HOSPITAL MORBIDITY AND FINANCIAL IMPACTS OF DIABETES MELLITUS

MORBIDADE HOSPITALAR E IMPACTOS FINANCEIROS POR DIABETES MELLITUS

MORBILIDAD HOSPITALARIA Y REPERCUSIONES FINANCIERAS POR DIABETES MELLITUS

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ABSTRACT

Objective: to describe the cases of hospital morbidity and the financial impacts of diabetes mellitus. **Method:** this is a quantitative, ecological and descriptive study, with data from the Department of Informatics of the Unified Health System in the state of Bahia (BA), Brazil, between 2013 and 2017. The following variables were selected: hospitalizations, deaths, gender, age, average stay length, hospital costs and race/color. Data were tabulated and analyzed through simple descriptive statistics in Excel program. **Results:** there were 52,267 hospitalizations, with greater prevalence in the East Macroregion (23.08%), in women (55.82%), aged ≥ 80 years (14.02%) and *pardo* race (50.74%). Institutions with ignored administration prevailed (47.38%), and an average stay length of 5.8 days. Moreover there was a financial impact exceeding R\$ 25.5 million, with the East Macroregion responsible for 36.74%. **Conclusion:** there is the absolute need for actions of control and prevention of the disease, primarily in the East Macroregion, which demonstrated higher prevalence of hospitalizations and, consequently, increased public spending in hospitals. This study can be used to guide preventive strategies in order to avoid hospitalizations and burdens from diabetic complications. **Descritores:** Epidemiology, Hospitalization, Diabetes Mellitus, Health Care Costs, Information Systems.

RESUMO

Objetivo: descrever os casos de morbidade hospitalar e os impactos financeiros por diabetes mellitus. **Método:** trata-se de estudo quantitativo, ecológico e descritivo, com dados do Departamento de Informática do Sistema Único de Saúde no estado da Bahia, Brasil, entre 2013 e 2017. Selecionou-se as variáveis: internações, óbitos, sexo, faixa etária, média de permanência, custos hospitalares e raça/cor. Tabulou-se e analisou-se os dados por meio de estatística descritiva simples no programa Excel. **Resultados:** registrou-se 52.267 internações e a maior prevalência ocorreu na macrorregião Leste (23,08%), no sexo feminino (55,82%), com idade ≥ 80 anos (14,02%) e pardas (50,74%). Prevalceu-se as instituições com regime ignorado (47,38%) e registrou-se média de permanência de 5,8 dias. Notificou-se ainda, um impacto financeiro superior a 25,5 milhões de reais e a macrorregião Leste responsabilizou-se por 36,74%. **Conclusão:** constata-se a imprescindibilidade de ações de controle e prevenção da patologia, prioritariamente, na macrorregião Leste, por evidenciar maior prevalência de internações, e consequentemente, implicar no incremento dos gastos públicos hospitalares. Ressalta-se, ainda, que esse estudo pode orientar estratégias preventivas no intuito de evitar as internações e onerações por complicações diabéticas. **Descritores:** Epidemiologia; Hospitalização; Diabetes Mellitus; Custos de Cuidados de Saúde; Sistemas de Informação.

RESUMEN

Objetivo: describir los casos de morbilidad hospitalaria y el impacto financiero debido a la diabetes mellitus. **Método:** se trata de un estudio cuantitativo, ecológico y descriptivo, con datos del Departamento de Informática del Sistema Único de Salud en el estado de Bahía, Brasil, entre 2013 y 2017. Fueron seleccionadas las siguientes variables: hospitalizaciones, muertes, sexo, edad, duración media de la estancia, gastos hospitalarios y raza/color. Los datos fueron tabulados y analizados por medio de estadística descriptiva simple en el programa Excel. **Resultados:** se registraron 52,267 hospitalizaciones y mayor prevalencia en la Macroregión Este (23,08%), en el sexo femenino (55.82%), con edad ≥ 80 años (14,02%) y pardas (50.74%). Si prevalecen las instituciones con esquema ignorado (47.38%) y se registró el promedio de estadía de 5,8 días. Se observó un impacto superior a los 25,5 millones de reales, con la Macroregión Este teniendo 36.74%. **Conclusión:** existe la necesidad absoluta de medidas de control y prevención de la enfermedad, sobre todo en la Macroregión Este, que demostró una mayor prevalencia de hospitalizaciones y, por consiguiente, un aumento en el gasto público en los hospitales. Cabe destacar que este estudio puede ser utilizado para guiar las estrategias preventivas a fin de evitar hospitalizaciones y costos debido a las complicaciones de la diabetes. **Descritores:** Epidemiología, Hospitalización, Diabetes Mellitus, Costos de la Atención en Salud, Sistemas de Información.

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INTRODUCTION

The increased life expectancy in Brazil and consequent population aging lead to epidemiological changes that increase the prevalence of chronic noncommunicable diseases (CNCD).^{1,2} In 2013, the CNCD were responsible for approximately 72.6% of deaths registered throughout the country.³ Therefore, there emerges the need for developing and implementing new and growing health care strategies for this population.¹

The Diabetes Mellitus (DM) stands out among the CNCD. This chronic pathology causes hyperglycemia and alterations in lipid, protein and carbohydrates metabolisms.^{2,4} It constitutes an important and growing public health problem worldwide,⁵ due to the high rates of morbidity and mortality, which generates a large impact to health services, in addition to financial and social impacts.⁶

A large part of the population with DM resides in developing countries. In 2010, Brazil presented a prevalence of 6.0%, and the estimates for 2030 reach 7.8%, corresponding to a quota greater than 12.7 million people. Moreover, these characteristics make Brazil the country with the highest rates in Latin America.⁶

The diagnosis of DM can be established according to two classifications, type 1 and 2. Type 1 is present in approximately 5 through 10% of the total number of people with the disease and is usually detected in childhood and adolescence. It results from partial or total destruction of betapancreatic cells, progressively reducing the amount of insulin in the bloodstream. Such destruction involves mainly sufferers of autoimmune diseases.^{7,8}

Furthermore, type 2 DM covers approximately 90 through 95% of cases⁹ and results from a deficiency in insulin secretion and action,⁸ which makes the body unable to use it effectively and, in both cases, the body becomes incapable of maintaining effective control of serum levels of glucose.⁴ Its diagnosis can occur at any age, but epidemiological data show that it usually occurs after 40 years of age.⁸

This silent disease, when associated with non-adherence to therapy, leads to a worsening of the situation and the development of micro and macrovascular severe consequences, such as blindness, kidney failure and amputation of limbs. The personal impact generated by DM should also

be considered, such as reduced working capacity, life expectancy and quality of life, and the need for new food habits.⁴

Therefore, it justifies the need to develop epidemiological studies on chronic diseases, in addition to highlighting how subsidies for the development of public policies enable the evaluation of the effectiveness of the Primary Health Care Network.

OBJECTIVE

- To describe the cases of hospital morbidity and the financial impacts of diabetes mellitus.

METHOD

This is a quantitative, ecological and descriptive study, conducted with secondary data on hospital morbidity from DM of the Department of Informatics of the Unified Health System (DATASUS). The study scenario selected was the state of Bahia, composed by nine macroregions of health: Mid-East, Mid-North, Extreme South, East, Northeast, North, West, Southwest and South. Its demographic density is of 24.82 inhabitants/km², territorial area of 564,732.45 km² and a population estimated for 2020 of 15,522,855 inhabitants, according to the Brazilian Institute of Geography and Statistics (IBGE).¹⁰

Data were collected in February 2018, considering the time limit from 10 January 2013 to 31 December 2017. The following variables were selected for categorization of the study: hospitalizations, deaths, gender (male and female), age (< 1 year ≥ 80 years), average stay length, hospital costs and race/color (white, black, *pardo*, yellow and indigenous), according to recommendations of IBGE to classify the Brazilian population.¹²

Data tabulation and descriptive analysis occurred in the same period of collection, adopting the program Microsoft Office Excel (Microsoft®, 2010). Since this is an ecological study, whose data are secondary and in the public domain, there was no need for submission to the Research Ethics Committee, in accordance with Resolution 466/2012 of the National Health Council.

RESULTS

Table 1 shows there were 52,267 hospitalizations for DM, which corresponds to 1.6% of the total number of hospitalizations in the state of Bahia. Furthermore, the East Macroregion presented the greatest results, approximately 23.08% (n=12,065).

Table 1. Hospitalizations for DM by health macroregion and year of admission. Bahia (BA), Brazil, 2013-2017.

Health Macroregions	2013	2014	2015	2016	2017	Total	%
Mid-East	85	1,930	1,928	1,411	1,246	6,600	12.63
Mid-North	94	1,325	1,437	696	599	4,151	7.94
Extreme South	46	862	829	732	702	3,171	6.07
East	174	3,033	3,093	3,053	2,712	12,065	23.08
Northeast	44	685	637	544	573	2,483	4.75
North	64	1,121	858	709	565	3,317	6.35
West	32	780	937	579	527	2,855	5.46
Southwest	96	2,127	2,450	1,527	1,642	7,842	15.00
South	127	3,107	2,954	1,937	1,658	9,783	18.72
Total	762	14,970	15,123	11,188	10,224	52,267	100

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

Table 2 shows that most hospitalizations occurred in people aged 80 years or more, 14.02% (n=7,329), followed by the age range

from 65 to 69 years, 12.23% (n=6,391). Moreover, DM presents growing trend of morbidity as age advances.

Table 2. Hospitalizations for DM according to age group and year of admission. Bahia (BA), Brazil, 2013-2017.

Age group	2013	2014	2015	2016	2017	TOTAL	%
<1 year	1	29	28	23	20	101	0.19
1 - 4 years	6	75	48	68	61	258	0.49
5 - 9 years	5	121	81	139	126	472	0.90
10 - 14 years	12	204	205	190	216	827	1.58
15 - 19 years	6	185	200	141	124	656	1.26
20 - 24 years	7	176	163	146	151	643	1.23
25 - 29 years	13	223	219	152	154	761	1.46
30 - 34 years	21	300	300	230	189	1,040	1.99
35 - 39 years	20	423	440	312	293	1,488	2.85
40 - 44 years	30	597	586	432	422	2,067	3.95
45 - 49 years	46	959	1,006	696	577	3,284	6.28
50 - 54 years	64	1,179	1,221	889	867	4,220	8.07
55 - 59 years	84	1,512	1,518	1,167	1,041	5,322	10.18
60 - 64 years	92	1,693	1,743	1,355	1,129	6,012	11.50
65 - 69 years	80	1,858	1,841	1,321	1,291	6,391	12.23
70 - 74 years	92	1,819	1,769	1,349	1,172	6,201	11.86
75 - 79 years	68	1,435	1,607	1,057	1,028	5,195	9.94
≥80 years	115	2,182	2,148	1,521	1,363	7,329	14.02
Total	762	14,970	15,123	11,188	10,224	52,267	100

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

Table 3 shows a higher prevalence of hospitalizations in self-reported *pardos*, with 50.74% (n=26,520). Moreove, 47.38% (n=24,762) of the institutions preented ignored administration system, followed by public administration, with 35.32% (n=18,463). In relation to the average stay length, it

ranges between 3.8 and 17.6 days of hospitalization, evidencing an average of 5.8 days. Stratifying such variable by macroregions, the east region presented higher average stay length in the period studied, with approximately 9.2 days.

Table 3. Hospitalizations for DM according to race/color, hospitalization administration, average stay length by year of admission. Bahia (BA), Brazil, 2013-2017.

Variables	2013	2014	2015	2016	2017	Total	%
Race/color							
White	32	893	828	628	532	2,913	5.57
Black	23	532	563	444	514	2,076	3.97
Pardo	324	7,299	7,543	5,618	5,736	26,520	50.74
Yellow	3	36	248	345	359	991	1.9
Indigenous	-	3	5	-	3	11	0.02
Uninformed	380	6,207	5,936	4,153	3,080	19,756	37.8
Total	762	14,970	15,123	11,188	10,224	52,267	100
Average stay length							
Mid-East	5.8	4.8	4.7	5	5.3	4.9	*
Mid-North	5.6	3.8	4.5	4.6	4.8	4.4	*
Extreme South	5.5	4.5	4	5	4.7	4.5	*
East	17.6	8.9	8.7	9.5	9.2	9.2	*
Northeast	6.6	4.9	5.8	5.8	6.7	5.8	*
North	6.9	5.6	5.3	5.9	6.1	5.7	*
West	6	4.2	4.1	4.6	4.9	4.4	*
Southwest	6.8	4.4	4.6	5	4.9	4.7	*
South	8.1	4.4	4.4	5.4	5.2	4.8	*
Total	9.1	5.4	5.4	6.3	6.3	5.8	*

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

- Numerical datum equal to 0 not resulting from rounding.

* -Values presented on average, no need to present percentage.

Table 4 shows that the female population showed a higher prevalence of hospitalization

in all years studied, which corresponds to the percentage of 55.82% (n=29,176).

Table 4. Hospitalizations for DM by gender and year of admission. Bahia (BA), Brazil, 2013-2017.

Gender	2013	2014	2015	2016	2017	Total	%
Male	305	6,332	6,480	5,253	4,721	23,091	44.18
Female	457	8,638	8,643	5,935	5,503	29,176	55.82
Total	762	14,970	15,123	11,188	10,224	52,267	100

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

Table 5 shows the public expenditures for hospital services offered to users during hospitalization. During the study period, DM generated a financial impact exceeding R\$

25.5 million to the Unified Health System, with the east macroregion concentrating a percentage of 36.74% (R\$ 9,372.669.11).

Table 5. Value of hospital services of DM distributed by year of admission and health macroregion. Bahia (BA), Brazil, 2013-2017.

Macroregions	2013	2014	2015	2016	2017	Total (R\$)	%
Mid-East	35,919.90	714,767.44	721,272.61	550,757.90	464,629.18	2,487,347.03	9.75
Mid-North	50,508.89	482,132.78	500,937.29	240,949.42	212,326.24	1,486,854.62	5.83
Extreme South	16,790.12	331,518.44	332,629.56	352,609.73	308,664.14	1,342,211.99	5.26
East	229,369.74	2,101,016.11	2,121,676.80	2,569,395.24	2,351,211.2	9,372,669.11	36.74
Northeast	19,392.79	255,804.61	280,935.57	229,578.94	270,014.99	1,055,726.90	4.14
North	27,831.13	524,085.06	390,293.30	351,894.54	235,846.38	1,529,950.41	6.00
West	18,451.38	279,766.09	325,570.63	233,913.05	200,475.61	1,058,176.76	4.15
Southwest	36,325.07	808,277.82	997,151.92	626,514.64	708,580.49	3,176,849.94	12.45
South	84,183.91	1,120,272.55	1,131,974.16	871,396.96	790,536.32	3,998,363.90	15.67
Total	518,772.93	6,617,640.90	6,802,441.84	6,027,010.42	5,542,284.57	25,508,150.66	100

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

DISCUSSION

The results of this survey highlight the expressive rates of hospitalization and the high burden resulting from the assistance for DM in the panorama of Bahia between 2013 and 2017. The knowledge acquired in this research also highlight the need for intensification of researches about the theme, as well as assistive measures in the pathological progress, which worsen sufferers' health condition, in the long term, due to the problems arising from a deficit of glycemic control.¹²

In this way, this study intends to collaborate with the understanding with respect to metabolic disorders, such as DM, and the contributing factors to their development and evolution. It also seeks to examine the epidemiological situation of the locality with respect to the morbidity of the investigated disease, thus contributing to the aggregation of information and elaboration of precise scientific researches in relation to the matter.

The analysis of the obtained results shows a possible interference of determining factors in its development. There are various health implications arising from collaboration to the outbreak of musculoskeletal, brain, digestive and oncologic morbidities as a possibility for evidencing this framework of hospitalizations¹³ when promoting high index of functional damages. Consolidating this information, once every 12 adult deaths are attributed to the DM,¹⁴ which originates the need for assistive measures, when necessary.

Furthermore, the population requirement favors the concentration of hospitalizations in East Bahia, since this locality concentrates a large contingent of the population, with an expressive contribution from the capital Salvador, presenting 2,675,656 residing individuals in the last demographic census.¹⁵ In this sense, the increasing level of urbanization, lifestyle and health, among other factors, collaborate to the development of DM¹⁶ and can provoke, in the future, the need for its sufferers' hospitalizations, evidencing the described situation.

However, the high number expressed possibly represents failures in primary health care once the DM is a condition sensitive to Primary Care (CSPC), consistent with the assistance provided by the Family Health Strategy.¹⁷ In this way, there is need to rethink the ways of interventions carried out in primary care in order to ensure effectiveness, access and quality of services to promote and protect the health of the

population. The attention to diabetes encompasses several factors not limited simply to the glycemic control, which makes the assistance complex and multifaceted.¹⁸

Seniors aged 80 years or more had higher prevalence of hospitalizations (14.02%), as shown in Table 2. The disease showed an increasing behavior as age advances. Data in the literature reinforce this result when demonstrating changes in the health profile of elderly people, whose previous main causes of deaths were infectious and parasitic diseases, and, currently, especially circulatory diseases (cardiovascular diseases, diabetes, hypertension, cerebrovascular accident).¹⁹

The population aging in Brazil is a growing phenomenon and the age over 60 years stands out as an independent risk factor for diabetic complications.²⁰ It is noteworthy, in addition, the absolute need of basic care investing in actions that interfere in the cycle of diabetic complications, avoiding, therefore, hospitalizations and avoidable burdens for the State. Moreover, preventive measures are able to improving the quality of life and increasing the survival of diabetic patients.

This study identified a greater prevalence of hospitalizations in self-reported *pardos* (50.74%), as shown in Table 3. Regarding the influence of this variable in the development of DM, the scientific consolidations indicate that this ratio is still debatable. Basing on significant social inequalities in Brazil, this result may be a reflection of the unfavorable socioeconomic conditions of the majority of the population,²¹ since several studies in different countries have already proven the association between chronic morbidity and populations with lower level of education and/or income.²²

The number of days of hospitalizations ranged between 3.8 and 17.6, with an average of 5.8 days. Stratifying such variable by macroregions, east region presented higher average stay length in the studied period with approximately 9.2 days. Such results become relevant for the management of bed occupancy and allocation of resources, since the longer time of hospitalization is associated to greater financial expenditures.²³ Moreover, there are direct repercussions on social, psychological and emotional aspects of patients, requiring a guarantee of an effective and quality assistance for the rapid rehabilitation of the individual.²⁴

In relation to gender, the female population had a greater prevalence of hospitalization in all years studied, which corresponded to the percentage of 55.82%, as shown in Table 4. These results are similar to

literature, as women historically have greater concern with health, which increases their demand for diagnostic and therapeutic services.⁹ A randomized clinical trial²⁵ also corroborate this statement when showing that, in women, chances exceeding 1.4 times of use of health services in relation to men.

A study about the care of men with DM type 2 evidenced that most participants reported lack of knowledge about descompensating complications and symptoms of the pathology. In addition, anthropometric measurements were above the recommended values and there was a significant absence to therapy compliance and monitoring of blood glucose levels.²⁶ In this context, these results become relevant for the strengthening of actions for men's health in the primary network. There is also need to work tirelessly in the numerous factors that influence the male presence in health services (cultural, social, individual and collective aspects).

Regarding public spending by hospital services offered to users during the hospital stay, there was a financial impact exceeding R\$ 25.5 million, as shown in Table 5. The pathology has an expressive burden and its morbidity is responsible for a significant portion of the financial resources of public health.⁶ There is also lack of funds specific for public health and values much lower than recommended by the World Health Organization (WHO). This condition is negatively reinforced due to regional diversity of access to health care in Brazil.²⁷

The expenditures by chronic diseases are high and with growing behavior at world level. A study carried out in 23 mid- and low-income countries, including Brazil, showed that between 2006 and 2015, cardiovascular diseases and DM represented a burden of 85 billion dollars. Estimates show an annual financial impact of 10 billion dollars for the Latin America and Caribbean. The expenses generated by chronic diseases reflect negatively on consumption, economics, labor supply, productivity and accumulation of human capital, which demonstrates the need for effective intervention in the prevention and control of such diseases.²⁸

CONCLUSION

There were 52,267 hospitalizations for DM in Bahia, reflecting a financial impact exceeding R\$ 25.5 million to the Unified Health System. The East Macroregion presented the highest percentage of morbidity and public spending, with 23.08% and 36.74%, respectively.

Therefore, it is indispensable to develop control and prevention actions of the disease primarily in east macroregion, which demonstrated higher prevalence of hospitalizations and, consequently, increased hospital public spending. This study can guide preventive strategies in order to avoid hospitalizations and burdens for diabetic complications.

DATASUS is a system that can contain underreporting and, consequently, imprecise recorded data. Nevertheless, it is an important tool capable of demonstrating, in a way closer to the reality, the profile of the Brazilian population associated to the various health determinants.

Moreover, the information contained in the system allows targeting health actions and public policies throughout the national territory, in addition to serving as a source of data collection for scientific researches.

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