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Impact Generated by the Pandemic

RESEARCH ARTICLE

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Impact of Covid-19 on Breast Cancer Screening

Kely Paviani Stevanato[1]*, Fernando Castilho Pelloso[2], Deise Helena Pelloso Borghesan[3], Helena Fiats Ribeiro[1], Maria Dalva de Barros Carvalho[1], Sandra Marisa Ribeiro[1]

Abstract

Objective: To assess the influence of the COVID-19 pandemic on breast cancer screening. **Methods:** This was a cross-sectional and retrospective study, which used data extracted from "TABNET" between 2014 to 2020. Statistical analysis was carried out using the ANOVA model. **Result:** In 2019, a total of 3,068,776 mammograms were conducted, which significantly decreased to 1,808,765 in 2020. Since the onset of the pandemic in Brazil in March 2020, there has been a reduction in the number of mammograms performed. Mammography coverage increased from 0.11 to 0.18 between 2014 and 2019 but sharply declined from 0.18 to 0.10 between 2019 and 2020. **Conclusion:** The COVID-19 pandemic has had a detrimental impact on breast cancer screening efforts, especially in detecting the disease in early stages. Health services shifted their focus towards caring for COVID-19 patients, therefore neglecting routine screening programs and interventions. Additionally, the population's fear of contagion contributed to a decrease in demand for screening tests.

Keywords: Breast cancer- Covid-19- Mammography

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Introduction

From 2019 to 2021, the world grappled with one of the most severe pandemics in history, caused by the SARS-CoV-2 virus. Initially identified in Wuhan, China, in 2019, this vírus has been responsible for respiratory system infections [1]. In January 2020, recognizing the global scale of infections and fatalities, the World Health Organization (WHO) declared the pandemic a Public Health Emergency of international concern. By January 30, 2023, the global tally stood at 670 million infections and 6.83 million deaths [1]. In Brazil, as of the same date, there were 36,807,814 confirmed cases of the disease, with 35,890,413 recoveries and 696,892 deaths. The Midwest region recorded the highest mortality rate at 403.9 per 100,000 inhabitants, followed by the Southeast at 379.1 per 100,000 inhabitants and the South at 368.2 per 100,000 inhabitants [2].

Given the current circumstances and the strain on hospital settings, healthcare providers have restructured how they deliver services to the population concerning disease screening and treatment, aiming to minimize the risk of exposure to new infections [3, 4]. In some countries, one strategy employed has been the abrupt termination of routine medical care, including cancer treatment. However, individuals affected by cancer are particularly vulnerable due to compromised immunity stemming from underlying pathophysiological conditions and the immunosuppressive effects of treatment regimens [5].

Mammography screening, crucial for early breast cancer detection, was suspended indefinitely or until the pandemic abated in many countries [6]. Nevertheless, mammographic screening remains pivotal for early breast cancer diagnosis and for reducing morbidity and mortality associated with the disease. Breast cancer continues to be the neoplasm with the highest global morbidity and mortality rates among women, and the COVID-19 pandemic may exacerbate these rates. To comprehend the pandemic's impact on women with breast cancer, targeted studies are imperative to enhance case assessment and prognosis. Implementing public health strategies tailored to this demographic is crucial in addressing this pandemic.

Recent studies have highlighted the COVID-19 pandemic's impact on breast cancer screening and treatment in certain countries, indicating a decline in screening tests, diagnosis, elective surgeries, chemotherapy, and radiotherapy [7, 8]. However, in Brazil, few studies have explored the relationship between the COVID-19 pandemic and breast cancer. Therefore, the objective of this study was to analyze the repercussions of the COVID-19 pandemic on breast cancer screening.

*[1]Department of Health Sciences, State University of Maringá, Maringá, Paraná, Brazil. [2]Department of Medicine, Federal University of Paraná, Curitiba, Paraná, Brazil. [3]Department of Aesthetics and cosmetics, Ingá University Center, Maringá, Paraná, Brazil. *For Correspondence: kelystevanato@gmail.com*

Materials and Methods

This is a cross-sectional, analytical, and retrospective study of the number of mammograms performed on women in Brazil. The health information was collected from the digital platform "TABNET" of the "Department of Informatics of the Unified Health System (DATASUS), Ministry of Health", which has a set of raw health data generated from health information systems such as the Hospital Information System (SIH), Mortality Information System (SIM) and Outpatient Information Systems (SIA).

Data

The variables used were: the total number of mammograms per year, the estimated female population aged 50-69 per year, and the number of new cases of COVID-19 per month. The period of time used to search for data on mammograms and the female population was from 2014 to 2020, while the number of new cases of COVID-19 per month was checked in 2020. Data prior to 2014 was not used to minimize the potential for incomplete reports.

To obtain the variable total number of mammograms per year and age group, we accessed Health Information (TABNET) on epidemiology and morbidities - Cancer Information System - SISCAN (cervical and breast), mammography by place of residence, geographical coverage of Brazil by region, UF (Federative Unit) and municipality. The data on the number of new cases of COVID-19 in Brazil is available on the CORONAVÍRUS BRAZIL page at [2].

Statistical Analysis

The data was tabulated using Microsoft Excel 2019 software, and IBM SPSS Statistics 26 software was used for the statistical analysis. The data normality test was carried out for the models, and the years 2014 and 2019 did not show normality, which is, by analyzing the data sequence, most of them were not close to the average. The ANOVA test was retained in this study by means of the Bonferroni paired comparison analysis since it is a robust test for small departures from normality. The ANOVA analysis of variance is used to check whether there is a significant difference between at least two group means, for which it is considered as a null hypothesis (H0) that there is no difference between the group means and, as an alternative hypothesis (HA) that there is a difference between at least two of the group means.

To calculate the ratio of screening mammograms in women in the target population by the total number of women in the age group, an indicator of coverage and adherence to national technical guidelines, the following calculation was used:

$$\frac{\text{Number of screening mammograms in the 50-69 age group living in a given place and period}}{\text{Half of the female population in this age group in the respective place and period}}$$

Ethics

The study followed all the ethical rules in accordance with Resolution 466/CNS 2012 and was approved by the Human Research Ethics Committee of the Centro Universitário Ingá/Uningá under opinion nº 5.283.015 in 2022. Due to the impossibility of obtaining the free and informed consent form (FICF), as this is secondary data from the public domain, a request to waive the FICF was requested and approved, with the commitment to comply with all the guidelines and regulatory standards described in Resolution 466/2012 - CNS/MS.

Results

The number of mammograms carried out in Brazil has increased over the years. In 2014, 1,800,997 women had mammograms; in 2015, 2,052,083, followed by 2,208,323 in 2016, 2,641,307 in 2017, 2,812,158 in 2018, and 3,068,776 mammograms in 2019. By contrast, in 2020, there was a significant drop in the number of mammograms, which fell to 1,808,765 mammograms for the whole year. When comparing the average number of mammograms performed per year over this period, the decline in 2020 is clear (Figure 1).

The mean number of mammograms performed in Brazil went from 150.083 (σ 58.777, 95%CI 112.865 -

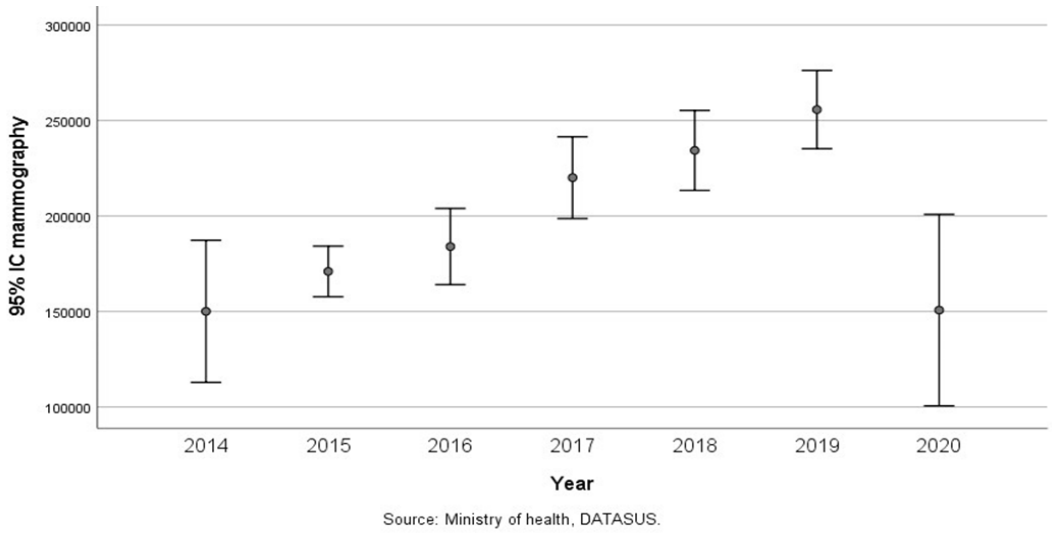

Figure 1. Mean Number of Mammograms Performed between 2014 and 2020, Brazil.

Table 1. Mean, Standard Deviation and Confidence Interval for the Number of Mammograms Performed between 2014 and 2020, Brazil.

			Confidence interval 95%	
Year	Mean	Standard Deviation	Lower limit	Upper limit
2014	150,083	58,777	112,865	187,301
2015	171,007	20,856	157,756	184,258
2016	184,027	31,387	164,084	203,970
2017	220,109	33,727	198,680	241,538
2018	234,347	32,969	213,399	255,294
2019	255,731	32,221	235,259	276,204
2020	150,730	78,899	100,600	200,861

Source: Ministry of Health, DATASUS.

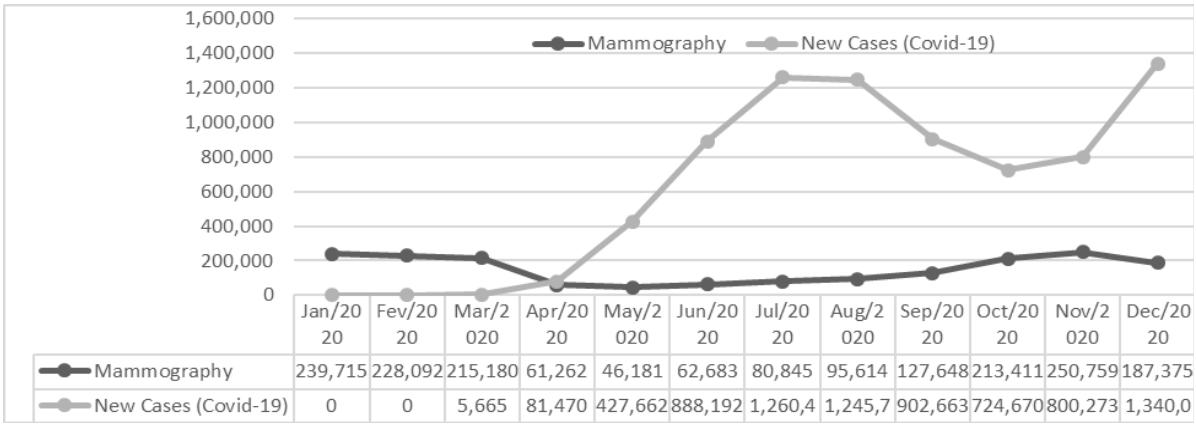

Figure 2. Comparison between the Total Number of Mammograms Performed on Brazilian Women and New Cases of Covid-19 Month by Month, Brazil, 2020. Source: Ministry of Health, Brazil.

187.301) in 2014 to 255.731 (σ 32.221, 95%CI 235.259 - 276.204) in 2019. In 2020, the mean decreased to 150.730 (σ 78.899, 95%CI 100.600 - 200.861) (Table 1).

The results highlight that for the years 2014 and 2019, the mean differences do not follow a normal distribution. Additionally, for the Years 2017, 2018, and 2019, the mean differences are statistically significant (indicated by p-values < 0.05), showing a significant variation between these years. On the other hand, the years 2016 and 2020 do not exhibit statistically significant differences compared to adjacent years (Table 2).

Analyzing the number of mammograms carried out in 2020 and comparing it with the data on the COVID-19 disease, there has been a reduction since January 2020 in the number of mammograms carried out, although the average was maintained in the first three months of the year. From March onwards, the drop was sharp, reaching 70% less than the number of exams between March and April, with May having the lowest number of exams at 46,181 mammograms. In the same period, there was an exponential increase in the number of new COVID-19 cases, which in May was 75 times higher than in March.

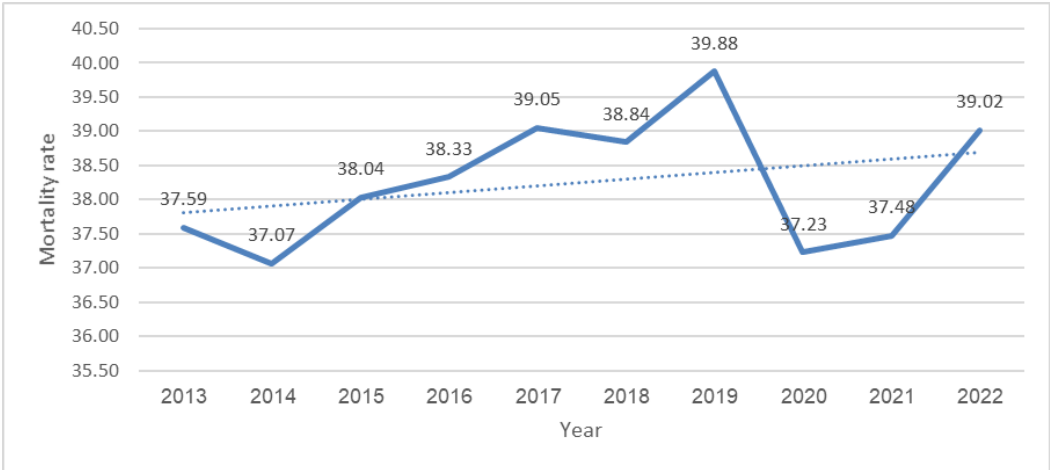

Figure 3. Breast Cancer Mortality Rate among Women Aged 50 to 69 Years, Brazil, 2023.

Table 2. Paired Comparison of Means between 2014 and 2020, Brazil.

Year[a]	Years	Mean difference	Standard error	P-value[a]	95% Confidence interval for the difference[a]
2014	2015	-20,924	13,635	1,000	(-74,411 – 32,563)
	2016	-33,944	11,301	0,252	(-78,278 – 10,391)
	2017	-70,026	10,206	0,001*	(-110,065 – -29,987)
	2018	-84,263	14,043	0,002*	(-139,354 – -29,173)
	2019	-105,648	14,050	0,000*	(-160,764 – -50,533)
	2020	-,647	32,888	1,000	(-129,663 – 128,368)
2015	2014	20,924	13,635	1,000	(-32,563 – 74,411)
	2016	-13,020	7,372	1,000	(-41,939 – 15,899)
	2017	-49,102	7,721	0,001*	(-79,392 – -18,812)
	2018	-63,340	8,251	0,000*	(-95,708 – -30,971)
	2019	-84,724	9,075	0,000*	(-120,325 – -49,124)
	2020	20,277	24,683	1,000	(-76,552 – 117,105)
2016	2014	33,944	11,301	0,252	(-10,391 – 78,278)
	2015	13,020	7,372	1,000	(-15,899 – 41,939)
	2017	-36,082	3,308	0,000*	(-49,060 – -23,104)
	2018	-50,320	4,774	0,000*	(-69,047 – -31,593)
	2019	-71,704	5,326	0,000*	(-92,597 – -50,812)
	2020	33,296	22,515	1,000	(-55,029 – 121,622)
2017	2014	70,026	10,206	0,001*	(29,987 – 110,065
	2015	49,102	7,721	0,001*	(18,812 – 79,392)
	2016	36,082	3,308	0,000*	(23,104 – 49,060)
	2018	-14,238	5,335	0,459	(-35,166 – 6,691)
	2019	-35,622	6,490	0,004*	(-61,082 – -10,163)
	2020	69,378	23,815	0,296	(-24,045 – 162,802)
2018	2014	84,263	14,043	0,002*	(29,173 – 139,354)
	2015	63,340	8,251	0,000*	(30,971 – 95,708)
	2016	50,320	4,774	0,000*	(31,593 – 69,047)
	2017	14,238	5,335	0,459	(-6,691 – 35,166)
	2019	-21,385	4,501	0,013*	(-39,043 – -3,726)
	2020	83,616	20,665	0,040*	(2,548 – 164,684)
2019	2014	105,648	14,050	0,000*	(50,533 – 160,764)
	2015	84,724	9,075	0,000*	(49,124 – 120,325)
	2016	71,704	5,326	0,000*	(50,812 – 92,597)
	2017	35,622	6,490	0,004*	(10,163 – 61,082)
	2018	21,385	4,501	0,013*	(3,726 – 39,043)
	2020	105,001	20,557	0,007*	(24,356 – 185,646)
2020	2014	,647	32,888	1,000	(-128,368 – 129,663)
	2015	-20,276	24,683	1,000	(-117,105 – 76, 552)
	2016	-33,296	22,515	1,000	(-121,622 – 55,029)
	2017	-69,378	23,815	0,296	(-162,802 – 24,045)
	2018	-83,616	20,665	0,040*	(-164,684 – -2,548)
	2019	-105,001	20,557	0,007*	(185,646 – -24,356)

Based on the estimated marginal means; *, The average difference is significant at 0,05; [a], Adjusted for several comparisons: Bonferroni; Source, Ministry of Health, DATASUS

The number of mammograms remained below average until September, when the total number of mammograms in the country began to normalize, reaching the expected average for breast cancer screening in October and November. The same cannot be said for new cases of COVID-19, which increased until August, decreased in September and October, and increased again in November and December (Figure 2).

The coverage of the number of mammograms can be seen in Table 3, which shows an increase in the ratio between 2014 and 2019, from 0.11 to 0.18, and a sharp reduction between 2019 and 2020, from 0.18 to 0.10.

Table 3. Number of Mammograms, Population Estimate and Mammography Ration for Women Aged 50 to 69 in the Same Period, Brazil, 2020

Year	Mammography[a]	Population [b]	Rate[c]
2014	1.030.044	18.304.253	0.11
2015	1.174.308	18.881.742	0.12
2016	1.319.280	19.448.090	0.14
2017	1.671.236	20.002.737	0.17
2018	1.764.780	20.543.311	0.17
2019	1.942.858	21.067.160	0.18
2020	1.128.215	21.572.285s	0.1

[a], Total number of mammograms; [b], Estimate of the female population aged 50 to 59 according to the Brazilian Institute of Geography and Statistics (IBGE); [c], Ratio of the number of screening mammograms in the 50-69 age group living in the same place and period to half the female population in the same age group, place and period. Source, Ministry of Health, DATASUS, TABNET.

The breast cancer mortality rate has been increasing over the years in Brazil, maintaining an upward trend, with the exception of the years 2020 and 2021, which saw a decline in the mortality rate (Figure 3).

Discussion

The COVID-19 pandemic had a significant impact on public health worldwide, and breast cancer was no exception. The disruption of health services, postponement of screening tests, and reorganization of healthcare systems in order to deal with the pandemic all had an adverse effect on early detection and treatment of breast cancer. Recent studies have shown this impact on the decrease in screening tests, reorganization, and clinical management of patients suffering from breast cancer around the world [8, 9].

This is one of the few Brazilian studies that portrays the pandemic scenario in breast cancer screening. Despite the high mortality rate due to complications from COVID, breast cancer remains the biggest cause of death in women. In 2020, it was responsible for the deaths of 17,825 women, corresponding to 2.61% of all deaths from other types of cancer, with its incidence being 73,610 new cases for the year 2023 [10]. This situation tends to worsen with the reduction of early detection actions due to social isolation, distancing, and lack of services during the pandemic. One study estimates an increase of 7.9 to 9.6% in the number of deaths due to breast cancer up to 5 years after diagnosis in women in the UK [11]. The estimated increase in the number of deaths from breast cancer was also reported in another study [12]. According to a report by the IQVIA Institute for Human Data Science, which analyzes cancer trends in the United States, it is suggested that in the 3-month period (early March to early June 2020) in which there were recommendations to postpone breast cancer screening due to the COVID-19 pandemic, there may have been 36,000 missed or delayed diagnosis [13]. This loss of diagnosis has also been reported as an impact generated by the COVID-19 pandemic in other countries [14, 15].

In Brazil, as well as in many other countries, the pandemic overwhelmed healthcare systems, leading to the cancellation of medical appointments, routine exams, and non-urgent procedures. This resulted in delays in detecting new cases of breast cancer and the continuity of treatment for already diagnosed patients. The reduced access to healthcare also negatively impacted the quality of life and prognosis of people with breast cancer. The backlog of "delayed" exams is a prospect that is expected to have a long-term impact in other countries [16]. Related to this, a decrease in the diagnosis, referral for the suspicion, and initial treatment of breast cancer is also being evidenced in some studies [17, 18]. Given this context, we see the importance of health teams rescuing these women and reorganizing the flow of care in health services in order to meet the pent-up demand for mammograms, which is used as a strategy for early diagnosis of breast cancer [19]. Early detection of breast cancer is essential for controlling the disease, as late diagnosis is responsible for the high morbidity and mortality rates in Brazil [20].

In this scenario, the work of the public nursing category is essential. Using their duties in primary health care (PHC), they are responsible for providing comprehensive care to individuals and their families at all stages of life, as well as promoting women's autonomy regarding their health and body [21]. It is through either opportunistic or organized screening that nurses can act in the early detection of breast cancer in PHC, as well as providing information and guidance to women on the benefits of self-care and a life of healthy habits [22].

Behavioral change, combined with information, is important if women are to be more engaged and encouraged to take up mammography screening. Nurses need to take advantage of all the opportunities available to them in Basic Health Units (BHU), especially in nursing consultations, by carrying out clinical breast examinations, requesting screening mammograms, providing guidance on the disease, signs and symptoms and actively seeking out women in the priority age group for screening [23]. It is also up to these professionals to plan and implement health education actions, enhancing their role as agents of change and playing their part in health promotion and disease prevention actions. Professionals need to adopt guidelines for raising women's awareness of breast cancer prevention.

This study clearly shows the reduction in the number of mammograms carried out in Brazil in 2020 compared to previous years. In the initial months of social distancing (April and May), there was a significant decrease in mammograms. During this period, there was greater social distancing due to the diagnosis of the first cases of COVID-19 in the country. There was also a rapid spread of the disease, causing an exponential increase in the number of new cases, and a lack of knowledge given it was something new for the scientific community, with the need to reorganize services in order to better deal with it. This decline in the number of mammograms has been reported in other studies [23].

The dramatic reduction in breast cancer screening has created considerable challenges for the early detection of the disease, showing a greater risk of diagnosis occurring at more advanced stages, as well as an increase in morbidity and mortality from this disease [24]. The current

scenario in several countries demonstrates a redirection of resources (humans, equipment, and supplies) to tackle the COVID-19 pandemic. As a result, health services need to be reorganized to ensure the continuity of breast cancer screening. Countries in Europe and the United Kingdom that use organized national screening programs for breast cancer are making it possible to systematically offer breast cancer screening during this pandemic period, thus enabling a reduction in mortality from this disease [25].

Although this study points to an increase in the number of mammograms from June 2020 onwards, it is still considered a low number compared to the same period from 2014 to 2019. There was a significant increase in the month of October, which may be related to the International Pink October Movement, created in the 1990s by the Susan G. Komen Cure Foundation, which aims to raise awareness among women about breast cancer control. During this period, health systems have made mammograms more available and have organized themselves to increase the number of services for this specific population. A study shows a 200% increase in the total number of mammograms carried out in 2017, when Pink October actions were intensified, compared to 2015 and 2016, thus positively impacting breast cancer screening. October alone accounted for 18% of the total number of mammograms carried out in the period [26].

When comparing the average number of mammograms since 2014, an analysis made available with public data by the Department of Informatics of the Brazilian Unified Health System (DATASUS), a gradual increase was observed from 2014 to 2019. Advances in the prevention and early detection of breast cancer in Brazil have occurred through the implementation of public policies in recent years, greater financial incentives for funding as well as investment aimed at screening, early detection, treatment, and rehabilitation of women with breast cancer [26].

On the other hand, in 2020, due to the COVID-19 pandemic, the average number of mammograms carried out by Brazilian women fell dramatically compared to 2019, meaning that the achievement of increasing breast cancer screening was paralyzed by a contagious disease that has hit the whole world, which is currently reflected in the demand for health services and the reduction in the number of early diagnosis of this disease. A study shows that most countries postponed or canceled preventive care, such as cancer screening programs and immunizations, during the COVID-19 pandemic [27]. A similar result was found in a survey carried out by the World Health Organization in 163 countries around the world, which found that 46% of countries canceled disease screening programs due to difficulty in accessing health facilities due to the lockdown strategy. In Brazil, a survey of women showed that 62% of them were waiting for the pandemic to end before resuming their medical appointments and routine breast cancer screenings [28].

These data portray the COVID-19 crisis in healthcare systems, given the focus of healthcare leaders was to rethink the organization of services after the pandemic, characterized by experts as COVID's third wave in Brazil. Taking into account the context that the third wave could interrupt the care of acute non-COVID-19 cases and chronic conditions with an increase in queues and an impact on morbidity and mortality in general [29]. One study showed that COVID-19 has serious implications for the diagnosis and treatment of oncological diseases. It points out that delaying the diagnosis of cancer leads to an increase in mortality, complications, and an average loss of ten years of life for those affected [30]. During this period, hospital care tends to suffer a rapid increase in post-COVID admissions. In view of this, there is a need for effective planning for the organization of services and postponed or suspended care during the pandemic period, as well as creating strategies for the post-pandemic period [29].

The mortality rate from breast cancer in women aged 50 to 69 in Brazil assessed in this study showed a gradual increase over the years, with the exception of the years 2020 and 2021, when there was a decline in the rate possibly related to the pandemic, in which COVID-19 deaths may have contributed as an additional cause. An epidemiological study conducted by the National Cancer Institute (INCA) showed a reduction in the mortality rate from breast cancer in the general population [31].

The results of this study point to a negative impact on breast cancer screening in Brazil during the COVID-19 pandemic, in which there was a significant reduction in the number of tests carried out, which could interfere in the future with both breast cancer prognosis and the accumulation of overdue tests in women. Based on this result, there is a need to prioritize services for women at greater risk of developing this disease, linked to a political will to design strategies that seek to standardize breast cancer screening, treatment services, and health professionals designated to carry them out, according to their attributions. It is also imperative to design active search strategies for overdue mammograms in order to meet the accumulated demand generated during this pandemic period.

The limitation of this study is the period of the data analyzed, as it might still be too early to assess whether there has been an impact on the incidence and mortality rate of breast cancer due to the reduction in screening mammograms.

Author Contribution Statement

All authors participated in the following stages of preparing the manuscript: Conception and design of the study, literature review, data acquisition, data analysis, and interpretation, preparation of the manuscript, intellectual review of the manuscript, final approval of the version submitted to the journal.

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Data Availability

https://datasus.saude.gov.br/informacoes-de-saude-tabnet/

Ethical Declaration

approved by the Human Research Ethics Committee of the Centro Universitário Ingá/Uningá under opinion No. 5.283.015, in 2022.

Conflict of Interest

The researchers state that there was no conflict of interest.

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