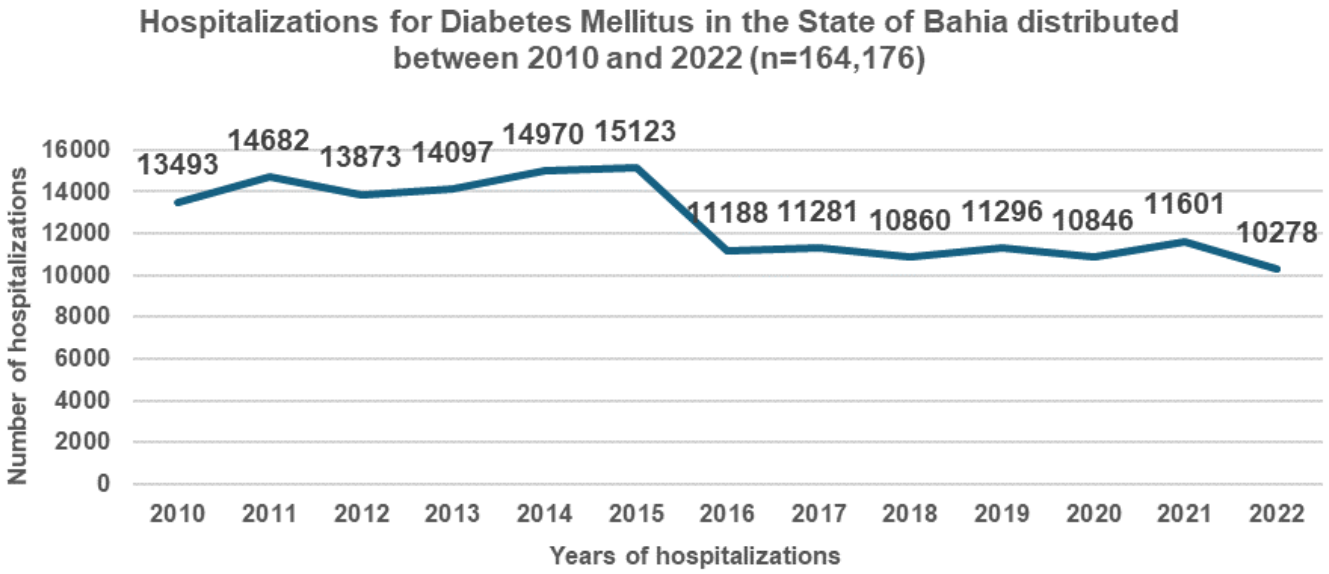
Variables	Diabetes Mellitus	Systemic Arterial Hypertension
	Bahia	Bahia
	n (%)	n (%)
Sex		
Man	73,561 (44.8)	47,257 (37.2)
Woman	90,615 (55.2)	79,823 (62.8)
Total	**164,176**	**127,080**
Age group		
0–19 years	7,534 (4.5)	1,775 (1.4)
20–59 years	59,798 (36.4)	51,227 (40.3)
60 years or over	96,844 (59)	74,078 (58.3)
Total	**164,176**	**127,080**
Race/skin color/ethnicity		
White	9,818 (9.2)	8,831 (10)
Black	7,624 (7.1)	10,177 (11.5)
Brown	86,639 (81.4)	67,707 (76.8)
Asian	2,360 (2.2)	1,546 (1.7)
Indigenous	41 (0.04)	38 (0.04)
No information	57,694 (35.1*)	38,781 (30.5*)
Total	**164,176**	**127,080**

*"No information" values were suppressed from the overall calculation of percentages.
Source: Brazilian Ministry of Health.[35]

group, 58.3% (n=74,078) of patients were 60 years or over, and as for skin color/race, 76.8% (n=67,707) of hospitalized patients self-reported to be brown (Table 1).

In Graph 1 we show the distribution of hospitalizations for DM in the state of Bahia during the study period, demonstrating an average of 12,628 occurrences per year. Between 2010 and 2015, the values were higher than this average; as of 2016, they were below it. Conversely, in Graph 2 we illustrate the

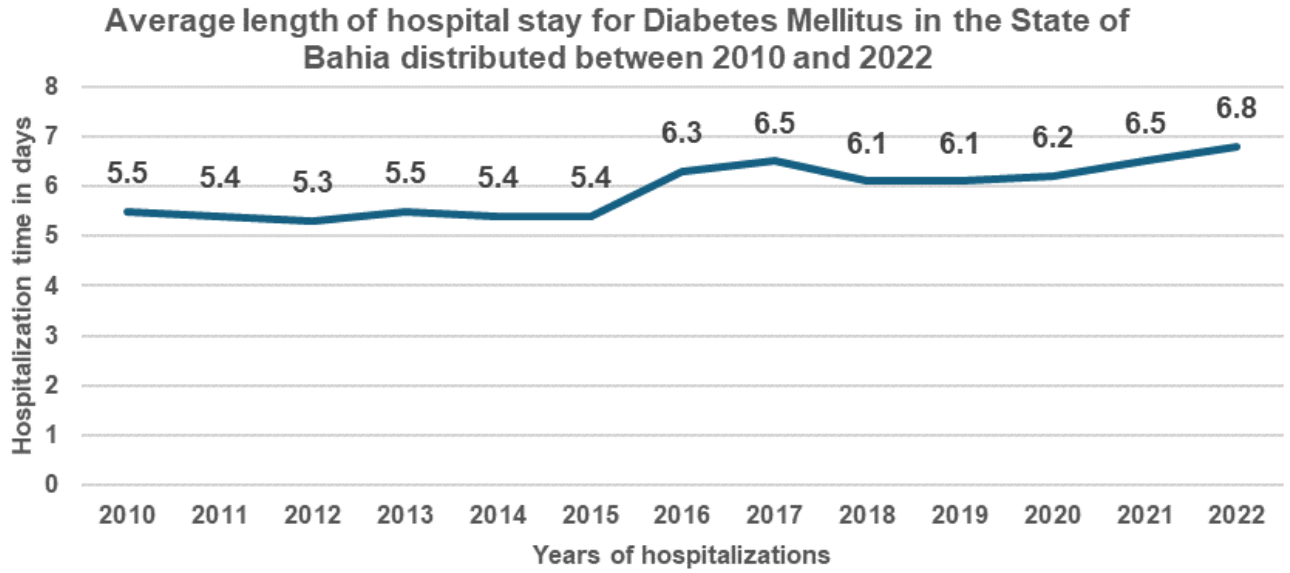
Graph 1. Hospitalizations for Diabetes Mellitus in the State of Bahia distributed between 2010 and 2022.



Source: Brazilian Ministry of Health.[35]

average length of hospital stay in the same period. Between 2010 and 2015, the average length of stay was approximately 5.4 days, whereas between 2016 and 2022 this average increased to 6.4 days.

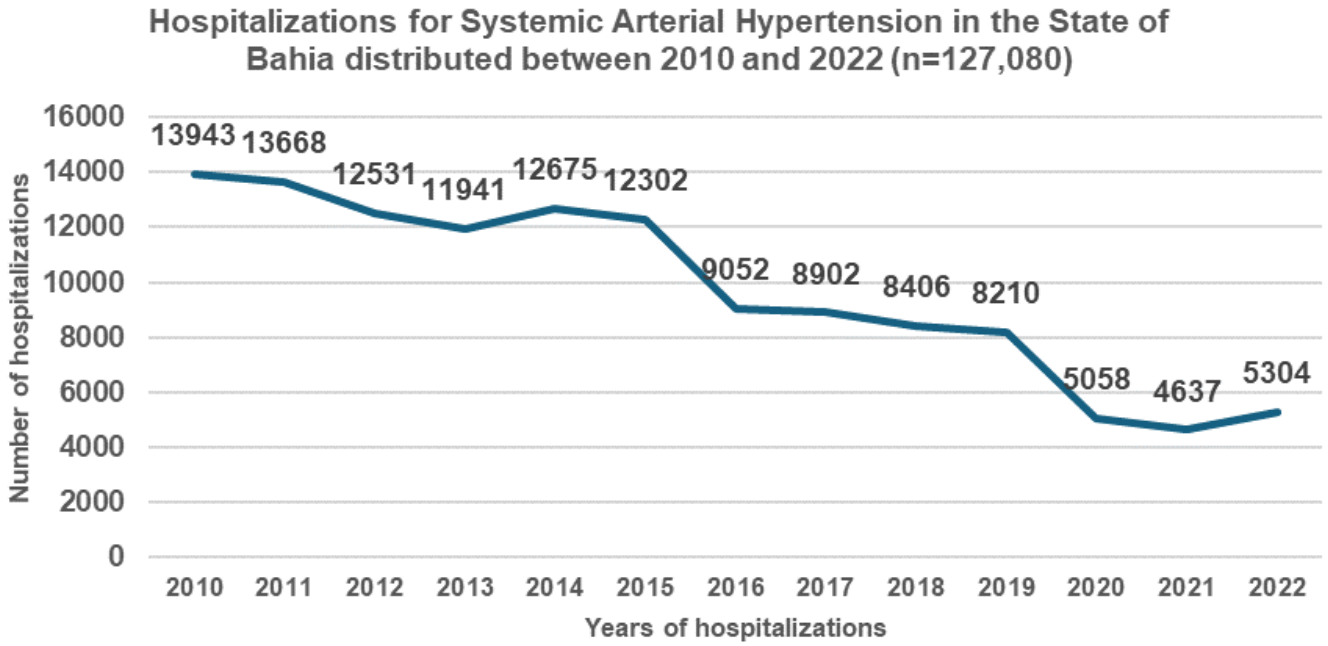
Graph 2. Average length of hospital stay for Diabetes Mellitus in the State of Bahia distributed between 2010 and 2022.



Source: Brazilian Ministry of Health.[35]

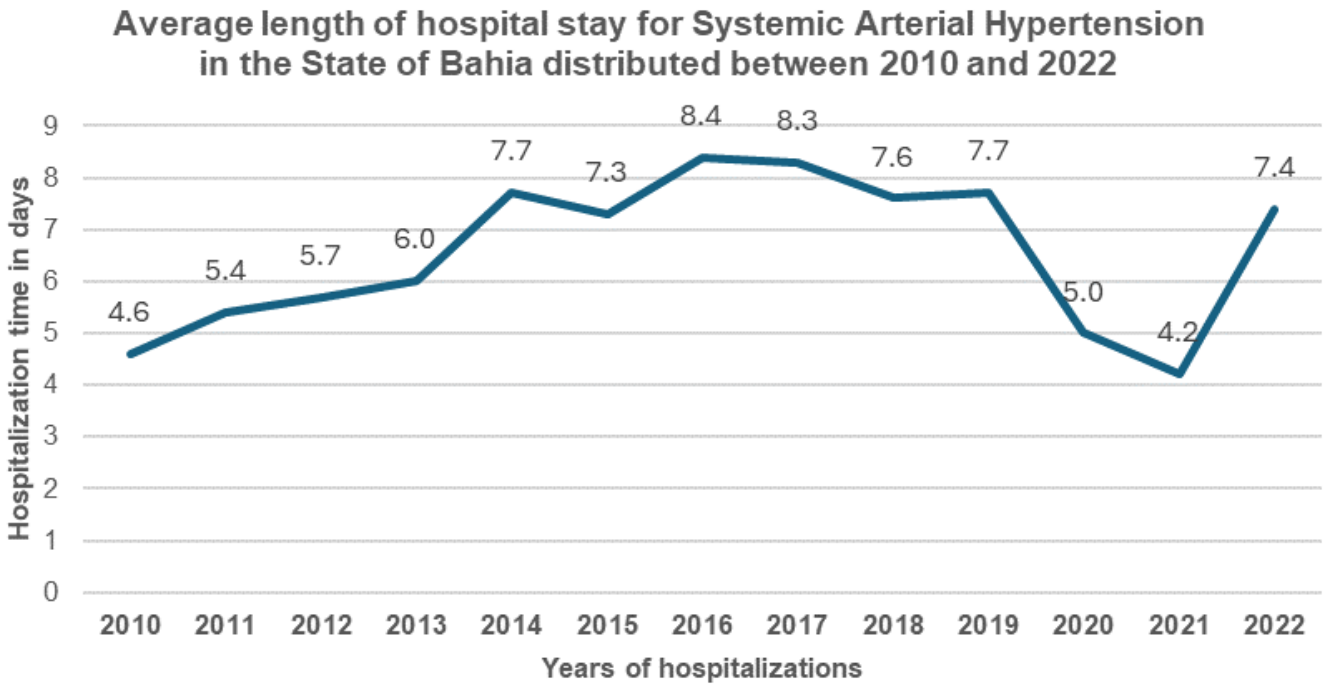
Regarding the annual distribution of hospitalizations for SAH in the study period (Graph 3), there was a significant drop in the number of records, from 13,943 in 2010 to 5,304 in 2022. As for the average length of hospital stay (Graph 4), there was an increase from 2010 to 2019, with slight reductions between 2014

Graph 3. Hospitalizations for Systemic Arterial Hypertension in the State of Bahia distributed between 2010 and 2022 (n=127,080).



Source: Brazilian Ministry of Health.[35]

Graph 4. Average length of hospital stay for Systemic Arterial Hypertension in the State of Bahia distributed between 2010 and 2022.



Source: Brazilian Ministry of Health.[35]

and 2015 and between 2017 and 2019. The steepest reduction occurred after that period, but the average increased again from 2021 to 2022.

According to Table 2, between 2010 and 2022, 67,385 deaths from DM were recorded in the state of Bahia. Most of these deaths (55.5%, n=37,420) concerned women, 60% (n=40,508) of people over 70 years of age, 59.8% (n= 36,801) of brown people, 71.9% (n=36,070) of individuals with none or up to three years of schooling, and 34% (n=19,382) of married people. Moreover, most deaths (63.7%, n=42,879) occurred in hospitals.

Table 2. Hospitalizations for Diabetes Mellitus and Systemic Arterial Hypertension in the State of Bahia, Brazil, between 2010 and 2022.

Variables	Diabetes Mellitus	Systemic Arterial Hypertension
	Bahia	Bahia
	n (%)	n (%)
Sex		
Man	29,957 (44.5)	25,676 (46.3)
Woman	37,420 (55.5)	29,802 (53.7)
No information	8 (0.01**)	7 (0.01**)
Total	**67,385**	**55,485**
Age group		
0–19 years	197 (0.3)	54 (0.1)
20–29 years	451 (0.7)	188 (0.3)
30–69 years*	26,213 (39)	16,639 (30)
Over 70 years	40,508 (60)	38,591 (69.5)
No information	16 (0.02**)	13 (0.02**)
Total	**67,385**	**55,485**

It continues...

Table 2. Continuation.

Variables	Diabetes Mellitus	Systemic Arterial Hypertension
	Bahia	Bahia
	n (%)	n (%)
Race/skin color/ethnicity		
White	13,320 (21.6)	10,682 (21)
Black	10,996 (17.9)	9,576 (18.9)
Asian	239 (0.4)	176 (0.34)
Brown	36,801 (59.8)	30,104 (59.4)
Indigenous	126 (0.2)	121 (0.3)
No information	5,903 (8.7**)	4,826 (8.7**)
Total	**67,385**	**55,485**
Years of Schooling		
None	20,860 (41.6)	19,539 (46.8)
1–3 years	15,210 (30.3)	11,820 (28.3)
4–7 years	7,800 (15.5)	6,039 (14.5)
8–11 years	5,179 (10.3)	3,535 (8.5)
12 years or over	1,116 (2.2)	756 (1.8)
No information	17,220 (25.6**)	13,796 (24.8**)
Total	**67,385**	**55,485**
Marital Status		
Single	17,492 (30.7)	13,939 (29)
Married	19,382 (34)	15,015 (31.3)
Widowed	15,421 (27)	15,346 (31.9)
Legally separated	2,057 (3.6)	1,537 (3.2)
Other	2,596 (4.5)	2,152 (4.5)
No information	10,437 (15.5**)	7,496 (13.5**)
Total	**67,385**	**55,485**
Place of occurrence		
Hospital	42,879 (63.7)	24,248 (43.7)
Other health facility	4,019 (6)	3,337 (6)
Household	19,079 (28.3)	26,075 (47)
Public pathway	524 (0.8)	669 (1.2)
Other	800 (1.2)	1,051 (1.9)
No information	84 (0.1**)	105 (0.2**)
Total	**67,385**	**55,485**

*Age group considered premature death.

**"No information" values were suppressed from the overall calculation of percentages.

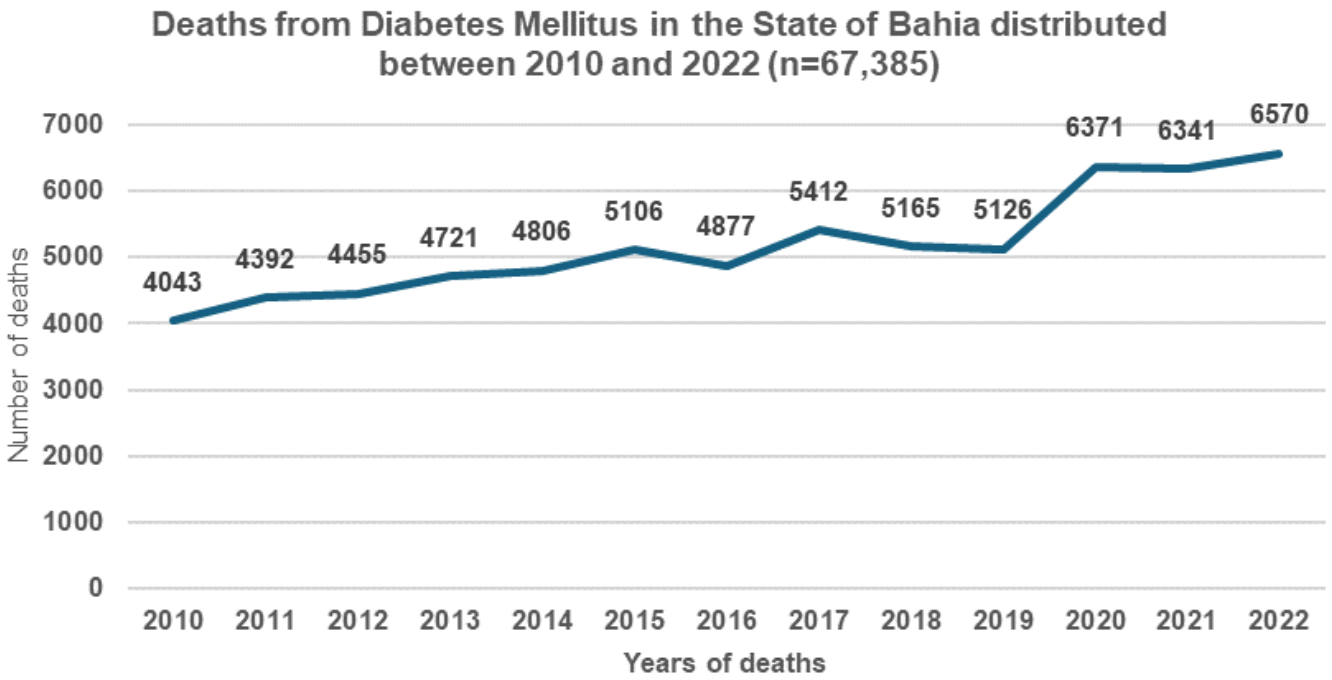
Source: Brazilian Ministry of Health.[36]

Regarding deaths from SAH, 55,485 cases were recorded. Of these, 53.7% (n=29,802) were women, 69.5% (n=38,591) were people over 70 years of age, 59.4% (n=30,104) of self-reported brown people, 75.1% (n=31,359) were individuals with none or up to three years of schooling, and 31.9% (n=15,346) were widowed. In addition, most deaths (47%, n= 26,075) occurred at the household.

As we show in Graph 5, the distribution of deaths from DM in the state of Bahia accounted for an average of 4,268 deaths per year during the analyzed period. From 2010 to 2022, there was an increase in the absolute number of deaths, with exceptions in the periods from 2015 to 2016, 2017 to 2019, and 2020 to 2021, when there were slight reductions followed by a subsequent increase in the number of recorded deaths.

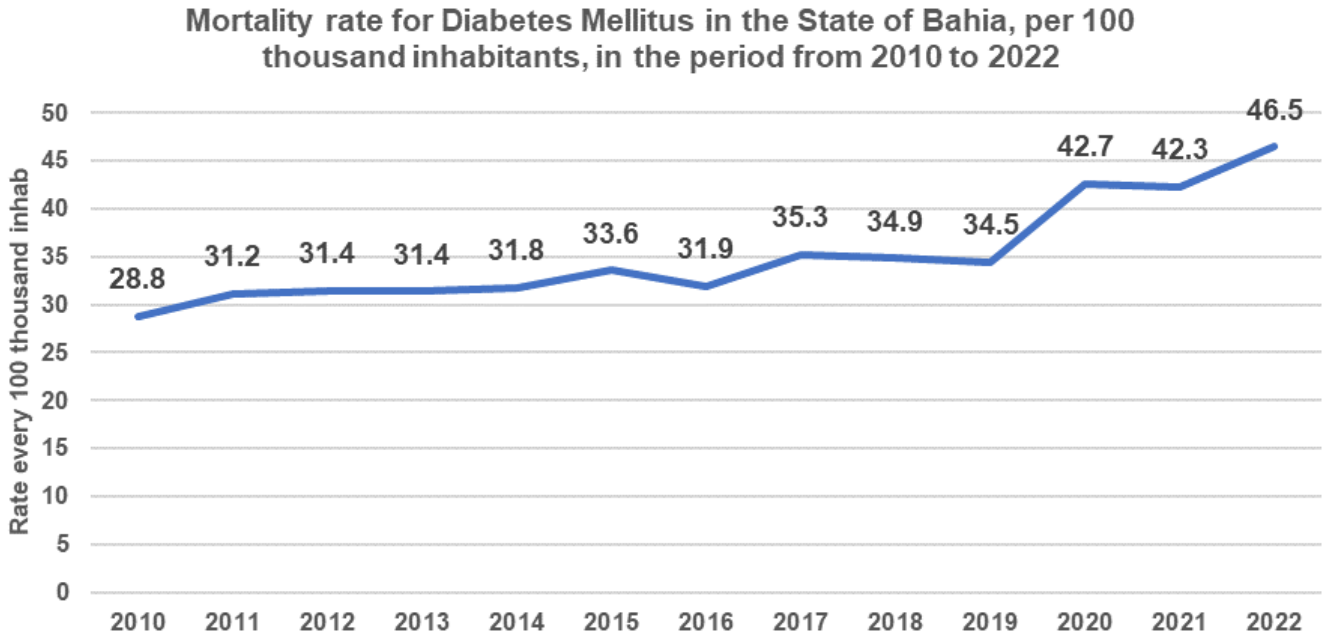
In Graph 6 we show the evolution of the DM mortality rate in the study period. We notice that in 2010 there were 28.8 deaths per 100 thousand inhabitants in the state of Bahia. There was an increase in the number of deaths over the period, reaching 46.5 deaths per 100 thousand inhabitants in 2022.

Graph 5. Deaths from Diabetes Mellitus in the State of Bahia distributed between 2010 and 2022.



Source: Brazilian Ministry of Health.[36]

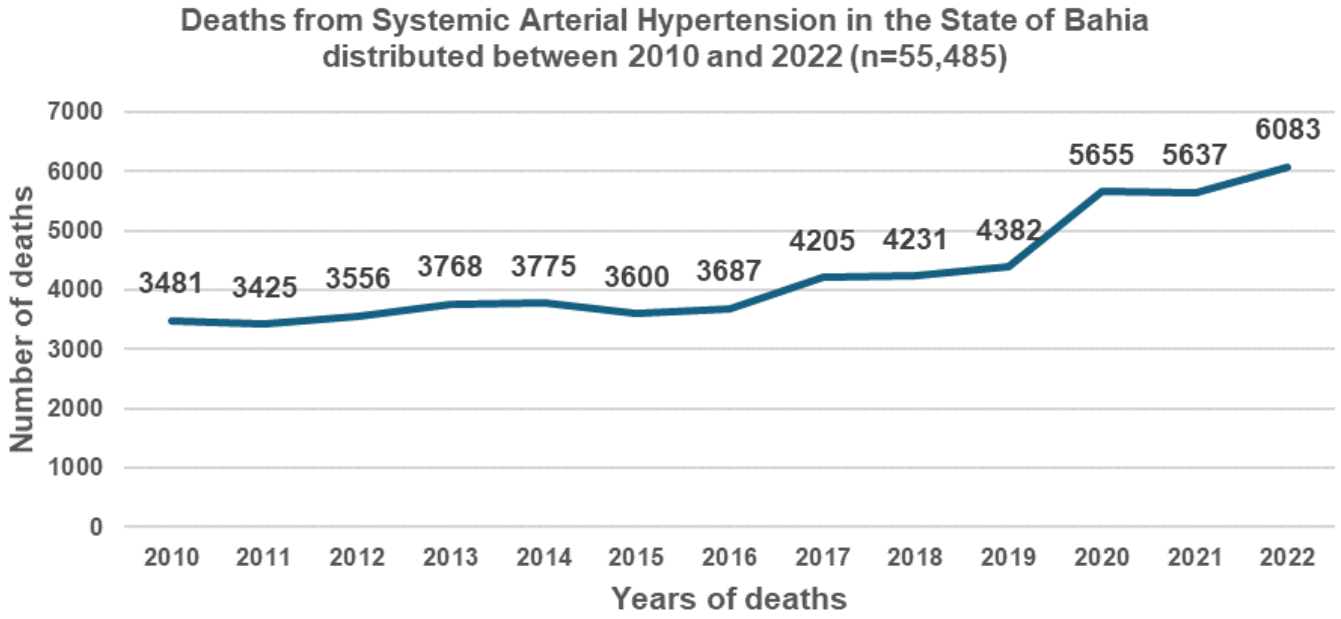
Graph 6. Mortality rate for Diabetes Mellitus in the State of Bahia, per 100 thousand inhabitants, in the period between 2010 and 2022.



Source: prepared by the authors based on information from the Mortality Information System of the Brazilian Ministry of Health[36] and the Brazilian Institute of Geography and Statistics.[16]

In Graph 7 we demonstrate the distribution of deaths from SAH in the state of Bahia between 2010 and 2022. During the study period, there were an average of 4,268 deaths per year. There is an increase throughout the time series, with emphasis on the years 2020, 2021, and 2022.

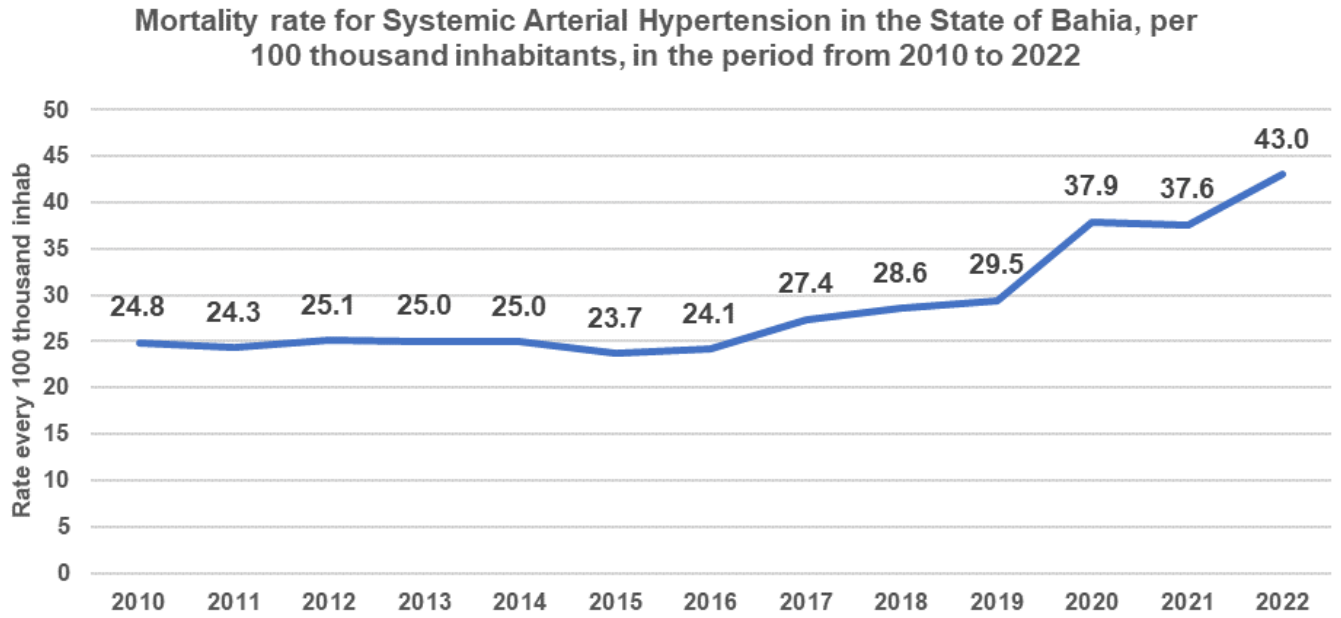
Graph 7. Deaths from Systemic Arterial Hypertension in the State of Bahia distributed between 2010 and 2022.



Source: Brazilian Ministry of Health.[36]

In Graph 8 we show the growth of the SAH mortality rate in the study period. We observe that in 2010 there were 24.8 deaths per 100 thousand inhabitants in the state of Bahia. Until 2016, there were small changes in the rate, which increased as of 2017, reaching 43 deaths per 100 thousand inhabitants in 2022.

Graph 8. Mortality rate for Systemic Arterial Hypertension in the State of Bahia, per 100 thousand inhabitants, in the period between 2010 and 2022.



Source: prepared by the authors based on information from the Mortality Information System of the Brazilian Ministry of Health[36] and the Brazilian Institute of Geography and Statistics.[16]

In Table 3 we show the distribution of care by DM and SAH according to the care nature and regime. For both diseases, most patients were treated urgently, with 97.7% (n= 160,418) of DM cases and 98.8% (n=98,524) of SAH cases. Regarding the care regime, most patients with DM (65%, n=54,275) and SAH (53%, n=30,379) were seen in public services.

Table 3. Information on the care nature and regime in the State of Bahia, Brazil, between 2010 and 2022, for Diabetes Mellitus and Systemic Arterial Hypertension.

Variables	Diabetes Mellitus	Systemic Arterial Hypertension
	Bahia	Bahia
	n (%)	n (%)
Care nature		
Elective	3,760 (2.3)	2.98 (0.2)
Urgency	160,418 (97.7)	124,094 (98.8)
Total	**164,176**	**127,080**
Care regime		
Public	54,275 (65)	39,780 (53)
Private	29,201 (35)	35,189 (47)
Total	**164,176**	**127,080**

Source: Brazilian Ministry of Health.[35]

DISCUSSION

According to the SIH, between 2010 and 2022, 1,778,601 hospitalizations for DM were recorded in Brazil, of which 164,176 occurred in the state of Bahia, corresponding to 9.2% of the national total. In the state of Bahia, the average length of hospital stay was 5.9 days, with 55.2% (n=90,615) of the hospitalized patients being women and 59% (n=96,844) aged 60 years or over. We observed that a significant proportion of hospitalizations occurred among patients aged 20 to 59 years, representing 36.4% (n=59,798) of cases. Regarding skin color/race, 81.9% (n=86,639) of hospitalized patients self-reported to be brown. Although according to the data in Graph 1 there was a reduction in the absolute number of hospitalizations, in Graph 5 an increase in the number of deaths stood out; and a significant increase in the mortality rate (number of deaths per 100 thousand inhabitants) over the time series was demonstrated in Graph 6, which raised from 28.8 in 2010 to 46.5 in 2022.

With regard to SAH, 1,153,521 hospitalizations were recorded by the SIH in Brazil between 2010 and 2022. In the state of Bahia, there were 127,080 hospitalizations, representing 11% of the national total, with an average length of hospital stay of 6.6 days. Among hospitalized patients, 62.3% (n=79,823) were women and 58.3% (n=74,078) aged 60 years or over. It is worth noting that the number of hospitalizations in the age group of 20 to 59 years was also significant, corresponding to 40.3% (n=51,227) of cases. As for skin color/race, 76.8% (n=67,707) of hospitalized patients self-reported to be brown. Although according to the data presented in Graph 3 there was a significant reduction in the absolute number of hospitalizations, in Graph 7 we observed an increase in associated mortality; and in Graph 8, a significant increase in the mortality rate over the study period, which raised from 24.8 in 2010 to 43 in 2022.

Between 2010 and 2022, the SIM recorded 67,385 deaths attributed to DM, corresponding to 41% of hospitalizations, and 55,485 deaths from SAH, representing 43.7% of hospitalizations. Most deaths occurred among women (DM=55.5% and SAH=53.7%), individuals who self-reported to be brown (DM=59.8% and SAH=59.4%), people with low level of education or no education (DM=71.9% and SAH=75.1%), and older

adults aged 70 years or over (DM=60% and SAH=69.5%). In addition, we observed a high premature mortality in individuals aged 30 to 69 years, with 39% of deaths from DM and 30% from SAH.

Authors of studies carried out in other Brazilian states corroborate the findings of this study on the epidemiological profile of hospitalizations and deaths. Lima Filho et al.[18] analyzed the profile of hospitalizations for DM and SAH in the state of Pernambuco, using SIH data between 2018 and 2022. The authors identified 27,721 hospitalizations for DM and 8,884 for SAH, highlighting a higher prevalence of hospitalizations among women (DM=51.3% and SAH=58.6%), older adults (DM=54.1% and SAH=58.6%), and brown individuals (DM=81.4% and SAH=64%). Regarding hospital mortality, the highest rates were also observed in women (DM=55% and SAH=57%) and older adults (DM=72.8% and SAH=83.8%), results that are in line with our findings.

Conversely, some researchers have found epidemiological profiles with distinct characteristics. Ribeiro et al.[19] evaluated the prevalence of hospitalizations for DM and SAH and mortality rates in the city of Manaus, state of Amazonas, based on 2,157 occurrences recorded in the SIH in 2019. The authors concluded that the highest prevalence of hospitalizations for DM and SAH occurred in men (DM=61.4% and SAH=52.9%), which contrasts with our findings, and in older people (DM=57.3% and SAH=62.0%). As for deaths, the highest proportions were observed among women (DM=56.3% and SAH=61%) and older adults (DM=80.5% and SAH=87.8%), results that corroborate the data found in our research.

Mendes et al.[20] analyzed the evolution of hospitalizations by the Brazilian Unified Health System (SUS) of residents of the state of São Paulo due to DM and SAH in the period from 2008 to 2018, based on SIH data. The authors observed an overall reduction of 3.2% in hospitalizations for DM and 53.3% for SAH. However, when stratifying the data by sex and age, they found a significant decrease in hospitalizations among women with DM, while the rate among men remained stable, especially in the age group below 60 years. Conversely, rates of hospitalization for SAH showed a consistent drop in both sexes. Mendes et al.[20] concluded that these reductions are associated with better access of diabetic and hypertensive patients to the information and inputs necessary for treatment in PHC.

We demonstrated that the epidemiological profile of hospitalizations and deaths due to DM and SAH is similar. Regarding hospitalizations, the highest prevalence was observed in women, brown individuals, and older people; with regard to deaths, the highest rates were found among women, brown individuals, older people, and those with low levels of education. The numbers of hospitalizations and deaths in younger age groups are noteworthy. The high prevalence of these diseases in Brazil and worldwide is associated with factors such as aging of the population, inadequate eating habits, sedentary lifestyle, obesity, and unfavorable socioeconomic conditions, including low levels of education, inadequate housing, and low family income.[21,22] These diseases, usually silent and insidious in their onset, are often identified after the emergence of complications such as cardiovascular, kidney, neuropathic, and ophthalmological diseases.[21,22] This scenario highlights the importance of PHC, which, for being closer to the community, can guide the population regarding prevention, in addition to enabling early diagnosis and appropriate treatments. This, in turn, can avoid complications that lead to morbidity and mortality, reducing the burden on SUS.[23]

According to data from the Brazilian Association of Cardiology (*Associação Brasileira de Cardiologia* – ABC),[24] in the last 30 years, there has been an increase in the number of women and young people (aged 15 to 49 years) with cardiovascular diseases. Risk factors associated with these conditions are well established and include DM, SAH, dyslipidemia, smoking habit, obesity, and sedentary lifestyle. Among these factors, the ABC points out that overweight and DM were more frequent among women, in addition to emphasizing that the prevalence of self-reported SAH in Brazil is higher in women compared to men.

The Brazilian Diabetes Society (*Sociedade Brasileira de Diabetes* – SBD)[25] highlights some reasons that may explain the higher prevalence of metabolic diseases in women, including a stronger culture of medical follow-up, which results in a greater number of diagnoses, and a scenario of social and economic difficulties that affects the female population more intensely. These socioeconomic issues have a significant impact on access to quality food and regular physical activity. With regard to SAH, the Brazilian Federation of Gynecology and Obstetrics Associations (*Federação Brasileira das Associações de Ginecologia e Obstetrícia* – Febrasgo)[26] points out that women are exposed to this condition in all age groups due to the aforementioned risk factors. However, after menopause, the loss of the vascular protective factor (estrogen) increases the risk of developing SAH in women compared to men.[26]

Regarding older adults, who represent a significant portion of the population affected by morbidity and mortality due to DM and SAH, the Brazilian Society of Geriatrics (*Sociedade Brasileira de Geriatria* – SBG)[27] highlights that this population has additional risk factors. These include significant functional and cognitive losses associated with the aging process. Moreover, older adults tend to be more inactive, more vulnerable to psychological and social conditions, and often face other comorbidities that can result in greater health fragility and the need for polypharmacy.[27]

As for low levels of education, several researchers[28,29] point out that this condition, considered an indicator of socioeconomic status, is directly related to worse health outcomes. This is because low levels of education make it difficult to access information on the prevention and control of diseases, such as DM and SAH, as well as limiting access to adequate healthcare services. In addition, individuals with low levels of education tend to adopt higher risk behaviors such as inadequate diet and sedentary lifestyle. Social determinants, such as unequal access to health care and education, directly affect health outcomes.[30,31] Braveman and Williams[31] argue that medical care alone is not enough to improve health; it is essential to consider people's life context.

The decrease in hospitalizations for both diseases may be associated with improvements in outpatient management, especially with the increase in PHC and Family Health Strategy (FHS) coverage in the state of Bahia. According to the Brazilian Ministry of Health,[32] in 2010, PHC coverage in the state was 66%, rising to 78.8% in 2022. Regarding the FHS, coverage was 59.8% in 2010, rising to 80.2% in 2022.[32] Conversely, the increase in the number of deaths and the mortality rate suggests an increasing severity of hospitalized cases. This trend may be related to factors such as late diagnosis, low adherence to drug therapy, aging of the population, and the presence of multiple comorbidities.[33-35]

Furthermore, most care for DM and SAH occurred urgently (97.7% and 98.8%, respectively) and there was a predominance of care in the public health service (65% for DM and 53% for SAH), highlighting the need for substantial investments in this sector. The high demand for emergency care overburdens the public service, emphasizing the importance of strengthening PHC, prevention, early diagnosis, and adequate control, leading to better clinical management of people with these NCDs.

Based on these findings, it is imperative that public policies focus on strengthening PHC, with an emphasis on prevention, early diagnosis, appropriate treatment, and control of DM and SAH. Implementing health education programs aimed at promoting healthy lifestyles, such as a balanced diet and regular physical activity, is crucial to reduce the incidence of these diseases.[30,31] In addition, ensuring living and working conditions that promote health, healthy life choices, and equitable access to healthcare services for all populations, especially the most vulnerable, is paramount to reduce health inequalities.[30,31]

This study offers a broad description of the prevalence and epidemiological profile of hospitalizations and deaths due to DM and SAH in the state of Bahia between 2010 and 2022, using comprehensive SIH and

SIM data from DataSUS. Strengths include the relevance of data and the identification of significant health disparities, providing valuable insights for public policies. Nevertheless, limitations include the possible underreporting of data, the ecological and descriptive nature of the study, and the lack of detail on comorbidities and socioeconomic factors, suggesting the need for further research for a deeper understanding.

CONFLICT OF INTERESTS

Nothing to declare.

AUTHORS' CONTRIBUTIONS

TS: Conceptualization, Data curation, Formal analysis, Supervision, Validation, Visualization, Writing – original draft, Investigation, Methodology, Project administration, Resources, Writing – review & editing, Software. MN: Conceptualization, Data curation, Formal analysis, Supervision, Validation, Visualization, Writing – original draft, Investigation, Methodology, Project administration, Resources, Writing – review & editing, Supervision.

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