ORIGINAL ARTICLE
https://doi.org/10.29289/2594539420250016

Compliance with Brazilian Law 12.732: assessing breast cancer treatment delays across different therapeutic modalities (2017-2022)

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ABSTRACT

Introduction: Breast cancer (BC) is the most common cancer among women in Brazil and worldwide, followed by non-melanoma skin cancer. Law No. 12,732, of November 22, 2012, stipulates that cancer treatment should begin within 60 days of the anatomopathological diagnosis. However, the time to start treatment is still variable in Brazil. **Methods:** A cross-sectional observational ecological study was conducted using data on breast cancer in Brazil between 2017 and 2022, obtained from the DATASUS-SISCAN database. Patients with a diagnosis of breast cancer (ICD C50), the federative unit (UF) of residence, and the treatment modality were considered. Five-time intervals were defined for the start of treatment. The χ^2 and Z tests of two proportions were used, considering a 95% confidence interval ($p<0.05$). **Results:** Of the 243,277 evaluated cases, the highest frequency of patients was in the interval of more than 120 days to start treatment (25.5%). Surgery as a modality had a predominance of treatment initiation within 30 days in Brazil and in all regions, with the Northeast and South presenting 63.3% and 66.9% of patients starting treatment within 30 days, respectively. The chemotherapy modality had a greater distribution of patients in the interval of 31 to 60 days in the Northeast (26.1%) and in the South (26.3%), with the remaining regions predominantly showing intervals of more than 120 days. For radiation therapy, the predominance of treatment was after 120 days from diagnosis in all segments. **Conclusion:** Most patients waited more than 120 days to start breast cancer treatment. Surgical treatment had the shortest waiting time, while radiation therapy showed the longest intervals. For chemotherapy, the time until initiation was variable. In the trend analysis, a decrease in the time to start treatment was evident.

KEYWORDS: breast neoplasm; treatment; delay; 60-day rule.

INTRODUCTION

Breast cancer (BC) remains a global public health challenge, representing the fifth leading cause of cancer death worldwide, with increasing incidence and mortality rates. In 2022, approximately 2.3 million new cases were diagnosed, and about 700,000 deaths related to this neoplasm were recorded[1,2]. Prevalence shows significant variation among countries, directly correlated with the level of socioeconomic development[3,4]. Epidemiological projections indicate a continued increase in incidence, driven by population growth, demographic aging, and changes in risk factor patterns[5].

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Conflict of interests: nothing to declare. **Funding:** none.
Received on: 03/17/2025. **Accepted on:** 08/15/2025.

In the Brazilian context, estimates for the 2023–2025 period point to approximately 704,000 new cancer cases annually, of which about 74,000 will correspond to breast cancer, excluding non-melanoma skin cancer cases. Breast neoplasm is the leading cause of cancer-related death among women in four out of the five Brazilian macro-regions[6]. The distribution of incidence follows the global pattern, with higher rates in states with greater socioeconomic development, particularly in the South and Southeast regions[7].

When identified and treated promptly, BC usually has a favorable prognosis. However, in Brazil, the high mortality rate is intrinsically related to diagnosis and treatment at advanced stages in most cases. The prolonged waiting time for diagnostic exams and the beginning of therapy significantly compromises the chances of cure and survival. This scenario negatively impacts the quality of life of patients and often requires more aggressive therapeutic approaches, involving multiple treatment modalities[8].

In light of this scenario, it becomes essential to adopt strategies that expand and expedite access to breast cancer diagnosis and treatment processes, aiming to improve clinical outcomes and reduce the associated healthcare costs. Therefore, the Brazilian Ministry of Health established Law N. 12,732 in 2012, which mandates the beginning of cancer treatment in the Unified Health System (SUS) within 60 days after diagnostic confirmation through a pathological examination. However, the effective implementation of this legislation only occurred the following year with the publication of Ordinance N. 876/13[9].

Although breast cancer poses a significant challenge in the Brazilian context, proper structuring of screening programs, early diagnosis, and timely treatment constitute an effective strategy to reduce its impact on women's health. In this context, the present study aims to obtain robust data to understand the magnitude of delays in initiating breast cancer treatment in the country. It is expected that the results will provide insights for strategic planning and the improvement of public policies aimed at controlling this neoplasm. The objective of this study is to analyze the time elapsed between diagnosis and the start of breast cancer treatment in Brazil, covering a six-year period (2017–2022).

METHODS

Study design

An observational, ecological, cross-sectional time series study was conducted, with a descriptive approach to data related to breast cancer in women in Brazil, covering the period from 2017 to 2022. This study followed the recommendations of the *Strengthening the Reporting of Observational Studies in Epidemiology* (STROBE) initiative for reporting observational studies[10].

Data source

The data were extracted from the Oncology Panel, a system provided by the Department of Informatics of the Unified Health System (DATASUS), which constitutes a publicly accessible secondary database available online. This tool compiles information related to the diagnosis and treatment of malignant cancers and allows monitoring of the time interval between diagnosis and the start of oncological treatment[11].

Inclusion and Exclusion Criteria

Records of female patients diagnosed with malignant neoplasm of the breast (ICD C50.9) between 2017 and 2022 were included. Records with incomplete or inconsistent data were excluded from the analysis, including those lacking information on diagnosis date, treatment start date, implemented therapeutic modality, or state of residence. Cases in which the interval from diagnosis to treatment was negative or considered implausible (more than 730 days) were also excluded.

Population and Sample

The sample was stratified according to the state of residence and the therapeutic modality implemented (chemotherapy, radiotherapy, or surgery).

Study variables

The primary dependent variable was the time elapsed between diagnosis and the start of treatment, categorized into five intervals: up to 30 days, 31 to 60 days, 61 to 90 days, 91 to 120 days, and more than 120 days. The independent variables analyzed were state of residence, geographic regions (North, Northeast, Central-West, Southeast, and South), therapeutic modality (chemotherapy, radiotherapy, and surgery), and year of diagnosis (2017 to 2022).

Statistical Analysis

The data obtained were organized and analyzed using Microsoft Excel spreadsheets. For the assessment of statistical significance, a global χ^2 test was initially used to identify associations between categories (regions, states, and therapeutic modalities). *Post-hoc* analyses with the Z-test for two proportions were conducted exploratorily, and their respective p-values were adjusted using the Bonferroni method, considering the total number of comparisons (n=132). The adjusted p-values are available in the supplementary tables; statistical significance was considered only when $p<0.00038$.

The temporal trend analysis was conducted using the Joinpoint Regression Program® (version 5.0, National Cancer Institute, USA) through segmented regression. The annual percentage change (APC) with 95% confidence intervals (95% CI) was calculated. Trends were classified as increasing, decreasing, or stable based on the limits of the 95% CI. This approach was used to evaluate the evolution of the waiting time between diagnosis and the start of treatment from 2017 to 2022.

Ethical aspects

This research was based on Resolution No. 510/2016 of the National Health Council, which establishes the exemption from registration and evaluation by the Research Ethics Committee for studies that use publicly accessible and open data[12]. There is no risk of patient identification, or any other risks related to the use and dissemination of the collected information, since the data analyzed are aggregated and do not allow for individual identification.

RESULTS

Between 2017 and 2022, 295,375 new cases of breast cancer were diagnosed, with 291,109 (98.6%) in women and 4,356 (1.4%) in men. Of these, 47,742 cases lacked treatment data and were excluded from the evaluation. A total of 243,277 cases of breast cancer in women were included in the study for analysis (Figure 1).

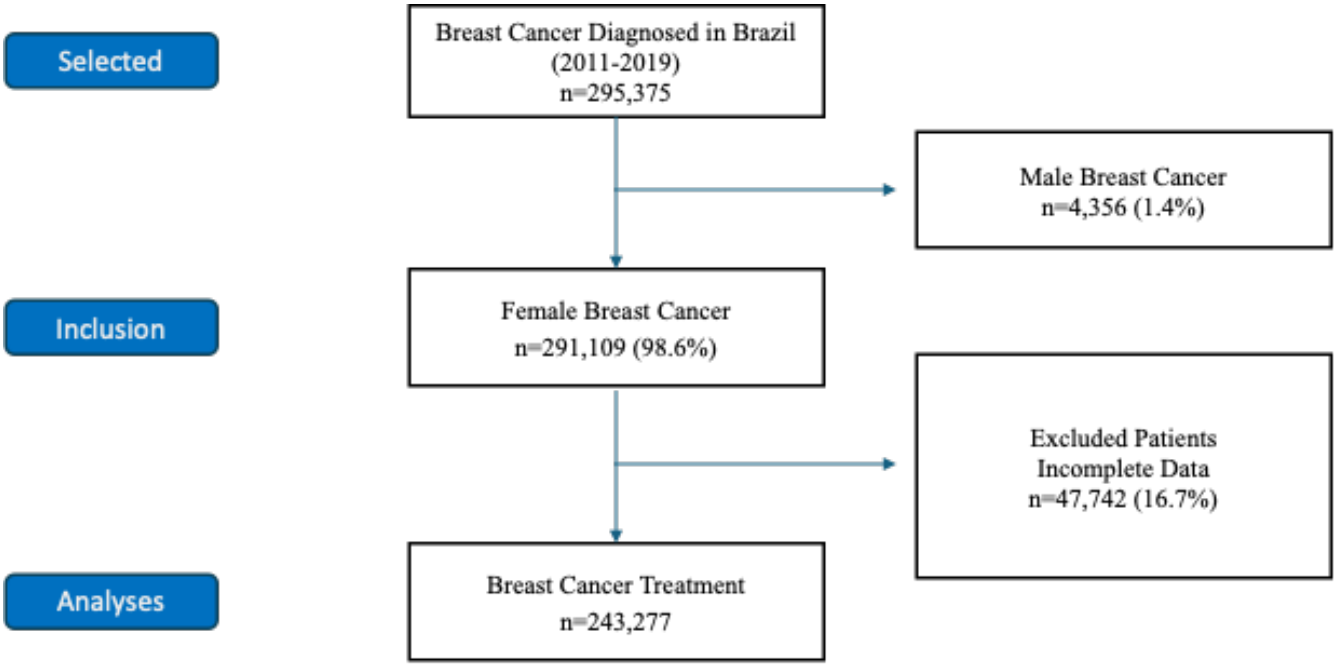
Distribution of time to the start of first treatment

During the analyzed period in Brazil, the highest relative frequency of patients was in the interval of more than 120 days for treatment initiation (25.5%), with more than half exceeding 60 days (54%). Among the Brazilian regions, a similar pattern was observed, with the highest percentage of patients taking more than 120 days to start treatment, particularly in the North Region, where 31% of patients required more than 120 days. In the South Region, however, there was a higher frequency of patients beginning treatment within 30 days of diagnosis (29.6%) and 52.3% starting treatment within 60 days. Table 1 presents time to initiate breast cancer treatment for Brazil and its regions.

In the evaluation of the states, significant variation was observed in the times to treatment initiation. Detailed data by state will be presented in the supplementary material. In the North Region, Tocantins was the only state with a higher proportion of patients starting treatment within 30 days (26.0%). In the Northeast Region, Maranhão, Piauí, Pernambuco, and Sergipe had the greatest number of patients initiating treatment within 30 days, while only Paraíba and Bahia showed a higher prevalence of cases with an interval of more than 120 days.

In the Southeast Region, only Espírito Santo showed the highest percentage of patients starting treatment within 30 days, while the other states had a greater concentration of patients beginning treatment after 120 days from diagnosis. In the South, there was a predominance of treatment initiation within 30 days in the states of Paraná and Rio Grande do Sul. In the Central-West, Mato Grosso do Sul and the Federal District had a higher frequency of patients with intervals of more than 120 days, while Mato Grosso and Goiás showed a greater frequency of treatment initiation within 30 days.

In the statistical analysis, it was observed that in most evaluated segmentations (33 in total, including states, regions, and Brazil), the most prevalent treatment periods were more than 120 days (in 19 of the 33 segmentations). The period of up to 30 days was more prevalent in 11 of the 33 segmentations. The p-values from the comparison of each period relative to the most prevalent one, using the Z-test for two proportions, confirmed the statistical



Source: Data available at https://datasus.saude.gov.br/informacoes-de-saude-tabnet/. Access on June 25, 2023.

Figure 1. Flowchart of cases selected for the study.

significance of these differences (p<0.05), and are detailed in the supplementary material (Figure 2).

Distribution of time to treatment initiation by modality

Comparing the therapeutic modalities, distinct patterns in the time to treatment initiation were observed. Table 2 presents the consolidated data by therapeutic modality for Brazil and its regions.

The surgical modality had a predominance of treatment initiation within 30 days in all the evaluated segments (Brazil and regions), with 58.8% of patients in Brazil starting surgical treatment within this interval. The Northeast and South regions stood out with the highest proportions of surgical treatment initiation within 30 days, with frequencies of 63.3% and 66.9%, respectively. On the other hand, the North Region showed the poorest performance, with 25.6% of patients starting surgical treatment after 120 days from diagnosis.

In the state analysis, it was observed that, for the surgical modality, in the North Region, only Acre (40.8%) and Roraima (44.4%) had higher rates of treatment initiation after 120 days from diagnosis, while Amazonas (60.5%) and Tocantins (54.5%) stood out with more than half of the patients starting surgery within 30 days. In the Northeast Region, the states of Piauí (72.8%) and Bahia (72.5%) had more than 70% of patients beginning surgical treatment within 30 days. In the Southeast Region, Espírito Santo showed the best performance (67.0% within 30 days), while Rio de Janeiro had the worst performance (29.2% after 120 days). In the South Region, Paraná stood out with 78.3% of patients starting surgery within 30 days, the best index nationally. In the Central-West Region, Goiás (69.3%) and Mato Grosso (68.2%) had the best results for surgical treatment.

Table 1. Time to initiate breast cancer treatment, Brazil and its regions, 2017–2022.

Brazil/Region	Time to initiate treatment					p-value	Total value
	Up to 30 days (%)	31 to 60 days (%)	61 to 90 days (%)	91 to 120 days (%)	>20 days (%)		
Brazil	24.4	21.5	16.8	11.7	25.5	<0.001	243,277
North	23.1	19.0	15.6	11.5	31.0	<0.001	10,430
Northeast	23.7	23.2	15.8	11.7	24.2	<0.001	57,478
Southeast	22.7	20.5	17.0	12.3	27.2	<0.001	109,456
South	29.6	22.7	16.0	10.3	21.7	<0.001	50,128
Central-West	24.9	20.2	17.1	11.4	26.2	<0.001	15,785

Source: Data available at https://datasus.saude.gov.br/informacoes-de-saude-tabnet/. Access on June 25, 2023.
Note: P-value obtained from the global χ^2 test. For comparisons of time intervals, Z-tests for proportions with Bonferroni adjustment (n=20) were performed. Significance was considered at p<0.0025.

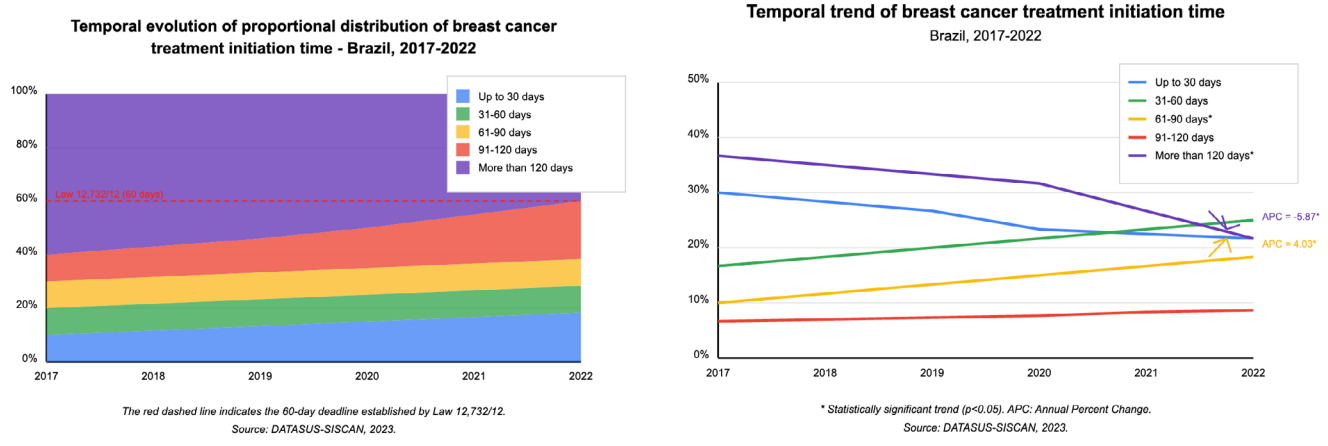


Figure 2. Temporal evolution of the proportional distribution of time to treatment initiation for breast cancer in Brazil. Analysis conducted using segmented regression with Joinpoint software (NCI, USA), including calculation of the annual percentage change (APC) and 95%CI.

Table 2. Time to initiate breast cancer treatment per treatment modality, Brazil and its regions, 2017–2022.

Brazil Region		Time to initiate treatment					n	p-value
		Up to 30 days (%)	31 to 60 days (%)	61 to 90 days (%)	91 to 120 days (%)	>120 days (%)		
Brazil	Surgery	58.8	10.4	9.5	6.8	14.5	44,688	<0.001
	Chemotherapy	17.7	25.1	18.8	12.7	25.7	182,910	<0.001
	Radiottherapy	5.3	11.4	14.9	13.6	54.8	15,336	<0.001
North	Surgery	49.9	7.6	8.6	8.2	25.6	2,581	<0.001
	Chemotherapy	14.9	22.9	18.5	12.8	31.0	7,416	<0.001
	Radiottherapy	5.8	8.3	10.0	11.3	64.6	432	<0.001
Northeast	Surgery	63.3	11.4	8.4	5.4	11.5	7,529	<0.001
	Chemotherapy	18.7	26.1	18.8	12.6	23.8	46,548	<0.001
	Radiottherapy	5.0	10.5	12.5	14.2	57.8	3,335	<0.001
Southeast	Surgery	54.8	10.4	10.3	7.8	16.7	22,051	<0.001
	Chemotherapy	15.5	24.3	19.2	13.5	27.5	80,018	<0.001
	Radiottherapy	4.8	9.9	15.0	13.6	56.7	7,214	<0.001
South	Surgery	66.9	10.3	8.5	5.0	9.3	9,103	<0.001
	Chemotherapy	22.0	26.3	17.7	11.3	22.7	37,554	<0.001
	Radiottherapy	6.6	16.1	18.7	14.4	44.1	3,384	<0.001
Central-West	Surgery	59.7	10.6	10.7	7.1	11.9	3,424	<0.001
	Chemotherapy	16.2	24.1	19.5	12.9	27.3	11,374	<0.001
	Radiottherapy	4.8	10.1	11.7	9.9	63.4	971	<0.001

Source: Data available at https://datasus.saude.gov.br/informacoes-de-saude-tabnet/. Access on June 25, 2023.
Note: P-values obtained from the Z-test for two proportions. A Bonferroni adjustment was applied for multiple comparisons (n=60). Statistical significance was considered at p<0.00083.

Chemotherapy showed a distinct pattern, with a higher concentration of patients starting treatment between 31 and 60 days in the Northeast (26.1%) and South (26.3%) regions. In the other macro-regions, the predominant timing was more than 120 days from diagnosis: North (31.0%), Southeast (27.5%), and Central-West (27.3%). Considering the country as a whole, 25.7% of patients began chemotherapy within this same interval.

Analyzing the states, chemotherapy exhibited variation with the intervals of 31 to 60 days and more than 120 days as the most prevalent. In the North Region, Amazonas showed the worst scenario, with 42.7% of patients starting chemotherapy after 120 days, while Pará (28.0%) and Tocantins (27.2%) had higher frequencies within the 31 to 60 days interval. In the Northeast Region, Rio Grande do Norte stood out with 31.4% of patients initiating chemotherapy between 31 and 60 days, while Paraíba had 37.3% starting after 120 days. In the Southeast Region, Espírito Santo showed the best performance (28.5% between 31 and 60 days), while Rio de Janeiro had 34.2% of patients starting chemotherapy after 120 days. In the South Region, Paraná had the best scenario (29.1% between 31 and 60 days), and Santa Catarina the worst (28.2% after 120 days). In the Central-West Region, Mato Grosso do Sul had 36.4% of patients beginning chemotherapy after 120 days.

The radiotherapy modality showed the most concerning scenario, with a predominance of treatment initiation after 120 days from diagnosis in all segments. In Brazil, 54.8% of patients started radiotherapy only after 120 days from diagnosis, with a particularly negative highlight in the North Region, where this percentage reached 64.6%.

For radiotherapy, all states, without exception, showed a predominance of intervals exceeding 120 days, with alarming percentages in most of them. In the North Region, Pará (80.3%) and Roraima (75.0%) had the worst national scores. In the Northeast, Maranhão (69.2%), Paraíba (66.7%), Alagoas (65.1%), and Bahia (66.1%) exhibited percentages above 65% of patients starting radiotherapy after 120 days. In the Southeast, Rio de Janeiro stood out negatively (71.4%). The South showed the best comparative performance for radiotherapy, yet Santa Catarina had 54.9% and Rio Grande do Sul 47.9% of patients starting treatment after 120 days. In the Central-West, Mato Grosso do Sul (70.6%) and Mato Grosso (64.2%) had the worst scores.

For the comparison of the scores, the Z-test for two proportions was used, which demonstrated a statistically significant difference (p<0.001) in all evaluated segments (states, regions, and Brazil), confirming the association between the therapeutic modality and the time to treatment initiation.

Assessment of the temporal trend in breast cancer treatment initiation

In the evaluation of temporal trends for the five studied time intervals, distinct behaviors were observed by region. For Brazil as a whole, the analysis revealed a trend of increase in the frequency of patients in the 61 to 90 days interval (VPA=4.03; p-value=0.027) and a trend of decrease in the interval of more than 120 days (VPA=-5.87; p-value=0.045). The other intervals (up to 30 days, 31–60 days, and 91–120 days) showed stability, with no statistically significant variations observed.

The analysis by region showed heterogeneous behaviors. In the North, a trend of increase was observed in the rates of 61–90 days (VPA=6.57; p-value=0.032) and 91–120 days (VPA=7.48; p-value=0.037), while the rate of up to 30 days showed a significant decrease (VPA=-7.49; p-value=0.045). In the Northeast Region, none of the rates showed a statistically significant trend, indicating stability across all time intervals during the studied period.

The Southeast also did not show significant trends in any of the intervals, although the data suggest a possible reduction in cases with more than 120 days of waiting, but without statistical significance (p-value=0.508).

In the South Region, a significant increasing trend was observed in the rate of patients in the 61–90 days interval (VPA=3.69; p-value=0.021), along with a significant reduction in cases with more than 120 days (VPA=-6.81; p-value=0.017), suggesting a shift of longer waiting cases to intermediate intervals.

In the Central-West Region, a significant increase was observed in the proportion of patients treated within the 61–90 days interval (VPA=3.78; p-value=0.030), while the other intervals remained stable throughout the analyzed period.

These results suggest a general trend of reduction in cases with longer delays (more than 120 days) and an increase in intermediate intervals (61–90 days) in some regions of the country, which may indicate gradual improvement in oncology care. However, this is still insufficient to guarantee compliance with the 60-day deadline established by Law No. 12,732/12 in most cases.

DISCUSSION

When detected and treated early, breast cancer is considered to have a good prognosis. In developed countries, despite high incidence rates, mortality rates are similar or even lower compared to developing countries[13]. Low- and mid-income countries have been experiencing longer wait times for oncology care, primarily due to inequalities in access to screening programs, early diagnosis, and immediate treatment. This results in a higher proportion of breast cancer cases diagnosed at advanced stages and higher mortality rates, even though the incidence is lower[8].

The maximum waiting time established for the start of treatment should represent a balance between the interval a cancer patient can wait without compromising their health and the available financial and technical resources that the country possesses to provide such services. The 30-day period refers to the average waiting time for the initiation of oncological treatment in certain countries, such as Canada. However, in Brazil, these timeframes are currently unfeasible[14].

The discussion about delays in the initiation of breast cancer treatment in Brazil is complex and multifaceted, reflecting a combination of social, economic, and healthcare infrastructure factors[15]. One of the main contributors to the delay in treatment start in Brazil is the inequality in access to healthcare services across macro-regions[6]. The country's vast geographical size, coupled with social inequalities, contributes to significant disparities in access to healthcare services, including early diagnosis, treatment, and follow-up.

Regional disparities and unequal healthcare infrastructure directly impact the availability and quality of services offered to patients across the country. Many patients need to migrate to other locations in search of appropriate healthcare professionals and treatment centers when these resources are not available in their region[16].

In 2010, 40% of all SUS care was concentrated in just seven Brazilian capitals located in the South, Southeast, and Northeast regions. This situation may explain the higher likelihood of treatment delays for residents of the Central-West and North regions, where significant gaps in healthcare service availability exist. On the other hand, in Southeast Brazil, which has a wide availability of chemotherapy and radiotherapy services, the increased likelihood of delays may be attributed to high demand for care[17].

The data from this present study demonstrated that, in Brazil as a whole and in four of the five regions, the majority of patients took more than 120 days to initiate breast cancer treatment. When comparing states by region, it was observed that the North and Southeast regions had the highest number of states with a predominance of treatment initiation after more than 120 days. A study evaluating access to breast cancer treatment involving 155 women in Piauí in 2016 and 2017 found an average time of 112.7 days to start treatment, with 71.6% of patients beginning treatment more than 60 days after diagnosis[18].

A retrospective cohort study analyzing the time interval between diagnosis and the initiation of the first oncological treatment in the Brazilian population with 540,529 patients, between 2000 and 2017, found that 54.9% of the population did not reside in the same municipality as the treatment facility. It also showed that individuals who had to travel to another location had a 16% higher chance of experiencing delays compared to those treated within their own municipality. According to this study, the median interval between diagnosis and the start of the first oncological treatment was 63 days[17]. Another study, which considered hospital admissions and treatments by chemotherapy and radiotherapy for malignant neoplasms of the breast within the scope of SUS between 2014 and 2016, found

that 51.34% of breast cancer patients in Brazil received care outside their municipality of residence. The travel time between the municipality of residence and the municipality of care had medians close to three hours[19].

In Brazil, when it comes specifically to radiotherapy, the disparity regarding access and the availability of this infrastructure is even more pronounced, as some regions still have limited or even no access to radiotherapy treatment. States in the North Region, such as Roraima and Amapá, do not have centers with radiotherapy facilities, forcing patients from these states to travel to others in search of appropriate treatment. Other regions of the country may also face difficulties accessing radiotherapy, especially in rural areas and locations far from major urban centers, since the availability of equipment is directly linked to investments and resources allocated to health in each state[20].

Therapeutic modalities differ in terms of the likelihood of delay in treatment initiation. Patients undergoing chemotherapy and radiotherapy had approximately twice the chance of experiencing delays compared to those who underwent surgical treatment as the first modality. The availability of chemotherapy and radiotherapy services through SUS is concentrated mainly in large cities across the country; as a result, many patients need to travel long distances to access oncology care[21].

A study evaluating the influence of demographic factors on the time to start oncological treatment in Brazil found a higher prevalence of delays in treatment initiation among elderly individuals, those with less advanced cancers, and those who required radiotherapy as the first therapeutic modality. Higher prevalences of timely treatment were observed in referrals for surgery compared to chemotherapy. The lowest prevalences of timely treatment were observed in chemotherapy combined with radiotherapy, and especially in radiotherapy alone. This therapeutic modality, whether in combination with chemotherapy or used independently, showed the lowest prevalence of timely treatments[22]. The findings were similar to those of the present study, in which surgical treatment showed the best results, with all evaluated segments exhibiting a predominance of patients starting treatment within 30 days. On the other hand, radiotherapy demonstrated a pattern of more than 120 days for treatment initiation.

Another factor that contributed to delays in treatment initiation was the level of education. Women with lower educational levels exhibited significant delays in the time between the initial symptoms and diagnosis, as well as between diagnosis and treatment[23]. A study evaluating delays in the treatment of 3,220 women with breast cancer at a reference center in Rio de Janeiro between 2011 and 2013 found that women with higher education levels had a 50% reduced risk of experiencing delays in treatment initiation compared to women with no formal education. The study reported a median time of 98 days for starting treatment, with 22.1% initiating treatment within 60 days, and more than half (55%) starting treatment within 90 days after diagnosis[13]. A retrospective cohort study of 137,593 women diagnosed in 239 hospitals across Brazil between 2000 and 2011 found a 13% increased risk of delay among patients with less than eight years of education compared to those with over eight years of education[24].

Few studies conducted in Brazil have analyzed the characteristics of delays in breast cancer treatment, which hampers the development of initiatives and the implementation of measures to reduce these periods. Delays in the start of treatment are not only a matter of individual health but also a public health issue[18]. The implications include increased mortality and the overload of the healthcare system due to a higher number of cases requiring palliative care. Assessing women's access to breast cancer treatment can provide a foundation for organizing quality services, ensuring that treatment is provided in a timely manner[19]. Thus, studies that evaluate the time interval between diagnosis and the start of treatment are important for guiding corrective measures, as they highlight aspects related to delays and contribute to the planning of health actions.

This study has some limitations that should be considered when interpreting the results. As it involves an analysis of secondary data from health information systems, it was not possible to evaluate relevant individual factors such as disease stage at diagnosis, comorbidities, socioeconomic profile, and educational level of the patients, which may directly influence the time to start treatment. There are also limitations related to data quality, including potential underreporting and missing data, which explains the exclusion of 47,742 cases from the initial analysis. Another limitation involves the inability to distinguish delays related to administrative issues from those resulting from clinical decisions or patient preferences. Additionally, it was not possible to assess the impact of delays on clinical outcomes such as overall survival and disease-free survival. Despite these limitations, the study used a nationally representative sample and included a temporal trend analysis, which strengthens the validity of the findings and their applicability for public policy planning aimed at reducing the identified delays.

During the analyzed period (2017–2022), in Brazil, the highest relative frequency of patients required an interval of more than 120 days to initiate breast cancer treatment. Comparing therapeutic modalities, it was observed that surgery had a predominance of treatment initiation within 30 days across all segments (Brazil and regions). Chemotherapy had a higher distribution of patients in the 31 to 60 days interval in the Northeast and South, and more than 120 days in the other evaluated segments. Radiotherapy was the modality that showed a predominance of treatment initiation after 120 days from diagnosis in all segments.

Finally, it was observed that, for Brazil, the frequency of patients in the 61 to 90 days interval showed an increasing trend, while in the more than 120 days interval, there was a trend of reduction. Although this trend indicates a slight improvement

in oncological care, it still reflects a scenario that is far from fully complying with Law No. 12,732/2012, which sets a maximum deadline of 60 days for the start of treatment.

These results highlight the urgent need for more effective public policies to ensure timely access to oncology treatment, with particular attention to regional disparities and various therapeutic modalities, especially regarding radiotherapy. Strengthening the oncology care network, expanding and decentralizing specialized services, as well as integrating different levels of healthcare, are essential strategies to reduce the delays identified and, consequently, improve the clinical outcomes of breast cancer patients in Brazil.

It is important to note that the high number of category comparisons may increase the risk of Type I error. To mitigate this risk, a Bonferroni adjustment was applied to the post-hoc tests, and statistically significant findings were interpreted with caution. Additionally, we chose to emphasize the descriptive analyses, which provide relevant information without leading to potentially biased conclusions.

CONCLUSIONS

During the analyzed period (2017–2022), in Brazil, the largest proportion of patients started breast cancer treatment after an interval of more than 120 days. Comparing therapeutic modalities, surgery had the shortest waiting time, with a predominance of treatment initiation within 30 days in all evaluated regions. Conversely, chemotherapy showed a higher concentration of patients in the 31 to 60 days interval in the Northeast and South regions, while the other regions had a predominance of treatment initiation after 120 days. Radiotherapy, on the other hand, demonstrated the greatest delay, with most patients starting treatment only after 120 days from diagnosis, regardless of the region analyzed.

Finally, it was observed that, for Brazil as a whole, there was a trend of increasing frequency of patients who started treatment within 61 to 90 days, while the interval of more than 120 days showed a trend of reduction. These findings suggest a slight improvement in oncological care over time, but still highlight significant challenges in fully complying with Law No. 12.732/2012, which establishes a maximum deadline of 60 days for the start of oncological treatment.

The results underscore the need to improve public policies aimed at reducing treatment delays, with particular attention to disparities in treatment modalities and regional inequalities. Measures such as expanding oncology infrastructure, decentralizing specialized services, and strengthening the oncology care network are essential to improving access to treatment and mitigating the negative impacts of delays on survival and the quality of life of breast cancer patients in Brazil.

AUTHORS' CONTRIBUTION

MA: Conceptualization, Funding acquisition, Investigation, Methodology, Project administration, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. SNBF: Data curation, Formal analysis, Investigation, Validation, Visualization, Writing – original draft, Writing – review & editing. AM: Conceptualization, Data curation, Formal analysis, Investigation, Visualization, Writing – original draft, Writing – review & editing. DJPCP: Data curation, Formal analysis, Investigation, Writing – review & editing. RCC: Data curation, Formal analysis, Investigation, Writing – review & editing. LXF: Methodology, Validation, Writing – review & editing. OF: Methodology, Validation, Writing – review & editing. FPC: Investigation, Validation, Writing – review & editing. FZ: Investigation, Validation, Writing – review & editing. FPB: Investigation, Validation, Writing – review & editing. ALF: Investigation, Validation, Writing – review & editing. ECM: Investigation, Validation, Writing – review & editing. RFJ: Investigation, Validation, Writing – review & editing.

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