Female Breast Cancer Mortality in Alagoas from 2001 to 2016: Trend Analysis and Spatial Distribution

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Mortalidade por Câncer de Mama Feminino em Alagoas no Período de 2001 a 2016: Análise de Tendência e Distribuição Espacial

Mortalidad por Cáncer de Mama en Mujeres en Alagoas nel Periodo de 2001 a 2016: Análisis de Tendencias y Distribución Espacial

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Abstract

Introduction: Breast cancer is the neoplasm that causes more deaths in the female population worldwide and in Brazil. **Objective**: To analyze the epidemiological profile, trend and spatial distribution of female breast cancer mortality in Alagoas from 2001 to 2016. **Method**: Mixed ecological study, including female deaths from breast cancer recorded in Alagoas in the period. Sociodemographic variables (age, color/race, marital status, education and place of occurrence) and the specific mortality rate by age group and municipality were used. Data were obtained from the Mortality Information System and population data from the Brazilian Institute of Geography and Statistics (IBGE). The trend analysis used the Joinpoint regression model and Moran statistics for the spatial distribution. **Results**: 1,816 deaths in the period, 25.3% between 50-59 years, 46.3%, brown race, 36.1%, married, 35.5%, with less than 8 years of education and 67.2% of deaths within the hospital environment. The age groups of 40 years or older showed a growing trend and the highest growth, for 80 years old or more (average annual percent variation: 9.2; p<0.001). The spatial distribution was random. **Conclusion**: The mortality rate for female breast cancer increased in the period from 2001 to 2016 in the age group of 40 years and older in the state and without defined spatial pattern.

Key words: Breast Neoplasms/mortality; Breast Neoplasms/epidemiology; Demography.

Resumo

Introdução: O câncer de mama é a neoplasia que mais causa mortes na população feminina mundial e brasileira. **Objetivo:** Analisar o perfil epidemiológico, a tendência e a distribuição espacial da mortalidade por câncer de mama feminino em Alagoas no período de 2001 a 2016. **Método:** Trata-se de um estudo ecológico misto, incluindo os óbitos femininos por câncer de mama registrados em Alagoas durante esse período. Foram utilizadas as variáveis sociodemográficas (faixa etária, cor/raça, estado civil, escolaridade e local de ocorrência) e a taxa de mortalidade por faixa etária e por município do Estado. Os dados foram obtidos do Sistema de Informações sobre Mortalidade e os dados populacionais, do Instituto Brasileiro de Geografia e Estatística (IBGE). A análise de tendência utilizou o modelo de regressão por pontos de inflexão (*joinpoint regression model*) e a espacial, a estatística de Moran. **Resultados:** Houve 1.816 óbitos no período, 25,3% entre 50-59 anos, 46,3% de cor parda, 36,1% casadas, 35,5% com menos de oito anos de estudos e 67,2% de óbitos no ambiente hospitalar. As faixas etárias de 40 anos ou mais apresentaram tendências de crescimento, destacando-se 80 anos ou mais (percentual médio de variação anual: 9,2; p<0,001) com o maior crescimento. A distribuição espacial foi aleatória. **Conclusão**: A taxa de mortalidade por câncer de mama feminino cresceu no período de 2001 a 2016 nas faixas etárias de 40 anos ou mais no Estado e sem padrão espacial definido.

Palavras-chave: Neoplasias da Mama/mortalidade; Neoplasias da Mama/epidemiologia; Demografia.

Resumen

Introducción: El cáncer de mama es el cáncer que causa más muertes en la población femenina en todo el mundo y en Brasil. **Objetivo**: Analizar el perfil epidemiológico, la tendencia y la distribución espacial de la mortalidad por cáncer de mama femenino en Alagoas durante el período 2001 a 2016. **Método**: Este es un estudio ecológico mixto, que incluye muertes femeninas por cáncer de seno registradas en Alagoas durante el período. Se utilizaron variables sociodemográficas (grupo de edad, color/raza, estado civil, educación y lugar de ocurrencia) y tasa de mortalidad por grupo de edad y municipio del estado. Los datos se obtuvieron del Sistema de Información de Mortalidad y los datos de población del Instituto Brasileño de Geografía y Estadística (IBGE). El análisis de tendencias utilizó el modelo de regresión de punto de unión y el espacial con las estadísticas de Moran. **Resultados**: Hubo 1.816 muertes en el período, 25,3% entre 50-59 años, 46,3% marrón, 36,1% casados, 35,5% con menos de 8 años de educación y 67,2% de muertes en el período. Ambiente hospitalario. Los grupos de edad de 40 años y mayores mostraron una tendencia creciente, con un punto culminante de 80 años y mayores (cambio porcentual anual promedio: 9,2; p<0,001) con el mayor crecimiento. La distribución espacial fue aleatoria. **Conclusión**: La tasa de mortalidad por cáncer de mama femenino aumentó en el período 2001 a 2016 en el grupo de edad de 40 años y más en el estado y sin un patrón espacial definido.

Palabras clave: Neoplasias de la Mama/mortalidad; Neoplasias de la Mama/epidemiología; Demografía.

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INTRODUCTION

In Brazil, 59,700 new cases of breast cancer were estimated for the biennium 2018-2019, with incidence of 56.33/100 thousand women. When considered the national context and, except for non-melanoma skin cancer, breast neoplasm is the type of cancer most frequent in the South, Southeast, West-Central and Northeast and is the second in the North Region[1].

This neoplasm is the leader in the mortality rank by cancer in the Brazilian female population[2,3]. In 2017 alone, 16,724 deaths of women were registered with this disease in the country[4], with rate of mortality of 13.22/100 thousand women[4].

From 1996 to 2010, it was registered 24,122 deaths by breast cancer in Brazil's Northeast, whose rate of mortality of the northeast states presented considerable tendency of increase, in despite of the heterogeneous pattern among geographic units[3]. Alagoas, the setting of this investigation, was the State with the third greatest annual growth (7.0%), only behind the states of Paraíba (9.1%) and Maranhão (8.15%)[3].

Alagoas health network is organized in two macroregions and ten microregions. The municipalities of Maceió (capital of the state and headquarter of the first macroregion) are those that concentrate the oncology services to attend the state population[5].

Brazil is deficient in studies of temporal and spatial analysis about mortality by breast cancer, overall in the northeast region, and more remarkably, in the State of Alagoas. Studies of this nature can contribute to know the profile of mortality in the state and help managers to take decisions about the planning the network care to breast cancer in order to reduce the negative impact of the disease in the quality of female life.

Based in this presentation, the current article had as objective the analysis of the epidemiologic profile, the tendency and spatial distribution of mortality by female breast cancer in Alagoas from 2001 to 2016.

MATERIALS AND METHODS

Mixed ecological study including all female deaths by breast cancer registered in Alagoas from 2001 to 2016.

The area of the study was Alagoas, State of the Brazil's northeast region with 102 municipalities, divided in two macroregions for health and subdivided in ten microregions[5]. The state has a territorial area of 27,848,003 km² and according to the forecast of the Brazilian Institute of Geography and Statistics (IBGE) for 2018, has an estimated population of 3,391,142 inhabitants[6].

In the study, it was included the socioeconomic variables (age-range, color/race, marital status, education and place of occurrence) and specific rate of mortality per age range (<20 years, 20-39 years, 40-49 years, 50-59 years, 60-69 years, 70-79 years and 80 years or more).

During data collection, it was considered the following criteria: i) Unit of the Federation: Alagoas; ii) Group ICD -10: Breast malignant neoplasms; iii) Category ICD-10: C50 – Breast malignant neoplasm; iv) Female gender; and v) Period: 2001-2016. The data were obtained from the System of Information about Mortality (SIM/DATASUS) at the website http://tabnet.datasus.gov.br. Additionally, the populational data were obtained from IBGE.

After data were collected, the rates of mortality were calculated and the following equations were used:

Annual rate of mortality of the state:

$$\text{Rate of annual mortality} = \frac{\text{Number of deaths per breast malignant neoplasm in women in the place and period}}{\text{Female population in the place and period}} x\ 100\ mil$$

B) Rate of mortality of the period:

$$\text{Mortality rate of the period} = \frac{\text{Mean of deaths (2001-2016) per breast malignant neoplasm in women in the place}}{\text{Female population in the middle of the period in the place}} x\ 100\ mil$$

C) Rate of specific mortality according to age-range:

$$\text{Rate of annual mortality per age-range} = \frac{\text{Number of deaths per breast malignant neoplasm in women in the place and year in each age range}}{\text{Female population in the place and year in each age range}} x\ 100\ thousand$$

It is emphasized that the rate of mortality was standardized by the direct method, utilizing the world population as reference and considering the following age structure: 0-4, 5-9, 10-14, 15-19, 20-24, 25-29, 30-34, 35-39, 40-44, 45-49, 50-54, 55-59, 60-64, 65-69, 70-74, 75-79, 80 or more.

The sociodemographic characterization of the population studied was presented through relative and absolute frequencies. For the analysis of the temporal series, it was utilized the joinpoint regression model. This model identified whether a line with multiple segments is more appropriate statistically to portray the temporal evolution of a set of data when compared to a straight line or to less segments[7]. The tendencies were classified in increasing, decreasing or stationary according to the inclination of the regression line. Still, it was calculated the APC – Annual Percent Change and the Average Percent Change with confidence interval of 95% (CI 95%) and significance of 5%. The analysis was performed utilizing the program Joinpoint, version 4.6.0.0 (Surveillance Research, National Cancer Institute, USA).

At last, spatial analysis and acknowledgment of areas with the lowest rates of mortality and number of deaths by breast cancer in Alagoas were performed. In this stage, it was adopted the statistic of Moran Global to recognize spatial dependence. Once observed the global spatial dependence it is applied the Moran local statistics – LISA – Local Index of Spatial Association for recognition of areas of great risk for the event investigated. According to LISA, the municipalities are positioned in the Moran Scatter Plot: Q1 – high/high (positive values and positive means); Q2 – low/low (negative values and negative means); Q3 – high/low (positive values and negative means); and Q4 – low/high (negative values and positive means). At last, thematic maps were elaborated to present the results. In this stage, it were utilized the software Terra View (*version* 4.2.2, of the National Institute of Spatial Researches – INPE, São José dos Campos, SP, Brazil) and QGis (version2.14.11, of the Open Source Geospatial Foundation – OSGeo, Beaverton, OR, USA).

This study was not submitted to the Institutional Review Board for review because only secondary data in public domain were utilized.

RESULTS

In the period investigated, it was identified 1,816 deaths by female breast cancer in the State of Alagoas, being 25.3% (n= 459) in the age range of 50-59 years; 46.3% (n= 840), Brown race; 36.1% (n= 655) married and 67.2% (n= 1221) of deaths in the hospital environment. No deaths for under 20 years old individuals were registered. It was observed the high proportion of fields ignored in the variable education (50;8%) (Table 1).

The regression model showed significant tendency of growth of female mortality either in the crude rate (AAPC: 5.6; p<0.001), whose mortality went from 8.1/100 thousand in 2001 to 14.7/100 thousand in 2016, or in the standardized world population (AAPC: 4.3%; p<0.001), whose rate passed from 6.4/100 thousand to 11.1/100 thousand. The age ranges of 80 years or more stood out (AAPC: 9.2; p<0.001), 70-79 years (AAPC: 6.5; p<0.001) and 40-49 years (AAPC: 5.7; p<0.001), that presented the greatest increases in descending order. Additionally, the age-range of 20-39 years kept stationary temporal standard (Figure 1).

In the spatial analysis, only two municipalities did not register any death in the period (Passo de Camaragibe and Santa Luzia do Norte) and two registered more than 100 deaths (883 in Maceió and 114 in Arapiraca). Seven municipalities stood out with the greatest rates of mortality: Jacaré dos Homens (20.1/100 thousand), Pilar (18.2/100 thousand), Estrela de Alagoas (17.1/100 thousand), Jacuípe (16.9/100 thousand), Maceió (16.7/100 thousand), Barra de Santo Antônio (15.8/100 thousand) and Paripueira (15.1/100 thousand). Moran Global statistics did not indicate spatial dependence (I Moran 0.0295; p= 0.27), reason for which it was not applied Moran local statistics (Figure 2).

Table 1. Sociodemographic profile of female deaths by breast malignant neoplasm Alagoas, Brazil, 2001 to 2016

Variables	n	%
Age range		
< 29 years	0	0.0
20 to 39 years	209	11.5
40 to 49 years	385	21.2
50 to 59 years	459	25.3
60 to 69 years	344	18.9
70 to 79 years	260	14.3
80 years and more	159	8.8
Color/race		
Caucasian	606	33.4
Black	61	3.4
Asian	4	0.2
Brown	840	46.3
Indian	2	0.1
Ignored	303	16.6
Education		
None	240	13.2
1 to 3 years	219	12.1
4 to 7 years	186	10.2
8 to 11 years	145	8.0
12 years and more	104	5.7
Ignored	922	50.8
Marital Status		
Single	459	25.3
Married	655	36.1
Widow	258	14.2
Legally separated	76	4.2
Other	22	1.2
Ignored	346	19.0
Place of occurrence		
Hospital	1,221	67.2
Other health facility	40	2.2
Domicile	537	29.5
Thoroughfare	3	0.2
Other	12	0.7
Ignored	3	0.2
Total	**1,816**	**100**

DISCUSSION

The knowledge of the profile of breast cancer death can contribute for the identification of the major risk.

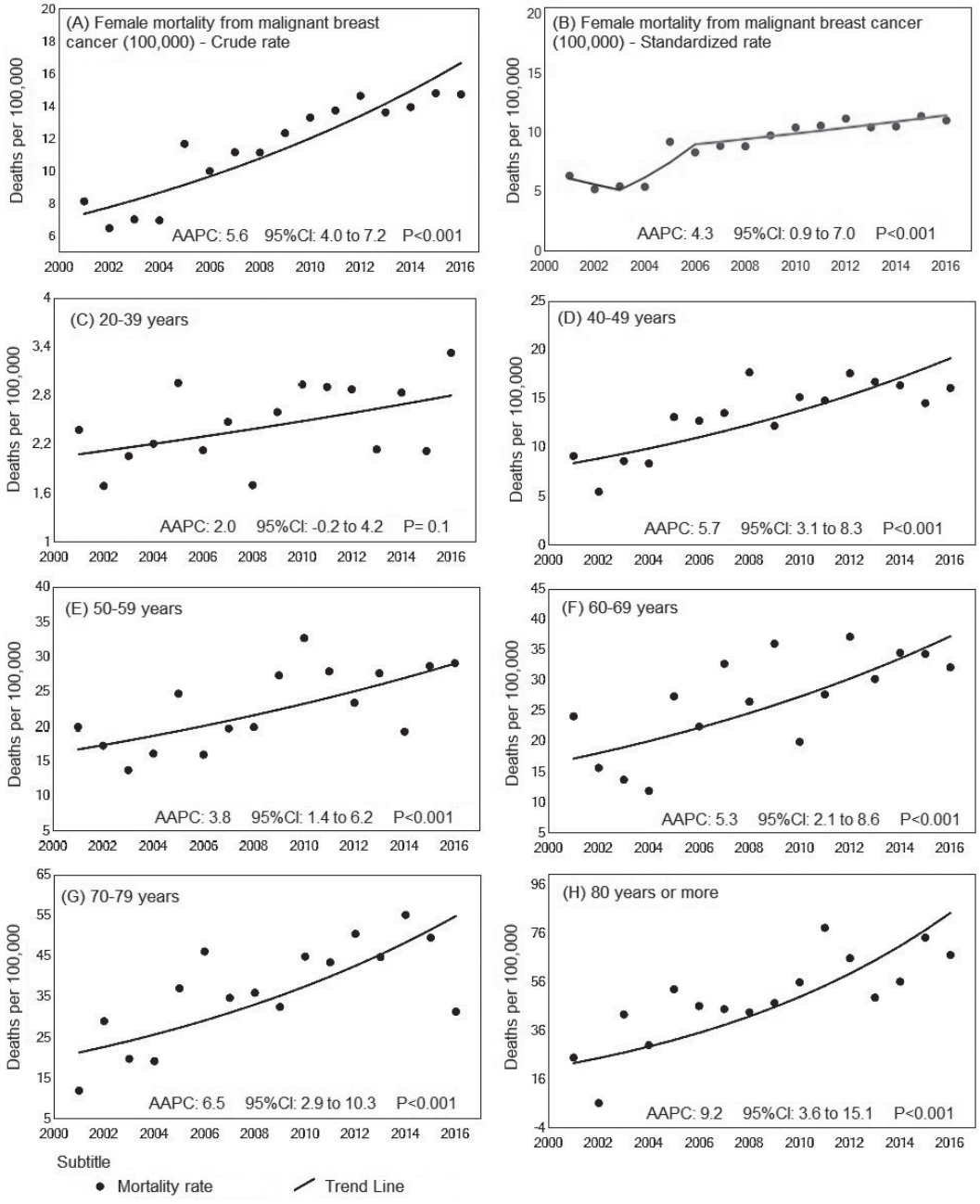

Figure 1. Female rate of mortality by breast cancer according to the age range in Alagoas, Brazil, 2001-2016

Caption: AAPC = Average Annual Percent Change.

In this study, the age ranges above 40 years stood out, Brown, married and low education. The percent increase was concomitant with ageing with random distribution in the State.

Ageing, on its own, is the most important factor in the causality of breast cancer. It is a natural physiological process of life where the individual becomes more susceptible to pathologies and infections because of the deterioration of the immune system, hormone decline and deregulation of the neuroendocrine system[8]. Women older than 65 years present relative risk 5.8 times more for breast cancer compared to younger women, for instance[9].

In this study, mortality grew following the age range. It was noticed that women older than 70 years are off the age range of the official recommendation for biennial mammography of the Ministry of Health (50 to 69 years). In that line of thought, the elderly have less access to the screening programs and to the modern methods of diagnosis and treatment, with damage to survival[10,11]. Validating the data referenced, this study presented significant increase of the tendency of mortality in all age ranges, excepting 20-29 years. The ranges of women of 80

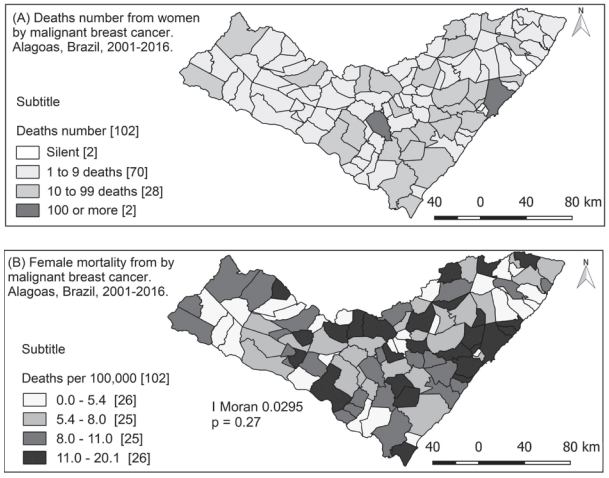

Figure 2. Spatial distribution of female deaths and specific rate of mortality by breast malignant neoplasm. Alagoas, Brazil, 2001-2016

years and between 70-79 years stood out with the greatest percent of growth during the period studied, respectively.

Another age range that is off the mammography screening of the Ministry of Health is from 40 to 49 years old, which presented the third greatest percent increase in this study. In Brazil and in other developing countries, the incidence of breast cancer for the period between 40 and 50 years old is proportionally higher than of the developed countries[12]. In the developing countries, it is estimated that 23% of the diagnosis occur in women within 15 to 49 years, a percent substantially superior to the observed in better life conditions countries whose percent is 10%[13].

Several investigations showed the positive impact of mammography for early detection of breast cancer and reduction of the mortality caused by the disease when properly indicated. In the United Kingdom, a study showed reduction of 25% of the relative risk of death in the first ten years of screening in women from 40 to 49 years[14]. In Brazil, the Brazilian College of Radiology and Imaging Diagnosis (CBR), the Brazilian Society of Mastology (SBM) and the Brazilian Federation of Associations of Gynecology and Obstetrics (Febrasgo) advocate the inclusion of this age group in the screening actions[12]. This attitude is corroborated by the experience adopted in the Health Regional Unit of Barretos, São Paulo, created in 2003 where it was observed an increase of the rates of breast cancer in initial state, reflecting the early diagnosis when utilizing the mammography screening in this age range[15].

It must be highlighted that the screening in these age ranges (below 50 and above 70) has been the object of wide debates. Investigations have shown that possible damages outdo the benefits and, therefore, this practice should not be adopted. Among the possible damages, are the overdiagnosis and overtreatment, potentially resulting in 30% of women treated unnecessarily, mastectomy and exposure to ionizing radiation and chemotherapy procedures[16].

The present study found the greatest percent of deaths in the race Brown (46.26%). This result is influenced by the ethnic differences between the regions of the country as evidenced in a national investigation of the years 2000 and 2010 where the deaths by female breast cancer in the South and Southeast concentrated in Caucasian women and in the Northeast instead, the Brown women stood out[17].Worth mentioning that in Alagoas, 59.8% of the women claimed they were of Brown race according to Census IBGE 2010[18].

An additional topic to be considered in relation to race is the worse survival for breast cancer for Black and Brown individuals when compared to Caucasians[10,17], possibly explained by the existing inequalities among the groups because of little access to mammography and delay in initiating the treatment in the first group in question and by the context itself of social vulnerability [19]. A study conducted in Santa Catarina showed that Caucasian race presented better survival in comparison to other grouped races (76.9 and 62.2%, respectively)[20]. Similar results were observed in the Brazilian southeast where survival in ten years of Caucasian women was higher than non-Caucasian (57.7 and 44.9%)[21].

Another determinant of the mortality is education. Women with low education, usually less than four years, present highest mortality rate[10,11,19,22]. In Santa Catarina, results evidenced that women with university level had better global survival in five years (92.2%) when compared to women with elementary school level (73.6%) and illiterate (56%). This last class had risk 7.40 times higher of death in relation to the group with university level[19]. It is important to highlight that 50.8% of the data registered in Alagoas presented the field education "ignored", showing flaw of the system of health surveillance that prevent the effective description of the epidemiological situation[19,20,22].

As high the social vulnerability, greater the interval between the diagnosis of the disease and beginning of the treatment[19]. Either because of scarce instruction about breast exam, reduced access to health services and mammography, or difficulty in obtaining the proper treatment, it is in this group that survival is low and higher mortality[10,11,16,19,22]. In Brazil's South region, in a population of 1,596 interviewees, women with high income presented three times more knowledge about the clinical exam of breasts compared to the group with less purchasing power[23]. Similar outcome was demonstrated in São Leopoldo, Rio Grande do Sul, with a sample of 1,026

women where the greatest prevalence of non-realization of exams was associated to classes D and E (60%) and to low education (55.8% of the women with four or less education did not submit to breast clinical exam)[24].

The municipalities of Arapiraca and Maceió were the unique in the State with register of more than 100 deaths in the period investigated. According to the Census 2010, these cities are characterized as the most populous of Alagoas with 932,748 and 214,006 inhabitants, respectively. The cities of Jacaré dos Homens (20.08/100 thousand) and Pilar (18.18/100 thousand) presented the highest rates of mortality in the period investigated. Inhabitants of more developed regions have more access to medical consultation and specific exams because of the urban concentration of the assistance services[25]. In the analysis, utilizing the data of the National Research by Domicile Sampling, it was clear the fact that living in urban area increased in 10.97 percent the probability of submitting to mammography exam[26].

Even considering methodological caution, this study has limitations: i) utilization of secondary data that may not reflect the reality, since there is still sub-notification of deaths in SIM with considerable variation in the coverage among the Brazilian regions; ii) elevated number of fields ignored as a result of the lack of standardization in collecting and organizing the data, which hampers the analyzes; iii) lack of epidemiological studies that ensure a deeper discussion of the spatial differences.

CONCLUSION

The profile of deaths was characterized by the predominance of women between 50 and 59 years and ethnicity Brown/Black. The mortality rate by female breast cancer increased in the years 2001 to 2016, mainly in the age-ranges above 70 years and between 40-49, that are not included in the monitoring of the Ministry of Health. The spatial distribution in the State did not obey a specific pattern. In addition, the number of deaths in younger women showed that assistance measures are necessary either for prevention or screening.

CONTRIBUTIONS

All the authors contributed in all the stages of the manuscript and approved the final version for publication.

DECLARATION OF CONFLICT OF INTERESTS

There is no conflict of interests to declare.

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None.

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