EPIDEMIOLOGICAL ASPECTS AND HOSPITAL COSTS OF HOSPITALIZATIONS FOR ALZHEIMER'S DISEASE IN BRAZIL

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ABSTRACT

Introduction: Alzheimer's disease is a degenerative and progressive disease that acts on the central nervous system. It affects about 10% of people over 60 years of age and 40% of people over 80 years of age and its complications can lead to death. When causing moderate to severe cognitive decline, hospitalization of the patient may be necessary.

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Objective: To analyze the profile of hospitalizations for Alzheimer's disease in Brazil from January 2003 to December 2022. Methodology: This is an ecological, retrospective and quantitative study. Sociodemographic data (gender, color or race, and age group) and clinical data (number of hospitalizations, average length of stay, total value of hospitalizations, deaths, and mortality rate) were analyzed. Results: A total of 19716 hospitalizations were observed in Brazil, most of whom were female (64%), over 80 years of age (56%) and white. The Southeast had the highest average length of stay (121.6 days); the total number of deaths during the analyzed period was 3831, with the Northeast having the highest mortality rate (26.2%). The total expenses were R$ 38596519.60. Conclusion: There is evidence of a progressive increase in hospitalizations for Alzheimer's disease in recent decades, which also impacts the increase in expenses. Elderly people over 80 years old were the most hospitalized, as well as women and white people. In the Southeast region, most deaths from Alzheimer's disease occurred. Strategies based on awareness of the disease are necessary to confront it.

Keywords: Hospitalization. Alzheimer's disease. Epidemiological Profile. Public health.

INTRODUCTION

Alzheimer's Disease (AD) is a degenerative and progressive disease that affects the central nervous system. It arises from deficiencies in protein processing, resulting in accumulation and consequent toxicity to neurons (LOPES, 2020). In this context, damage to neural cells generates impairment of cognitive functions and, consequently, an important social and functional deficit (SILVA, 2019). Thus, age is the major risk factor for AD, but even so, it is not enough to cause its appearance, and the genetic component is essential in the pathophysiology of the disorder (FERREIRA, 2018).

The prevalence of Alzheimer's Disease increases considerably due to population aging, with a significant growth in the proportion of elderly individuals in relation to other ages (SANTOS, 2021). In view of this, AD is the main neurodegenerative disease, affecting about 10% of people over 60 years of age and 80% of people over 80 years of age. It is estimated that by 2040 it will be present in more than 80 million people in the world (OLIVEIRA, 2017).

In the period between 2010 and 2017, there were about 8014 hospitalizations for Alzheimer's disease in Brazil, of which 685 (8.5%) occurred in the Northeast region, 4773 (59.6%) in the Southeast region and 1992 (24.9%) in the South region (CARVALHO, 2020). This disease has an epidemiological profile more prevalent among women, elderly, of the white race/color, but this disease can affect races, cultures and sexes indistinctly (MENDES, 2020).

Because it is a disease that is not very well explained, the prevention of Alzheimer's becomes a promising and audacious challenge for the population and for health promoting organizations (COSTA, 2021). Some factors are pointed out as risk factors for AD, such as an inadequate lifestyle (ALMEIDA, 2019), low educational levels, and some previous comorbidities such as diabetes and hypertension (BARROS, 2020). Therefore, strategies can be adopted to modify these predisposing factors so that there is a possibility of delaying or avoiding the onset of dementias such as Alzheimer's (NUNES, 2020).

The risk factors associated with Alzheimer's Disease have an intrinsic relationship with the patient's genetics, with the presence of amyloid plaques, due to the accumulation of beta-amyloid (BA) protein, being the main characteristic (SILVA, 2022). In addition, the damage caused by the BA protein is related to accumulation, due to the decrease in the metabolism of this molecule, as well as excess production (MARTINS, 2021). In addition, the formation of amyloid plaques is also interconnected with the neurotoxicity caused by tau protein, metabolism, and autoimmunity (GONÇALVES, 2020). There are studies that indicate that type 3 diabetes is related to dementia and, therefore, to the development of

AD. In view of this, the decrease in insulin and insulin resistance itself may be linked to neurodegenerative changes, given the high number of insulin receptors present in the brain, especially in areas associated with cognition (FERREIRA, 2019).

It is worth mentioning that, in the intermediate stage of the disease, the patient has many difficulties in daily life, while more striking facts are forgotten, such as names of people close to them, difficulties in personal hygiene and self-care, inability to take care of the home, difficulty in speaking and expressing themselves, hallucinations, and changes in behavior (SOUZA, 2021). At this stage, the symptoms of Alzheimer's become more evident, and patients usually begin to be hospitalized (ALVES, 2020). The last stage of Alzheimer's before death lasts from one to three years (COSTA, 2018).

As soon as the elderly person with Alzheimer's Disease is hospitalized, in addition to specific and complex care models, they will need monitoring and participation by a caregiver, especially during the hospitalization and recovery process (SILVA, 2021). In the advanced stage, they become totally dependent (GOMES, 2020). However, many families are unaware of the care of these patients affected by this dementia, and hospitalization becomes a consequence due to the evolution of the disease (SANTOS, 2021). Describing the profile of hospitalizations associated with Alzheimer's disease, especially those hospitalized, can contribute to a better understanding of the outcomes in this population (PEREIRA, 2019). In addition, it can stimulate the creation and implementation of specific public policies aimed at the health of the elderly affected by dementia, particularly aimed at reducing the time and recurrence of hospital admissions, as well as the entire recovery and rehabilitation process for those involved (NUNES, 2020; OLIVEIRA, 2021).

Thus, the objective of this study was to analyze the profile of hospitalizations associated with Alzheimer's Disease in Brazil from 2003 to 2022.

METHODOLOGY

This is an ecological study of documentary, observational, retrospective, and quantitative design, which evaluated the epidemiological profile of hospitalizations for Alzheimer's disease in Brazil between January 2003 and December 2022.

The data were obtained from all records of hospitalizations for Alzheimer's Disease in Brazil that occurred between January 2003 and December 2022. Data collection took place in February 2023, through the SUS Hospital Information System (SIH/SUS) (DATASUS, 2013-2022), widely made available by the SUS Department of Informatics (DATASUS), at the electronic address (https://datasus.saude.gov.br/). The information studied was sociodemographic (gender and age group) and clinical variables (number of

hospitalizations, average length of stay, deaths, mortality rate, and total value of hospitalizations according to the regime).

A descriptive analysis of the variables was performed. The observed values were arranged in graphs and tables, in a categorized manner. The variables were grouped into five-year periods, from 2003 to 2022, with absolute values and percentages. In addition, they were classified as: Gender - female and male; Age group - under 19 years old, 20 to 39 years old, 40 to 59 years old, 60 to 79 years old, 80 years old and over; Race - white, black, brown, yellow, indigenous, without information; Region/Average length of stay/Deaths/Mortality rate/Total value - North, Northeast, Southeast, South, Midwest. Prevalence and percentages were calculated, and the results of the country as a whole were compared, as well as for each region and year. For data management and analysis, Excel software was used (Microsoft Office®, 2019).

RESULTS

In the period from 2003 to 2022, as can be seen in table 1, 19716 hospitalizations for Alzheimer's disease were observed in Brazil. The number of hospitalizations between the five-year periods ranged from 1719 to 7279, with an average of 1037 cases per year. There was a progressive increase in hospitalizations, reaching the highest number in the period from 2018 to 2022 (36.92%).

Analyzing the number of hospitalizations for Alzheimer's according to the geographic regions of Brazil, a higher number of cases was observed in the Southeast region, corresponding to about 56.66% of the occurrences between 2003 and 2022. Regarding the number of hospitalizations according to gender, there was a higher frequency in females, with approximately 64% of the cases in the periods analyzed.

According to the age group, there was a higher number of hospitalizations in the age of 80 years and above from 2008 to 2022, with a predominance of cases between 60 and 79 years in the period 2003-2007 (54.39%). It was found that occurrences in the population under 60 years of age correspond to around 4.7% of the total hospitalizations between 2003-2022.

According to the results related to race, it was not possible to describe its relationship with the pathology during the first five-year period due to the lack of information in the database. Thus, the predominance of hospitalizations in white people was noticed, corresponding to about 51% of the total cases (12708), disregarding those in which information was not obtained. In addition, a small occurrence was noted in indigenous individuals, with 0.01% of the total cases, excluding the data referred to "no information".

According to the average length of stay of hospitalizations, a predominance of longer hospitalizations was noticeable in the Southeast and Northeast regions in the period from 2008 to 2022, with the South occupying the second highest average only in the 2003-2007 interval (Figure 1).

The survey showed the occurrence of 3831 hospital deaths in the period from 2003 to 2022, with the southeast region having the highest proportion (65%). There was also a progression in the number of deaths comparing the period 2003-2007 (7.3%) to the 2018-2022 interval (45.7%). Observing the mortality rate, it was also noticed that the Southeast had the highest rate. It was noted that there was no progressive increase in all regions according to the periods analyzed. For example, the values of the Northeast region, in which there was an increase in the rate in the period 2008-2012 (26.2), compared to the interval of 2003-2007 (15.66), followed by a decrease in 2013-2017 (14.44), with a new increase between 2018-2022 (17.14).

The total value of costs observed in the analyzed periods was R$ 38596519.60, with the highest average cost (figure 2), and proportion (75.6%) in the Southeast region. A reduction in the interval between 2018-2022 (7%) was also noticeable, despite the amounts spent in the previous five-year period (figure 3).
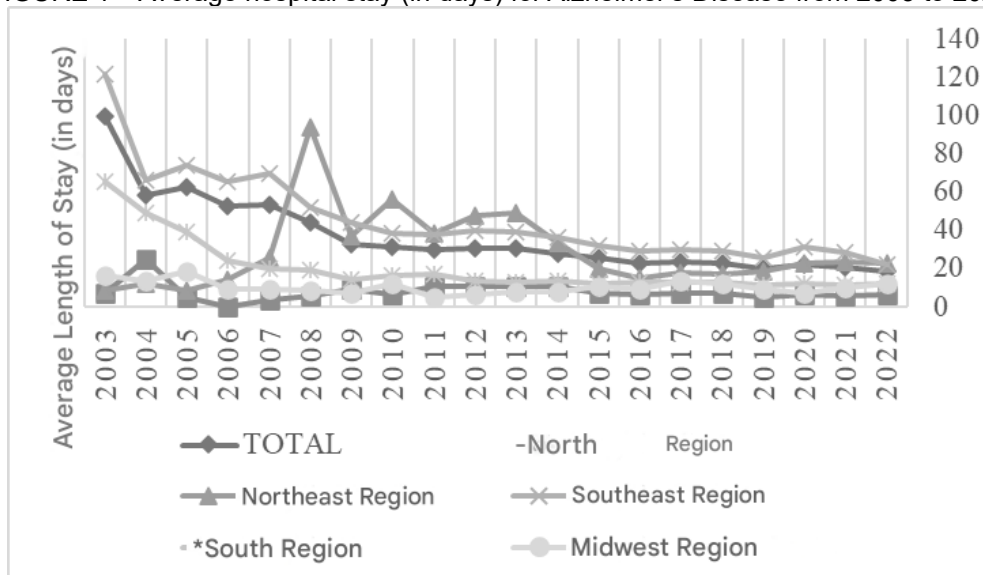
TABLE 1. Sociodemographic data patients hospitalized for Alzheimer's disease in Brazil, 2003 to 2022.

Variables	2003-2007		2008-2012		2013-2017		2018-2022	
	N	%	N	%	N	%	N	%
Admissions								
Brazil	1719	8,72	3831	19,43	6887	34,93	7279	36,92
North	10	0,58	119	3,11	194	2,87	223	3,06
Northeast	83	4,83	313	8,17	498	7,37	1082	14,86
Southeast	1220	70,97	2165	56,51	4153	61,46	3634	49,93
On	346	20,13	1085	28,32	1585	23,46	1857	25,51
Central-West	60	3,49	149	3,89	327	4,84	483	6,64
Total	1719		3831		6575		7279	
Gender								
Male	702	40,83	1400	36,54	2432	35,31	2473	33,97
Female	1017	59,17	2431	63,46	4455	64,69	4806	66,03
Total	1719		3831		6887		7279	
Age group								
Under 19 years old	7	0,43	6	0,16	12	0,17	21	0,29
20 to 39 years old	48	2,97	42	1,10	46	0,67	30	0,41
40 to 59 years old	116	7,18	197	5,15	215	3,12	185	2,54
60 to 79 years old	879	54,39	1668	43,58	2715	39,43	2695	37,03
80 years old or older	566	35,02	1914	50,01	3898	56,61	4348	59,73

Total	1616		3827		6886		7279	
Race								
White	-	-	2111	55,10	3.242	47,07	3603	49,39
Black	-	-	160	4,18	217	3,15	331	4,54
Brown	-	-	496	12,95	1231	17,87	1558	21,35
Yellow	-	-	17	0,44	68	0,99	103	1,41
Indigenous	-	-	2	0,05	0	0,00	2	0,03
No information	-	-	1045	27,28	2129	30,91	1698	23,28
Total	-	-	3831		6887		7295	
Average Stay (days)								
North	9,2		8,3		8,2		6,1	
Northeast	15,7		51,2		23,4		21,0	
Southeast	74,5		41,5		32,5		26,9	
South	34,3		15,5		12,7		11,8	
Midwest	12,0		8,1		10,1		10,1	
Total	61,0		32,6		25,4		20,4	
Deaths								
North	-	-	10	1,49	19	1,69	49	2,80
Northeast	13	4,59	82	12,22	91	8,10	186	10,61
Southeast	231	81,63	464	69,15	739	65,75	1046	59,67
On	28	9,89	104	15,50	228	20,28	357	20,36
Midwest	11	3,89	11	1,64	47	4,18	115	6,56
Total	283		671		1124		1753	
Mortality rate								
North	-		8,40		9,79		17,41	
Northeast	15,66		26,20		14,44		17,14	
Southeast	18,93		21,43		17,81		28,71	
On	8,09		9,59		14,39		19,25	
Midwest	18,33		7,38		14,29		24,02	
Total	16,46		17,52		16,32		23,02	
Cost(R$)								
North	3452,95	0,06	49318,12	0,58	95008,21	0,75	110495,71	0,93
Northeast	82271,88	1,50	1127108,88	13,26	1121202,07	8,80	1619833,75	13,63
Southeast	4704811,84	85,87	6376108,75	75,04	9913204,71	77,83	8214620,30	69,12
On	660372,86	12,05	937407,16	11,03	1510124,72	11,85	1516131,19	12,76
Midwest	28110,52	0,51	12394,57	0,14	97571,16	0,77	422970,27	3,56
Total	5479020,05		8496337,48		12737110,9		11884051,2	

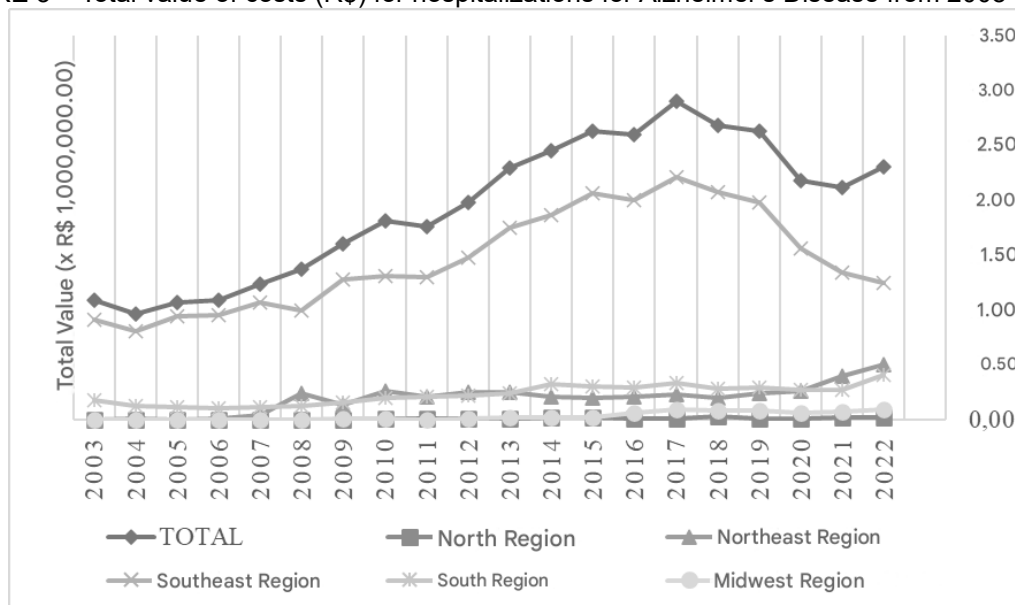FIGURE 1 – Average hospital stay (in days) for Alzheimer's Disease from 2003 to 2022.

FIGURE 2 – Average value (R$) of hospitalizations for Alzheimer's Disease from 2003 to 2022.

FIGURE 3 – Total value of costs (R$) for hospitalizations for Alzheimer's Disease from 2008 to 2022.
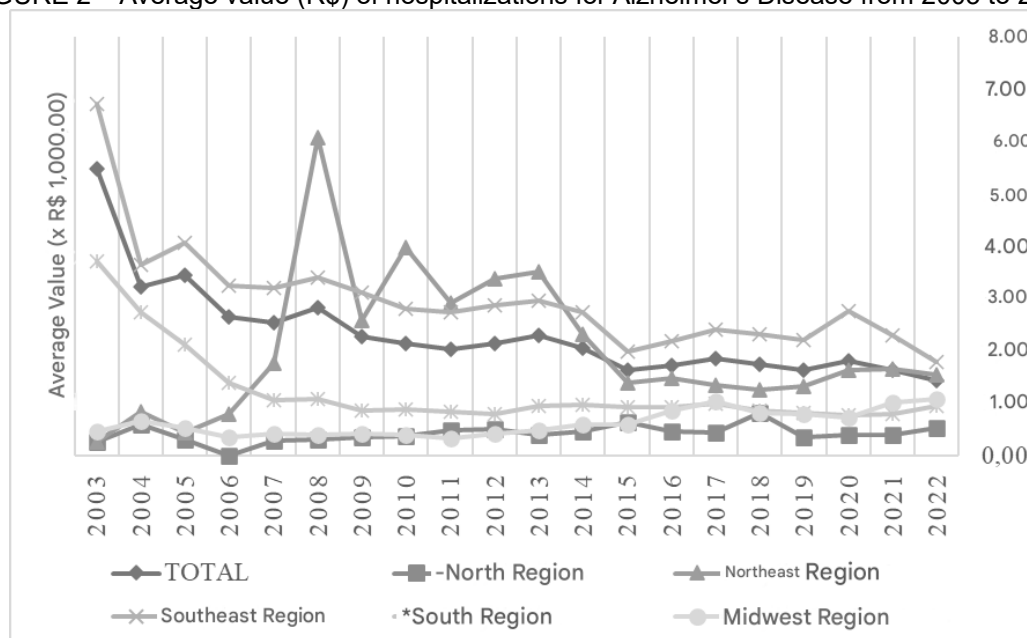
Source: SIH/SUS (DATASUS; 2013-2022).

DISCUSSION

The present study found a progressive increase in hospitalizations for Alzheimer's disease (AD) in Brazil in the last two decades. The Southeast region holds the majority of hospitalizations and, together with the Northeast region, is where people remain hospitalized for the longest time and, consequently, where the most financial resources are spent for this cause. Most hospitalizations involve females and people aged eighty and over. It is also in the Southeast where most deaths caused by this disease are registered.

AD is also a challenge at the international level, because early diagnosis is crucial to control the disease. However, there are barriers to diagnosis that differ by region (RAJKUMAR, 2005). While in Brazil, socioeconomic inequalities and low recognition of dementia by physicians can prevent diagnosis (NITRINI et al., 2009), in China, a very large population makes diagnosis problematic (JIA et al., 2020). In Nigeria, cultural stigma plays an important role (ADEBIYI et al., 2016). In Spain, patient hesitancy and an overburdened health system are the barriers (VILLANUEVA et al., 2018). In Sweden, the barrier lies in the inconsistent use of biomarkers (LAURIN et al., 2017).

The first national-based time series study (2010 to 2019), which described hospital admissions for Alzheimer's disease in Brazil, reported that hospitalization rates and the total cost of hospitalization due to Alzheimer's disease increased in that period (FONSECA et al., 2020). These findings are consistent with the findings of the present study, since the last four show the largest records. On the other hand, the average number of days hospitalized and the costs per hospitalization decreased in the same period, which could also be observed in this study. A possible explanation would be an increase in the coverage of

Family Health Strategies which, based on effective primary health care, improve health outcomes, benefit other levels of the health system, and reduce hospital admission rates and/or the number of days hospitalized, reducing hospitalization costs (SILVA et al., 2018).

Although the present study found a higher prevalence of hospitalizations among women in all periods analyzed, an increase in the rate of hospitalization among men (84.2%) was also observed (FONSECA et al., 2020), indicating a temporal trend of increase in the absolute number and rate of hospitalization in both sexes over the years. These findings may be related to the longer survival time presented by women, as well as a higher prevalence of more affective symptoms and disability among them (SANTOS et al., 2017). Men, in turn, account for more comorbidities, more decline in behavior control, and higher mortality rates (ALMEIDA et al., 2019), leading to this growing need for hospital admissions.

Regarding ethnicity, people declared white represent the highest percentages of hospitalizations for Alzheimer's Disease, which can reach almost three times more than black and brown patients (FONSECA et al., 2020), findings that are consistent with those of the present study. Despite this, a significant increase in hospitalizations in blacks and mestizos has been observed. In this context, a higher prevalence of dementia was reported among black men compared to whites (PEREIRA et al., 2019), which can be associated with the increase in the population that self-declares itself as black and brown, with brown becoming the most prevalent ethnicity in Brazil (46.5%) (IBGE, 2022).

With the aging of the Brazilian population, it is estimated that, from 2000 to 2050, the prevalence of people aged at least 60 years will increase by 280% (OLIVEIRA et al., 2017). This fact makes age an important risk factor for Alzheimer's disease, with the prevalence of the disease doubling every 5 years after the age of 65 (MARTINS et al., 2021). These numbers may explain the increase in hospitalizations of patients aged 80 years or older found in this study. These findings could also explain the regression found in the amounts spent on hospitalizations in recent years, since higher values are perceived in the younger age group, whose early Alzheimer's disease is associated with genetic mutations (PINHEIRO et al., 2020), affecting people who are more likely to have more brain changes (FERREIRA et al., 2018), which would negatively impact the cost per hospitalization.

Still concerning the costs of the disease, there is the change in the type of admission from elective to emergency (FONSECA et al., 2020), explaining the increase in costs related to emergency hospitalizations and the decrease in the costs of elective hospitalizations. A similar pattern was observed in the United Kingdom, where emergency services admissions increased from 2008 to 2016 (SMITH et al., 2017).

The findings of this study indicate an annual increase in the hospitalization rate in the South, Northeast, Midwest, and Southeast regions. Regarding the length of hospital stay, a reduction was observed in four of the five Brazilian regions, with the only increasing trend observed in the Central-West region. This verification is also recorded in another study (FONSECA et al., 2020) and seems to be related to the 153% increase in morbidities associated with Alzheimer's Disease. In addition, the elderly population in the Central-West Region has increased, mainly due to the migration of people from other Brazilian regions (BRASIL, 2021).

The death rate from Alzheimer's disease had its highest increase in 2019. This made the disease the third with the highest all-cause mortality in Brazil, followed by septicemia and malignant neoplasms in the trachea, lungs, and bronchi (26.8%) (FONSECA et al., 2020). In the United States, the percentage of death from Alzheimer's disease increased by 145% from 2000 to 2017 (ALZHEIMER'S ASSOCIATION, 2019), killing more than breast and prostate cancer combined (ALZHEIMER'S ASSOCIATION, 2019). The present study found the majority of deaths from Alzheimer's disease in the Southeast, probably because this is the region with the highest number of hospitalizations for Alzheimer's among all geographic regions of Brazil, and also where the highest number of cases of the disease is observed.

The present study, however, has an ecological character, resulting in the difficulty of establishing causal relationships. It is important to conduct longitudinal studies that can assess and characterize the risk factors associated with the progression of AD. Despite this, the present research design has national coverage, and is relevant to build a broader view of the current situation of Alzheimer's Disease, especially in hospital environments. This becomes relevant because the prevalence of this disease will triple by 2050 (BOMBACK et al., 2020), affecting more than 3 million people, while only one in four cases of dementia are diagnosed (ALZHEIMER'S ASSOCIATION, 2020). Thus, public health policies, not only the free distribution of high-cost drugs, need to be outlined, in order to remove Alzheimer's Disease from the level of underdiagnosis, undertreatment, underrecognition and undermanagement of the evolutionary process, as well as its biopsychosocial consequences on the quality of life of patients and family members/caregivers. In addition, the action of trained health professionals is necessary for the comprehensive and globalized care of the study population.

CONCLUSION

Alzheimer's disease is already a public health problem in Brazil and worldwide. There is evidence of a progressive increase in hospitalizations due to complications of this condition in the last two decades, which progressively generates an increase in financial expenses. The Southeast and Northeast regions, which are more populous, have the majority of hospitalizations and represent the longest hospitalization, spending more financial resources. Elderly people over 80 years of age are the most hospitalized due to negative AD outcomes, especially women. There is a predominance of hospitalizations in white people, corresponding to more than half of the total cases. It is also in the Southeast region where most deaths from Alzheimer's disease are registered. Strategies based on awareness about the disease are necessary to cope with it.

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