REGIONAL INEQUALITIES IN HOSPITALIZATION FOR BLADDER CANCER IN BRAZIL: IMPACTS OF HOSPITAL COST, LENGTH OF STAY, AND MORTALITY (2013-2023)

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ABSTRACT

Introduction: Bladder cancer is the seventh most common neoplasm among men and the fourteenth among women in Brazil, and is a disease that predominantly affects the urinary bladder epithelium. The main histological classifications include urothelial carcinoma (transitional cells), squamous cell carcinoma, and adenocarcinoma. Several risk factors are associated with its development, such as advanced age, ethnicity, smoking, occupational exposure to industrial carcinogens, consumption of substances contaminated by arsenic, and family history of the disease. **Objective:** To analyze the relationship between the average cost of hospitalization, the average length of hospital stay, and the mortality rate from bladder cancer in the five Brazilian macro-regions, from 2013 to 2023. **Method:** This is an observational ecological study, based on secondary data obtained from the Hospital Information System of the Unified Health System (SIH/SUS), available at DataSUS. Information on hospital morbidity, hospitalization costs, and clinical outcomes of hospitalized patients diagnosed with bladder cancer was analyzed. **Results:** The Southeast region had the highest absolute number of hospitalizations, while the North region recorded the lowest frequency. The highest average cost per hospitalization was observed in the Northeast region, while the North region had the lowest average hospitalization value. Regarding the average length of hospital stay, the North region led, concomitantly, the highest mortality rate among the regions analyzed. The other regions had an average length of hospital stay of around 4.7 days, with an average hospital mortality rate of approximately 6.5% over the study period. **Discussion:** The findings suggest that the North region, despite having the lowest average cost of hospitalization, faces greater challenges related to hospital care, reflected in longer hospital stays and higher mortality rates. Factors such as limited availability of hospital infrastructure, barriers to access to specialized treatments, and socioeconomic inequalities can contribute to this scenario. On the other hand, the Southeast region, despite presenting average costs similar to those of the North region, exhibits the best clinical indicators, suggesting greater efficiency in resource management and greater access to specialized care. The Northeast region, although

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registering the highest investments in hospitalizations, did not present the best clinical outcomes, possibly due to structural differences in health care and in the quality of hospital care. **Conclusion:** The regional disparities evidenced in the study highlight the need for investments aimed at improving the quality of hospital care, especially in the North region, where the indicators of hospital stay and mortality are higher. Strengthening hospital infrastructure, expanding access to specific treatments, and optimizing cost management are key strategies for reducing regional inequalities in the hospital approach to bladder cancer in Brazil.

Keywords: Bladder Cancer. Hospitalization. Hospital Mortality. Regional Disparities. Health Management.

INTRODUCTION

Bladder cancer is one of the most common malignant neoplasms of the urinary tract, occupying the seventh position among the most common types in men and the fourteenth among women in Brazil, according to data from the National Cancer Institute (INCA). For the period from 2020 to 2022, approximately 7,590 new cases were estimated in men and 3,050 in women, showing a predominance in males. This neoplasm predominantly affects the cells of the transitional epithelium that lines the bladder, known as the urothelium, and is responsible for about 90% of diagnosed cases (FILHO, 2013).

Bladder cancer can be classified into three main histological subtypes: i) urothelial carcinoma (or transitional cell carcinoma), the most prevalent, affecting the most superficial layers of the bladder epithelium; ii) squamous cell carcinoma, often associated with chronic inflammatory processes or persistent urinary tract infections; and iii) adenocarcinoma, a rare form of the disease, originating in the glandular cells of the bladder epithelium, usually related to chronic inflammation and prolonged irritation (DANESHMAND, 2023).

Several risk factors are associated with the development of bladder cancer, including advanced age, male gender, and race, and are more common in white men over 50 years of age. Smoking is widely recognized as the main risk factor, significantly increasing the likelihood of developing the disease. In addition, occupational exposure to carcinogenic chemicals such as aromatic amines and tar-derived compounds, prolonged contact with arsenic-contaminated water, and family history of bladder cancer are also strongly related to the etiology of the disease (DANESHMAND, 2023).

The diagnosis of bladder cancer requires a detailed clinical approach, including thorough anamnesis, symptom assessment, and complementary tests. Painless hematuria, characterized by the presence of blood in the urine without associated pain, is the most common symptom and often the first warning sign. However, this finding is not exclusive to the disease, and may be related to other conditions, such as kidney stones and urinary infections. Thus, complementary tests, such as cystoscopy, urinocytes, and imaging tests, are essential for diagnostic confirmation and staging of the tumor (WITJES et al., 2016).

Epidemiologically, the incidence of bladder cancer in Brazil has shown a downward trend over the years. According to data from INCA, between 2010 and 2018, there was a drop of approximately 68% in the number of diagnosed cases. The regional distribution of the disease reveals a higher prevalence in the Southeast region,

responsible for 39% of the cases, followed by the Midwest region (30%), the South region (14%), the Northeast region (10%) and, finally, the North region, with only 6% of the reported cases.

In view of the regional variations in the incidence and clinical outcomes of the disease, this study aims to analyze the relationship between average hospitalization costs, average length of hospital stay, and bladder cancer mortality rate in the five Brazilian macro-regions, from 2013 to 2023. The identification of possible regional disparities may support strategies to optimize the management of health resources and improve hospital management of the disease in the country.

METHOD

This ecological observational study investigated the relationship between the average cost of hospitalization, the average length of hospital stay, and the mortality rate of hospitalized patients diagnosed with bladder cancer in the five Brazilian macro-regions, from January 2013 to December 2023.

Data were extracted from the database of the Hospital Information System of the Unified Health System (SIH/SUS), available on the DataSUS platform, specifically in the Hospital Morbidity and Epidemiology and Morbidity modules. Demographic and population information for calculating hospitalization rates were obtained from the database of the Brazilian Institute of Geography and Statistics (IBGE).

INCLUSION AND EXCLUSION CRITERIA

The study included records of hospital admissions for malignant bladder neoplasm (ICD-10: C67), with information on the total number of hospitalizations, the mean value per hospitalization, the average length of hospital stay, and the mortality rate associated with the disease. Only data recorded from 2008 onwards, with detailed information on place of residence, were considered. To ensure the quality of the analyses, records prior to 2013, after 2023, or that were not directly related to the scope of the research were excluded.

The hospitalization rate was calculated by dividing the total number of hospital admissions for bladder cancer by the size of the resident population in each state/region for the respective year, according to IBGE estimates.

STATISTICAL ANALYSIS

For the analysis of the temporal trend of hospitalization rates, the Prais-Winsten generalized linear regression model was applied, suitable for time series with

autocorrelation. The independent variables (X) corresponded to the years of occurrence of hospitalizations, while hospitalization rates were treated as dependent variables (Y). Initially, the Y values were logarithmically transformed to stabilize the variance, and then the Prais-Winsten autoregressive model was applied to estimate the coefficient β the standardized hospitalization rate, both overall and stratified by sex.

The level of statistical significance was set at 5% ($p < 0.05$), and the confidence interval was set at 95% (95% CI). The analyses were performed using the statistical software Stata version 18.0® (Data Analysis and Statistical Software for Professionals).

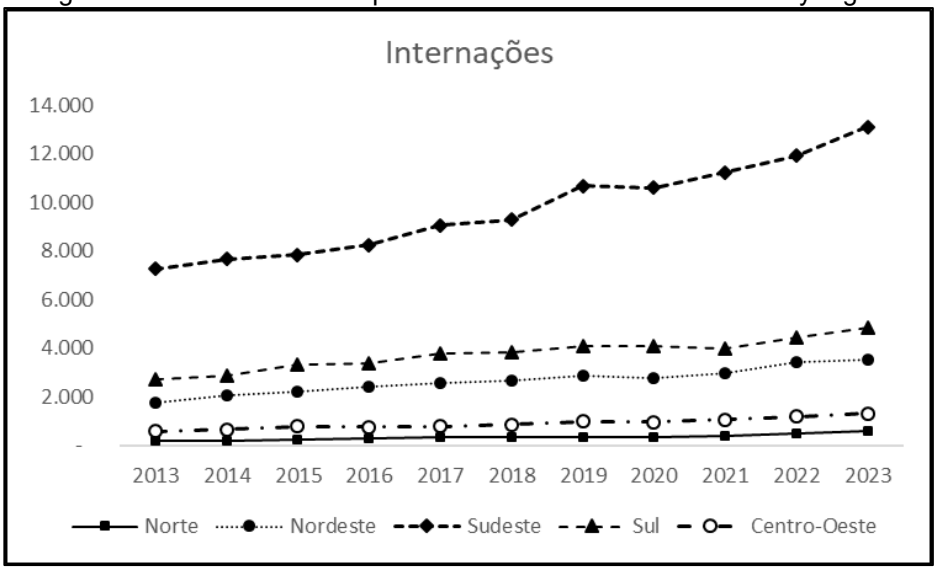
ETHICAL ASPECTS

As this is a study based exclusively on secondary data, widely available in the public domain and anonymized, it was not necessary to submit it to the Research Ethics Committee, as established by Resolution No. 510/2016 of the National Health Council (CNS), which dispenses with ethical assessment for research with unrestricted access data.

RESULTS

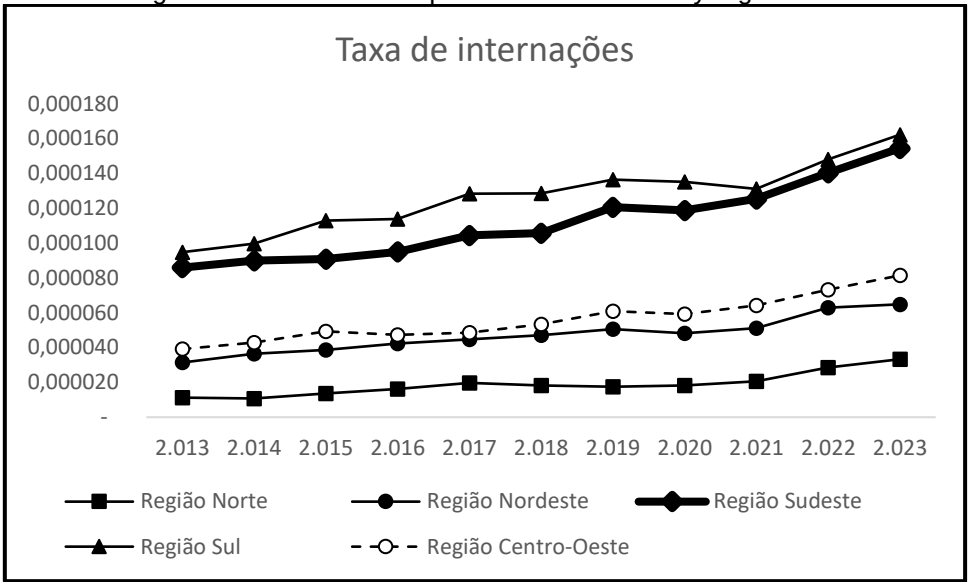
The first topic analyzed was the number of hospitalizations for bladder cancer and the hospitalization rate in Brazil by region, as can be seen in figures 1 and 2.

Figure 1. The number of hospitalizations that occurred in Brazil by region.



Source: DataSUS

Figure 2.: The rate of hospitalizations in Brazil by region.



Source: DataSUS

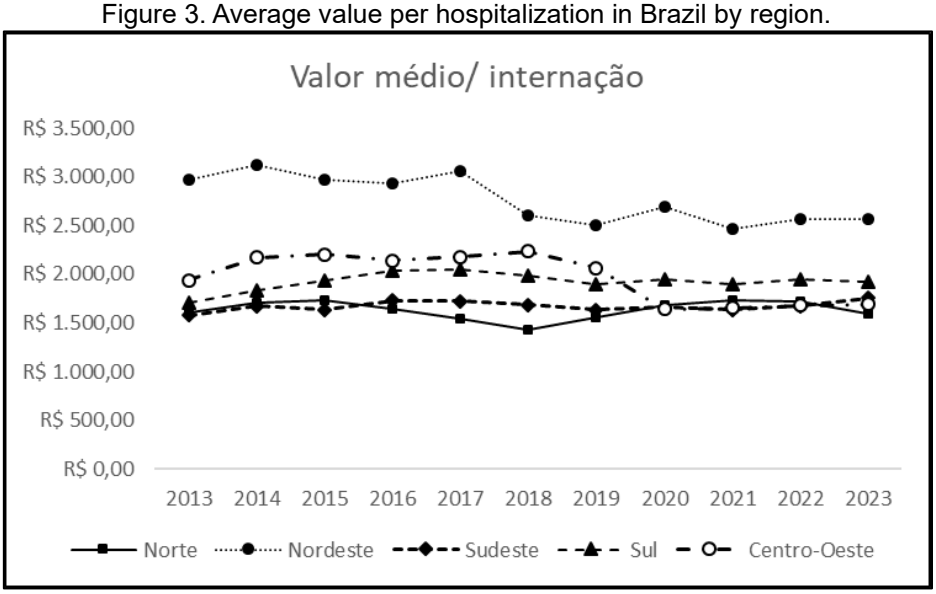
Table 1. APC - Annual percentage change and trend in hospitalization rate.

Internações por Região/Unidade da Federação e Ano processamento			
Região/Unidade da Federação	**p**	**VPA**	**Tendencia**
Região Norte	< 0,001	196%	Crescente
.. Rondônia	0,007	385%	Crescente
.. Acre	< 0,001	181%	Crescente
.. Amazonas	< 0,001	129%	Crescente
.. Roraima	< 0,001	10%	Crescente
.. Pará	0,016	178%	Crescente
.. Amapá	< 0,001	501%	Crescente
.. Tocantins	< 0,001	185%	Crescente
Região Nordeste	< 0,001	106%	Crescente
.. Maranhão	< 0,001	92%	Crescente
.. Piauí	< 0,001	16%	Crescente
.. Ceará	< 0,001	218%	Crescente
.. Rio Grande do Norte	0,500	269%	Estacionário
.. Paraíba	< 0,001	75%	Crescente
.. Pernambuco	< 0,001	142%	Crescente
.. Alagoas	< 0,001	316%	Crescente
.. Sergipe	0,003	209%	Crescente
.. Bahia	< 0,001	43%	Crescente
Região Sudeste	0,004	80%	Crescente
.. Minas Gerais	0,001	98%	Crescente
.. Espírito Santo	< 0,001	74%	Crescente
.. Rio de Janeiro	< 0,001	68%	Crescente
.. São Paulo	0,004	76%	Crescente
Região Sul	< 0,001	71%	Crescente
.. Paraná	< 0,001	76%	Crescente
.. Santa Catarina	< 0,001	87%	Crescente
.. Rio Grande do Sul	< 0,001	60%	Crescente
Região Centro-Oeste	0,001	108%	Crescente
.. Mato Grosso do Sul	0,012	181%	Crescente
.. Mato Grosso	< 0,001	73%	Crescente
.. Goiás	0,001	91%	Crescente
.. Distrito Federal	0,001	109%	Crescente

Figure 1 shows that the region with the highest number of hospitalizations was the Southeast region, with values above 158% when compared to the South region, which succeeds it. Next in the South region, there is a record in the Northeast, Midwest and North regions, respectively. The Southeast region had an average growth rate of 6.2% per year, while the South region had an average growth rate of 6.1%. The Northeast region presented an average growth rate per year of 7.5%. The Central-West region showed a growth of 8.7% per year, while the North region showed the highest growth rate per year, of 12.4%. When we look at graph 2, it is observed that the South region concentrates the

largest portion of the hospitalization rate, followed by the Southeast, Midwest, Northeast and North regions. By calculating the annual percentage change (APC), the North region (196%) is the region with the highest change in 10 years, and the South region (71%), the lowest change. Considering the p-value < 0.05 (with a confidence level of 95%), it is verified that all regions have a tendency for data to increase in the period studied for hospitalization rate.

Figure 3. Average value per hospitalization in Brazil by region.



Source: DataSUS

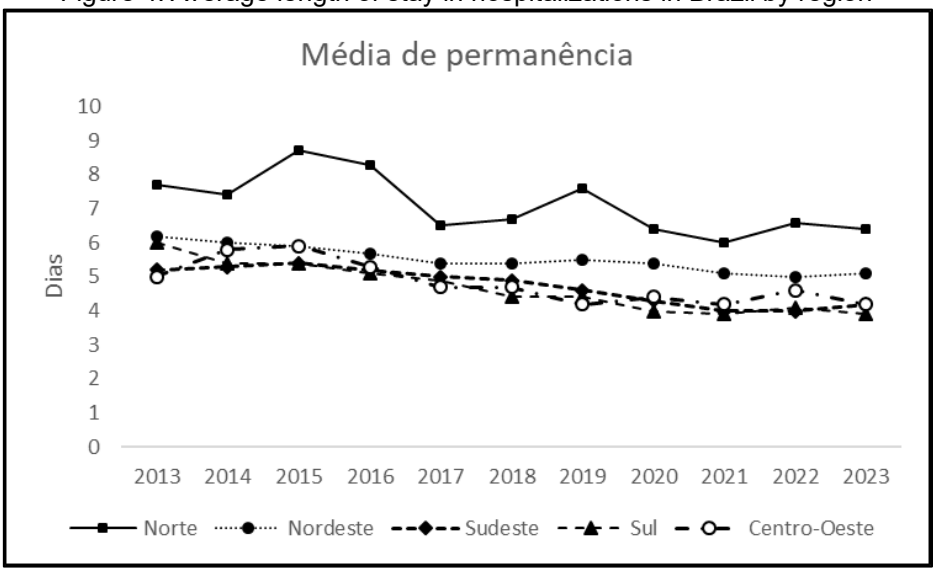
Table 2. APC - Annual percentage change and trend in the average value of hospitalizations.

Valor médio intern por Região/Unidade da Federação e Ano processamento			
Região/Unidade da Federação	**p**	**VPA**	**Tendencia**
Região Norte	< 0,001	-0,2%	Decrescente
.. Rondônia	< 0,001	63,3%	Crescente
.. Acre	0,005	175,8%	Crescente
.. Amazonas	< 0,001	38,0%	Crescente
.. Roraima	< 0,001	-2,4%	Decrescente
.. Pará	< 0,001	-32,0%	Decrescente
.. Amapá	< 0,001	119,1%	Crescente
.. Tocantins	< 0,001	4,0%	Crescente
Região Nordeste	< 0,001	-13,6%	Decrescente
.. Maranhão	< 0,001	3,0%	Crescente
.. Piauí	< 0,001	104,1%	Crescente
.. Ceará	0,051	-36,0%	Estacionário
.. Rio Grande do Norte	< 0,001	30,3%	Crescente
.. Paraíba	< 0,001	-8,1%	Decrescente
.. Pernambuco	< 0,001	4,5%	Crescente
.. Alagoas	< 0,001	97,8%	Crescente
.. Sergipe	< 0,001	92,3%	Crescente
.. Bahia	< 0,001	-33,1%	Decrescente
Região Sudeste	< 0,001	11,2%	Crescente
.. Minas Gerais	< 0,001	-7,1%	Decrescente
.. Espírito Santo	< 0,001	18,0%	Crescente
.. Rio de Janeiro	< 0,001	37,8%	Crescente
.. São Paulo	< 0,001	13,5%	Crescente
Região Sul	< 0,001	13,0%	Crescente
.. Paraná	< 0,001	6,5%	Crescente
.. Santa Catarina	< 0,001	24,8%	Crescente
.. Rio Grande do Sul	< 0,001	15,5%	Crescente
Região Centro-Oeste	< 0,001	-12,9%	Decrescente
.. Mato Grosso do Sul	< 0,001	4,1%	Crescente
.. Mato Grosso	< 0,001	29,7%	Crescente
.. Goiás	0,001	-27,2%	Decrescente
.. Distrito Federal	< 0,001	6,2%	Crescente

From the data illustrated in Figure 2, it is possible to observe that the region with the highest average values per hospitalization is the Northeast region, with values between R$ 2,500.00 and R$ 3,000.00. The other regions are in the range of values between R$ 1,500 and R$ 2,000, with the region with the lowest average values being the North region (average of R$ 1,632.47 in the last 10 years). It can be observed from the APC value that the North (-0.2%), Northeast (-13.6%) and Central-West (-12.9%) regions had a reduction in the mean hospitalization value in the period studied. While the Southeast

(11.2%), South (13%) and Federal District (6.2%) regions had an increase in the average hospitalization value.

Figure 4. Average length of stay in hospitalizations in Brazil by region



Source: DataSUS

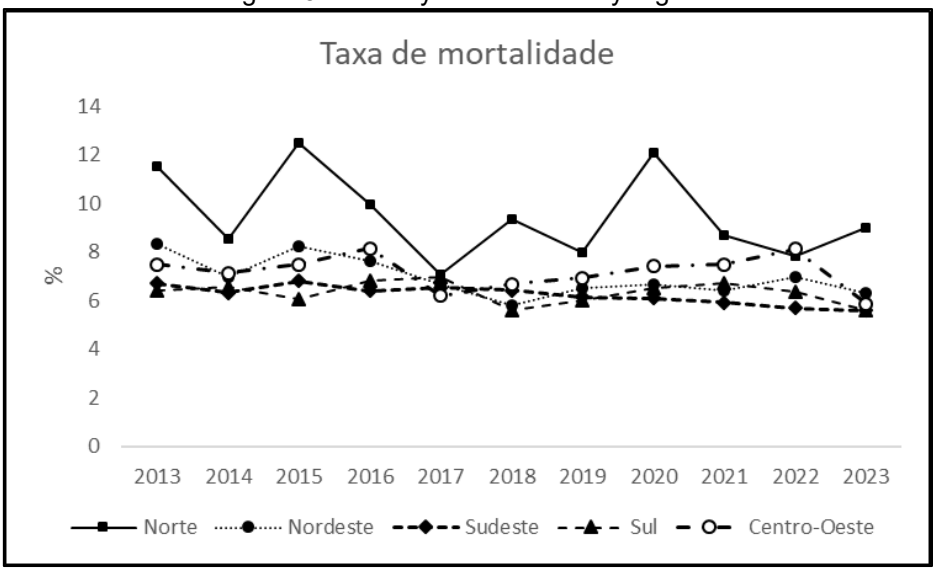
Table 3. APC - Annual percentage change and trend in the average length of stay of hospitalizations.

Média permanência por Região/Unidade da Federação e Ano processamento			
Região/Unidade da Federação	**p**	**VPA**	**Tendencia**
Região Norte	< 0,001	-16,9%	Decrescente
.. Rondônia	< 0,001	12,5%	Crescente
.. Acre	< 0,001	20,0%	Crescente
.. Amazonas	< 0,001	2,0%	Crescente
.. Roraima	< 0,001	23,1%	Crescente
.. Pará	< 0,001	-30,8%	Decrescente
.. Amapá	< 0,001	147,5%	Crescente
.. Tocantins	< 0,001	-33,7%	Decrescente
Região Nordeste	< 0,001	-17,7%	Decrescente
.. Maranhão	< 0,001	-12,8%	Decrescente
.. Piauí	< 0,001	-22,4%	Decrescente
.. Ceará	< 0,001	-49,5%	Decrescente
.. Rio Grande do Norte	< 0,001	-26,0%	Decrescente
.. Paraíba	< 0,001	11,8%	Crescente
.. Pernambuco	< 0,001	-10,9%	Decrescente
.. Alagoas	< 0,001	42,1%	Crescente
.. Sergipe	< 0,001	3,9%	Crescente
.. Bahia	< 0,001	-12,5%	Decrescente
Região Sudeste	< 0,001	-19,2%	Decrescente
.. Minas Gerais	< 0,001	-27,8%	Decrescente
.. Espírito Santo	< 0,001	11,6%	Crescente
.. Rio de Janeiro	< 0,001	-21,2%	Decrescente
.. São Paulo	< 0,001	-18,2%	Decrescente
Região Sul	< 0,001	-35,0%	Decrescente
.. Paraná	< 0,001	-29,5%	Decrescente
.. Santa Catarina	< 0,001	-31,5%	Decrescente
.. Rio Grande do Sul	< 0,001	-36,4%	Decrescente
Região Centro-Oeste	< 0,001	-16,0%	Decrescente
.. Mato Grosso do Sul	< 0,001	-50,0%	Decrescente
.. Mato Grosso	< 0,001	-7,3%	Decrescente
.. Goiás	< 0,001	20,0%	Crescente
.. Distrito Federal	< 0,001	-15,3%	Decrescente

Figure 3 shows the average values of permanence by region. It is possible to observe that the region with the highest average stay is the North region, with values between 7 and 9 days. The second region with the highest average stay is the Northeast region, with an average of 5.5 days of stay. The other regions have an average stay of around 4.7 days. From the APC and p-value values, it is observed that, in the interval studied, all regions have a trend towards a reduction in the average length of stay of hospitalizations, with the South region having the largest drop (-35%), followed by the

Southeast (-19%), Northeast (-18%), North (-17%), Midwest (-16%) and Federal District (-15.3%).

Figure 5. Mortality rate in Brazil by region.



Source: DataSUS

Table 4: APC - Annual percentage change and trend in mortality rate.

Taxa mortalidade por Região/Unidade da Federação e Ano processamento			
Região/Unidade da Federação	**p**	**VPA**	**Tendencia**
Região Norte	< 0,001	-21,9%	Decrescente
.. Rondônia	< 0,001	-49,2%	Decrescente
.. Acre	< 0,001	66,6%	Crescente
.. Amazonas	< 0,001	89,9%	Crescente
.. Roraima	< 0,001	40,0%	Crescente
.. Pará	< 0,001	-25,7%	Decrescente
.. Amapá	< 0,001	-50,0%	Decrescente
.. Tocantins	< 0,001	-65,6%	Decrescente
Região Nordeste	< 0,001	-24,0%	Decrescente
.. Maranhão	< 0,001	-12,9%	Decrescente
.. Piauí	0,001	-41,3%	Decrescente
.. Ceará	< 0,001	-57,6%	Decrescente
.. Rio Grande do Norte	< 0,001	-33,4%	Decrescente
.. Paraíba	< 0,001	12,6%	Crescente
.. Pernambuco	< 0,001	-20,8%	Decrescente
.. Alagoas	< 0,001	77,7%	Crescente
.. Sergipe	0,005	-51,7%	Decrescente
.. Bahia	< 0,001	-8,0%	Decrescente
Região Sudeste	< 0,001	-16,6%	Decrescente
.. Minas Gerais	< 0,001	-35,1%	Decrescente
.. Espírito Santo	< 0,001	-6,0%	Decrescente
.. Rio de Janeiro	< 0,001	-13,4%	Decrescente
.. São Paulo	< 0,001	-8,5%	Decrescente
Região Sul	< 0,001	-12,9%	Decrescente
.. Paraná	< 0,001	-4,1%	Decrescente
.. Santa Catarina	< 0,001	-3,8%	Decrescente
.. Rio Grande do Sul	< 0,001	-24,0%	Decrescente
Região Centro-Oeste	< 0,001	-21,6%	Decrescente
.. Mato Grosso do Sul	< 0,001	-7,1%	Decrescente
.. Mato Grosso	< 0,001	-55,4%	Decrescente
.. Goiás	< 0,001	-21,3%	Decrescente
.. Distrito Federal	< 0,001	-10,4%	Decrescente

Regarding the mortality rate, we can see the data in Figure 4. It is observed that the region with the highest mortality rate in the period from 2013 to 2023 is the North region, with values ranging from 7% to 12%, with an average of 9.5% in the period studied. The second region with the highest mortality rate is the Central-West region, with an average of 7.2% in the period. The other regions have an average mortality rate of 6.5% in the period. Analyzing the values of APC and p, there is a downward trend in the mortality rate of all regions, with the largest decrease in mortality in the Northeast region (-24%), followed by

the North region (-22%), Midwest (-22%), Southeast (-17%), South (-13%) and Federal District (-10.4%).

DISCUSSION

The regional analysis of hospitalization data for bladder cancer in Brazil reveals distinct epidemiological and structural patterns, strongly influenced by demographic and socioeconomic factors, and by access to specialized health services.

The Southeast region, which concentrates 41.8% of the Brazilian population (84.8 million inhabitants), recorded the highest absolute number of hospitalizations for bladder cancer, representing more than 55% of the total. This finding may be correlated both with the population contingent and with prevalent risk factors, such as smoking and occupational exposure to industrial carcinogens. According to the National Cancer Institute (INCA), in 2019, 13.3% of the population in the Southeast was a smoker, second only to the South region (14.7%). The high prevalence of smoking in the South may explain the fact that this region has the highest proportional rates of hospitalization for bladder cancer, despite representing only 15% of the national population.

The analysis of the average costs of hospitalization revealed important disparities. The Northeast region had the highest average values per hospitalization (R$ 2,770.15), while the Southeast and North regions recorded the lowest average costs (R$ 1,672.19 and R$ 1,632.47, respectively). The high investment in health in the Northeast region, in contrast to its high poverty rate (47.9% of the population in a situation of vulnerability), may be associated with a greater supply of hospital beds. Data from Fiocruz (2019) indicate that the Northeast has 75,317 beds in the SUS, with the highest national availability, followed by the Southeast (61,656 beds) and North (20,873 beds). This greater hospital capacity may be related to the 24% reduction in the mortality rate from bladder cancer in the Northeast over a decade, indicating a positive impact of investments in hospital infrastructure and care for cancer patients.

Despite having the highest number of hospitalizations, the Southeast has one of the lowest average hospital stays and lower mortality rates. This trend may be related to factors such as greater access to advanced diagnostic and therapeutic technologies, allowing for early interventions and reduced need for prolonged hospitalizations. Studies indicate that regions with a higher Human Development Index (HDI) have better survival rates for cancer patients, reinforcing the influence of access to qualified health care on bladder cancer mortality (RICHETERS et al., 2020).

On the other hand, the North region had the worst indicators of hospital care. Despite registering the lowest number of hospitalizations, the average hospital stay was the highest, exceeding the average intervals of the other regions (between 5 and 6 days). In addition, the North region had the highest mortality rate from bladder cancer throughout the study period. This scenario can be attributed to lower investments in healthcare, low efficiency in resource management, and limited hospital infrastructure, as reported by Weise (2023).

In addition, the North region has a greater lack of advanced diagnostic equipment, such as enhanced cystoscopy and computed tomography, resulting in late diagnosis and greater need for radical surgical interventions. A study by Timoteo et al. (2020) corroborates this hypothesis, demonstrating that the North region had the highest rate of cystectomies in Brazil between 2008 and 2017. Cystectomy, a surgical procedure of total or partial removal of the bladder, is usually indicated in advanced cases of the disease, which suggests that late detection may be a determining factor for the high mortality rate observed in the region.

Investments in the North region did not keep up with the growth in demand for specialized services, evidencing a worrying scenario. The downward trend in health investments in the last decade may have aggravated this situation, contributing to a cycle of low problem-solving capacity in bladder cancer care, with prolonged hospitalizations and unfavorable clinical outcomes.

CONCLUSION

The findings of this study reinforce the existence of significant regional disparities in the hospital approach to bladder cancer in Brazil, influenced by socioeconomic differences, availability of hospital infrastructure, and access to specialized treatments.

The Southeast region, despite registering the highest absolute number of hospitalizations, demonstrated greater efficiency in resource management and better access to advanced therapies, resulting in shorter average length of hospital stay and lower mortality rates. In contrast, the North region had the worst clinical outcomes, with longer hospital stays and higher mortality rates, evidencing deficiencies in hospital infrastructure and less access to early diagnosis and treatment.

The Northeast region, despite concentrating a high number of beds and having one of the highest per capita investments in hospitalizations, still faces structural challenges to achieve more significant reductions in mortality rates, which may be related to organizational factors and the quality of the services provided.

Given this scenario, it is essential to implement public policies aimed at equity in access to the diagnosis and treatment of bladder cancer in Brazil, with an emphasis on the expansion

of hospital infrastructure and the efficient allocation of resources to more vulnerable regions, such as the North and Northeast. Strategies such as strengthening primary cancer care, expanding early diagnosis services, and decentralizing referral centers can contribute to improving clinical indicators and reducing regional inequalities in the care of patients with bladder cancer in the country.

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