HOSPITALIZATIONS, DEATHS AND HOSPITAL COSTS DUE TO DIABETES MELLITUS INTERNAÇÕES, ÓBITOS E CUSTOS HOSPITALARES POR DIABETES MELLITUS HOSPITALIZACIONES, MUERTES Y COSTOS HOSPITALARIOS POR DIABETES MELLITUS

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ABSTRACT

Objective: to describe hospitalizations, deaths and public hospital costs for Diabetes Mellitus in Northeastern Brazil between 2013 and 2017. **Method:** this is a quantitative, descriptive and ecological study with secondary data collection from the Hospital Information System. Data was collected regarding hospitalizations, deaths, hospital costs, average hospitalization value and average length of stay. Data was analyzed using simple descriptive statistics, presenting them using tables prepared using Excel software. **Results:** 136,504 hospitalizations and 7,424 deaths from diabetes mellitus were recorded in the Brazilian Northeast. Also noteworthy were the public hospital costs over R\$ 65 million, with an average hospitalization value of R\$ 545.08 and an average length of stay of 5.4 days. **Conclusion:** it can be concluded that hospitalizations, deaths and public hospital costs for Diabetes Mellitus showed a slight reduction and, even so, they significantly implied the public budget, in addition to the personal and family repercussions imposed by the disease. **Descriptors:** Public Health; Epidemiology; Endocrinology; Health Care Costs;

RESUMO

Objetivo: descrever as internações, óbitos e custos públicos hospitalares por Diabetes Mellitus no Nordeste brasileiro entre 2013 e 2017. **Método:** trata-se de estudo quantitativo, descritivo e ecológico com levantamento de dados secundários do Sistema de Informações Hospitalares. Coletaram-se os dados referentes às internações, óbitos, custos hospitalares, valor médio de internação e média de permanência. Analisaram-se os dados mediante estatística descritiva simples, apresentando-os por meio de tabelas elaboradas no *software Excel*. **Resultados:** registraram-se 136.504 internações e 7.424 óbitos por Diabetes Mellitus no Nordeste brasileiro. Destacaram-se, além disso, os custos públicos hospitalares superiores a R\$ 65 milhões, com valor médio de internação de R\$ 545,08 e média de permanência de 5,4 dias. **Conclusão:** conclui-se que as internações, óbitos e os custos públicos hospitalares por Diabetes Mellitus apresentaram discreta redução e, mesmo assim, implicaram, de maneira expressiva, o orçamento público, além das repercussões pessoais e familiares impostas pela doença. **Descritores:** Saúde Pública; Epidemiologia; Endocrinologia; Custos de Cuidados de Saúde; Doenças do Sistema Endócrino; Indicadores Básicos de Saúde.

RESUMEN

Objetivo: describir las hospitalizaciones, muertes y costos hospitalarios por diabetes mellitus en el noreste de Brasil, entre 2013 y 2017. **Método:** se trata de un estudio cuantitativo, descriptivo y ecológico, con la recopilación de datos secundarios del Sistema de Informaciones Hospitalarias. Se recopilaron los datos de hospitalizaciones, muertes, costos hospitalarios, valor promedio y tiempo de permanencia de la hospitalización. Los datos se analizaron mediante estadísticas descriptivas simples y se presentaron a través de tablas elaboradas en el *software Excel*. **Resultados:** se registraron 136,504 hospitalizaciones y 7,424 muertes por diabetes mellitus en el noreste de Brasil. Además, se destacaron los costos hospitalarios públicos superiores a R \$ 65 millones, con un valor promedio de hospitalización de R\$ 545.08 y una permanencia con promedio de 5,4 días. **Conclusión:** se concluye que las hospitalizaciones, las muertes y los costos hospitalarios debidos a la diabetes mellitus presentaron una ligera reducción, y aun así, estaban significativamente implicados en el presupuesto público, además de las repercusiones personales y familiares impuestas por la enfermedad. **Descriptores:** Salud Pública; Epidemiología; Endocrinología; Costos de la Atención en Salud; Enfermedades del Sistema Endocrino; Indicadores de Salud.

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INTRODUCTION

Non-communicable Chronic Diseases (NCDs) are known to be the leading cause of death and disability worldwide, establishing themselves as one of the greatest public health challenges of the 21st century.^{1,2} Among the NCDs, Diabetes Mellitus (DM) stands out, defined as a complex set of metabolic alterations represented by chronic hyperglycemia and disorders in protein, lipid and carbohydrate metabolism.^{3,4}

DM is classified as type 1 (DM1), type 2 (DM2), gestational and, among other specificities, being the second type of greater magnitude. It is estimated that DM1 is present in 5% to 10% of the population affected by the disease and results from the intense destruction of pancreatic beta cells, which in turn promotes absolute insulin deficiency in the body. It is reported that DM2 affects about 90% to 95% of individuals and is the result of decreased insulin production or ineffective response of the body to its use.³

Worldwide, in the 2000s, around 151 million people were diagnosed with DM. In 2015, the gross number of people with the disease reached 415 million, corresponding to a prevalence of 8.8%.² In Brazil, there are 14.3 million people with the disease,^{5,6} ranking fourth among the countries with the highest prevalence of DM, second only to China, India and the United States.⁶

It is noteworthy that, in addition to the increasing mortality behavior, DM promotes challenges regarding the economic costs associated with pathology.^{2,7} From this perspective, it is warned that if the global epidemiology of DM continues to be progressive, there will be a massive increase in financial impacts on health in the coming years. It should also be noted that 12% of global health revenues currently go to the care of people with DM and its complications,² generating a great economic responsibility for those affected, their families, health systems and countries.⁸

It is reported that DM is a risk factor for vascular diseases,⁹ renal diseases^{10,11} and other pathologies, generating socioeconomic repercussions, increasing health inequities and compromising the quality of life (QoL) of patients.¹ Nevertheless, it is stated that the prevention of complications in the short, medium and long term depends on the self-management of

Hospitalizations, deaths and hospital costs due to... the pathology^{3,5} and the follow-up in basic health service.

Among these services, we highlight the actions developed by Primary Health Care (PHC), considered the population's gateway to the services. It is pointed out that PHC has a resolution capacity of 85% of the population demands, resulting in lower health expenses and a decrease in morbidity and mortality rates, mainly due to cardio and cerebrovascular complications.^{12,13} Moreover, DM is considered a sensitive condition for primary care,¹² and the increase in its morbidity and mortality rates may indicate low effectiveness of the service in terms of access, coverage and quality.¹⁴

From this perspective, epidemiological studies of this nature constitute an indirect indicator of health services evaluation. However, it is mentioned that studies on health expenses help in the survey of characteristics that may contribute to the reduction of pathological complications and, consequently, the reduction of hospitalizations and their respective costs.¹³

OBJECTIVE

- To describe the hospitalizations, deaths and public hospital costs for Diabetes Mellitus in Northeast Brazil between 2013 and 2017.

METHOD

This is a quantitative, descriptive and ecological study conducted with data collected from the Hospital Information System (HIS). HIS is an administrative tool of the Department of Informatics of the Unified Health System (DATASUS) that contains data on hospitalizations performed in public health institutions throughout the Brazilian territory.¹⁵

From this perspective, data were collected from the Northeast region of Brazil, considered the second region with the largest number of inhabitants, which is equivalent to approximately 56.7 million people distributed in nine Federative Units (FU),¹⁶ according to table 1.

Table 1. Federative Units belonging to the Northeast region of Brazil. Jequeie (BA), Brazil, 2018.

Federative units	CAPITAL	HDI*	POPULATION**	TERRITÓRY (km²)
Maranhão	São Luís	0.639	7,035,055	331,936,949
Piauí	Teresina	0.646	3,264,531	251,611,929
Ceará	Fortaleza	0.682	9,075,649	148,887.633
Rio Grande do Norte	Natal	0.684	3,479,010	52,811.107
Paraíba	João Pessoa	0.658	3,996,496	56,468,435
Pernambuco	Recife	0.673	9,496,294	98,076.021
Alagoas	Maceió	0.631	3,322,820	27,848,140
Sergipe	Aracaju	0.665	2,278,308	21,918.443
Bahia	Salvador	0.660	14,812,617	564,732,450

* HDI: Human Development Index - Last updated in 2010

** Last updated on 2018

Source: Brazilian Institute of Geography and Statistics¹⁷

The variables were collected in September 2018, considering the time limit between 2013 and 2017. Thus, one selected the option of “Diabetes Mellitus treatments”, protocolled with the code: 03.03.03.003-8 throughout the national territory. These are medium complexity clinical procedures that require urgent care in hospitals and home care, according to the National List of Actions and Health Services (RENASES).

Data was then stratified by hospitalizations and hospital deaths, values of hospital services offered to users, average hospitalization value and average length of stay. It is noteworthy that all data collected are described in chapter IV (Endocrine, nutritional and metabolic diseases) of the 10th International Classification of Diseases and Related Health Problems (ICD-10), covering categories E100 - E149.

It is informed that, due to the source of data collection being in the public domain, free access and without identification of the participants, there was no need to submit the study to the Research Ethics Committee, according to Resolution 466/2012 of the National Health Council.

RESULTS

During the study period, there were 136,504 hospitalizations and 7,424 deaths from DM in the Northeast of Brazil, as shown in Table 2. The state of Bahia with the highest prevalence of hospitalizations was highlighted, with 42,306 (31.0%). , and deaths, with 2,717 (36.6%). In addition, the decreasing behavior of hospitalization and death records throughout the study period was observed.

Table 2. Hospitalizations and deaths from diabetes mellitus in northeastern Brazil according to year of care. Jequeie (BA), Brazil, 2018.

Variables	2013	2014	2015	2016	2017	TOTAL	%
HOSPITALIZATIONS							
Maranhão	266	6,800	7,084	5,969	6,856	26,975	19.8
Piauí	112	3,962	4,112	3,671	3,099	14,956	11.0
Ceará	187	3,207	2,856	2,565	2,217	11,032	8.1
Rio Grande do Norte	105	1,340	1,191	1,097	970	4,703	3.4
Paraíba	96	2,456	2,487	2,161	2,074	9,274	6.8
Pernambuco	296	4,774	4,451	4,157	4,069	17,747	13.0
Alagoas	122	1,778	1,696	1,702	1,562	6,860	5.0
Sergipe	45	610	690	650	656	2,651	1.9
Bahia	582	12,596	12,573	8,478	8,077	42,306	31.0
Total	1.811	37,523	37,140	30,450	29,580	136,504	100
ÓBITOS							
Maranhão	9	229	220	212	193	863	11.6
Piauí	9	121	130	101	91	452	6.1
Ceará	15	182	165	148	133	643	8.7
Rio Grande do Norte	16	135	112	102	88	453	6.1
Paraíba	9	159	149	115	108	540	7.3
Pernambuco	17	239	227	190	162	835	11.2
Alagoas	10	162	176	189	130	667	9.0
Sergipe	3	44	60	70	77	254	3.4
Bahia	47	723	728	595	624	2,717	36.6
Total	135	1,994	1,967	1,722	1,606	7,424	100

Source: Ministry of Health - UHS Hospital Information System (HIS / UHS)

In table 3, we highlight what concerns the values of hospital services, that the DM generated a financial impact of over R\$ 65 million to the

public coffers. Nevertheless, the largest burden was generated in the State of Bahia, with R\$ 19,249,087.69 (29.6%).

Table 3. Values of hospital services by the treatment of diabetes mellitus in northeastern Brazil. Jequie (BA), Brazil, 2018.

Federative Units	2013	2014	2015	2016	2017	Total	%
Maranhão	124,283.09	2,634,441.82	2,626,577.98	2,306,662.69	2,568,081.02	10,260,046.60	15.8
Piauí	63,165.46	1,380,279.19	1,485,436.86	1,411,700.83	1,111,536.42	5,452,118.76	8.4
Ceará	119,294.44	1,451,346.59	1,388,945.27	1,378,275.77	1,131,561.11	5,469,423.18	8.4
Rio G. Norte	100,308.00	692,149.76	621,764.45	601,198.60	606,561.60	2,621,982.41	4.0
Paraíba	95,400.97	1,296,729.55	1,348,896.08	1,148,835.42	1,121,274.67	5,011,136.69	7.7
Pernambuco	185,117.07	2,935,441.75	2,554,216.47	2,648,993.36	2,826,191.81	11,149,960.46	17.1
Alagoas	72,588.99	1,099,785.56	1,012,790.66	1,073,105.92	1,063,192.67	4,321,463.80	6.6
Sergipe	29,606.37	286,232.86	411,649.44	459,564.96	345,019.41	1,532,073.04	2.4
Bahia	332,345.29	5,195,523.01	5,276,329.42	4,343,669.90	4,101,220.07	19,249,087.69	29.6
Total	1,122,109.68	16,971,930.09	16,726,606.63	15,372,007.45	14,874,638.78	65,067,292.63	100

Rio G. Norte - Rio Grande do Norte
Source: Ministry of Health - UHS Hospital Information System (HIS / UHS)

According to Table 4, the average value of hospitalization in the Northeast was R\$ 545.08 and Alagoas had the highest average value among the Northeastern States, with R\$ 718.59. Regarding

the average length of stay in the hospital, Rio Grande do Norte stood out with 7.8 days, while the overall average of the region was 5.4 days.

Table 4. Average value of hospitalization and average length of stay for Diabetes Mellitus in Northeast Brazil. Jequie (BA), Brazil, 2018.

Federative Units	Average value of hospitalization (r\$)	Average length of stay
Maranhão	436.49	4.2
Piauí	419.05	4.3
Ceará	564.74	6.2
Rio Grande do Norte	636.14	7.8
Paraíba	614.41	6.3
Pernambuco	714.12	6.4
Alagoas	718.59	6.1
Sergipe	665.87	6.7
Bahia	521.81	5.3
Total	545.08	5.4

Source: Ministry of Health - UHS Hospital Information System (HIS / UHS)

DISCUSSION

In recent decades, the epidemiological pattern of DM has changed throughout the world, mainly due to behavioral changes, increased life expectancy and the urbanization process that favor the increase in the diagnostic rates and complications of the pathology.¹⁸ The Ministry of Health recently published the Strategic Action Plan to Confront Non-communicable Chronic Diseases (NCDs) in Brazil, 2011-2022,¹⁹ in order to prepare the country to address and stop them in the future. cited period, and among the NCDs is the DM.

According to Table 2, 136,504 hospitalizations and 7,424 (5.43%) deaths from DM in the 2013-2017 period were recorded in the Northeast. From this perspective, it is noted that comparing these values for the three-year period 2013-2015, with a study²⁰ conducted in the three-year period 1999-2001, an increase in hospitalizations by 37%, jumping from 28,349 (1999-2001) to 76,474 (2013-2015). On the other hand, a proportional reduction of 1.8% in hospital deaths was obtained, from 2,016 deaths (7.1%) in 1999-2001 to 4,096 (5.3%) deaths in 2013-2015.

It is warned that the Northeast region of Brazil has the highest incidence of poverty²¹ and its

inhabitants are twice as likely to die during hospitalization for DM.²² This data is reinforced by the results of a study²³ carried out in a northeastern capital, which showed intense dissatisfaction among users and health professionals regarding the obtaining of medicines, tests, access to the specialized network and long queues at PHC units, factors that may influence the increase in hospital morbidity.

In addition, another study²⁴ of global burden of type 2 DM, presented in Brazil, which shows the Northeast region as having the highest rates of life years lost due to premature death, is presented. The authors emphasize that this result may be correlated with the low rate of early diagnosis and difficulties in obtaining pharmacological therapy, which in turn increases mortality from the disease.

It is emphasized that another point that must be taken into consideration is the insufficient living conditions of Brazilian society that contribute to the emergence of individuals or groups with greater social vulnerability, as there is a feeling of exclusion from the system and basic rights such as health, education, work and leisure, evolving to the loss of freedom of choice in view of the narrow range of opportunities.¹²

It is noteworthy that the increase in morbidity and mortality due to DM is directly proportional to

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the increased vulnerability, therefore, it is necessary to direct health actions to prioritize individuals who fit this category in order to achieve success in interventions.¹²

However, although the Northeast region is marked by the economic characteristics mentioned, the scenario of hospitalizations and deaths presented a decreasing behavior over the years of study. It is suggested that these results may reflect a possible effectiveness of PHC in controlling the disease.

Notwithstanding, the State of Bahia stands out, as it shows a higher prevalence of hospitalizations, with 42,306 (31.0%) and deaths with 2,717 (36.6%). It is inferred that such results may reflect the largest population contingent observed in the state. It is also mentioned that the population of Bahia has a higher prevalence of risk factors for DM, such as degree and type of obesity, physical inactivity, low socioeconomic conditions and greater predominance of people of African descent, since only the state capital is composed by 22% black and 60% mulatto.²⁵

It is also evidenced that the DM generated a financial impact of over R \$ 65 million to the public coffers and the State of Bahia generated the largest burden with R\$ 19,249,087.69 (29.6%), as shown in table 3. It is warned that the financial repercussions of DM are costly for today's society.⁸ From this perspective, it was revealed in one study²⁵ that hospitalizations for DM and its chronic complications in Brazil accounted, respectively, for 6.7% and 51.4% of annual expenditures in the three-year period 1999-2001. In addition, DM as the underlying cause corresponds to 55% of direct costs on the European continent, 44% in the United States and 10% in Latin America.²⁰

However, it is noted that the average value of hospitalizations attributable to DM was 36% higher than non-attributable hospitalizations, besides generating a governmental financial impact of 2.2% of the resources of the Ministry of Health.²² In this study, it was verified an average value of hospitalization in the Northeast of R\$ 545.08 and Alagoas had the highest value among the Northeastern States, with R\$ 718.59. It is also mentioned that Rio Grande do Norte stood out with an average permanence of 7.8 days, according to table 4.

It is mentioned that, since the regulation of the Unified Health System (UHS), the interior of the country and regions with lower socioeconomic development present difficulties for its implementation,²⁴ such as the North and Northeast regions. This fact is explained mainly due to the physical organizational precariousness and insufficient human and monetary resources observed in municipalities with small population contingent.²⁴

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Deaths in hospitals are configured as a variable to evaluate the patient care process as to the outcome.²⁰ It is also emphasized that hospitalizations with deaths are more expensive even when they have the same average length of stay without hospitalizations. Such burdening is justified due to the use of intensive treatments that occurs at an average frequency of more than 6.5 times when there is death. Additionally, it is cited that laboratory services, which indicate higher consumption of technological resources,²⁰ which may be correlated with the State of Bahia, which showed a higher prevalence of deaths and hospital costs.

In this sense, the accelerated change in the Brazilian age pyramid, which clearly shows the process of population aging and, consequently, the increase in the prevalence of NCDs, is worrying. It is evidenced in the literature that the highest expenses with hospitalizations are registered among elderly individuals and constitute a reality on an international level. This is explained by the greater consumption of material, human and financial resources.²⁶

Nevertheless, this phenomenon can be observed in all countries, regardless of their economic development, since the elderly need the assistance of specialists and higher technological resources of high complexity. It is also mentioned the immunological fragility observed in the elderly, which, in turn, increases the risk of complications and, consequently, increases the length of stay.²⁶

This data is strengthened by a survey²⁷ conducted in the city of Londrina, Paraná, which revealed that the elderly corresponded to 9.3% of the municipal population in 2000, accounting for 22.1% and 29%, respectively, of the total days of stay and hospital costs, values higher than those found in the population under 15 years. These results are emphasized by the high economic burden that the elderly demand in tertiary care.²⁷

Considering economic studies in the health field, the approval of Constitutional Amendment 55, which freezes public spending for 20 years in Brazil, should be considered. The Amendment was approved in 2016 and warns that it will not bring economic growth and will substantially reduce investments in public health and education in the country.²⁸

Economic simulations show that, with the freezing of public spending, the 4% of GDP in 2015 for health and education will drastically decrease to 2.7% in 20 years of the new fiscal regime, a time where the Brazilian population will grow by up to 10%. It is thus stated that the Amendment precludes any improvements in these two social areas and creates a loophole for scrapping and extinction of universality.²⁸

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Therefore, it is worrying that this spending limit interferes with the decreasing behavior of hospitalizations and hospital deaths due to DM, as investments in health will not accompany population growth and aging. It is warned that the system must be constantly restructured in order to ensure health promotion, disease and disease prevention and early diagnosis and treatment of diseases and disabilities.²⁶ In this perspective, it is informed that the actions directed to the control of DM produced in PHC have the objective of assuring the right to health to users affected with the disease and to reduce morbidity and mortality related to the pathology and its complications.¹²

It is noteworthy that such actions should elucidate general information about the disease, enabling the improvement of self-care skills, which facilitates coping with the pathology of both patients and their families.²⁹ Furthermore, it is warned that most factors associated with the high prevalence of DM are preventable. Thus, it is pointed out the necessity of habitual life changes as one of the main strategies for DM prevention and control and its implications.³⁰

However, it is mentioned that the Brazilian context shows significant socioeconomic and cultural diversity that significantly reflects on health needs in different regions. Therefore, it should be pointed out that among the factors that have the potential to influence the implementation of health-promoting actions, social vulnerabilities, media, industrial and pharmaceutical influence, governmental commitment and the existence of other care categories stand out.¹²

CONCLUSION

Hospitalizations, deaths and hospital costs were found to be slightly reduced and yet generated significant impacts on the public budget. It is worrying that this situation may be reversed with the approval of Constitutional Amendment 55, which freezes public spending for 20 years and, as a result, health investments may not keep up with population growth and aging.

It should be noted, however, that PHC efforts are being sufficient to ensure a reduction in hospitalizations and deaths in the Northeast. However, it should be noted that such efforts should be redoubled to continue ensuring such a scenario amid the containment of public spending, especially in Bahia, as it shows a higher prevalence of hospitalizations and hospital deaths.

A limitation of the study is highlighted regarding the impossibility of stratifying the type of DM in the HIS and, therefore, the data are presented in general. It is inferred, however, that due to the higher prevalence of T2DM, affecting up to 95% of cases, most hospitalizations and

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financial resources spent during hospital stay is due to this typology.

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