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Extent of breast cancer screening and diagnosis in the state of Piauí and the impact of the COVID-19 pandemic

Amplitude do rastreio e diagnóstico do câncer de mama no estado do Piauí e o impacto da pandemia da COVID-19

Pedro Henrique dos Santos Silva*

Franciele Basso Fernandes Silva

Universidade Federal do Delta do Parnaíba (UFDPar), Parnaíba, PI, Brasil

* **E-mail:** ph_beta@ufpi.edu.br

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ABSTRACT

Introduction: The COVID-19 pandemic has brought about a new epidemiological reality worldwide that is responsible for altering the entire dynamics of addressing health issues globally. Cancer management policies were directly impacted, potentially leading to a decline in early case detection and a consequent increase in morbidity and mortality among patients with cancer. **Objective:** To analyze the impacts of the pandemic on breast cancer screening measures in the state of Piauí. **Method:** This epidemiological study used secondary data provided by the Department of Health Information of the Brazilian Unified Health System regarding the performance of mammograms and breast cancer diagnoses in the state of Piauí between 2017 and 2021. **Results:** Between 2017 and 2019, an average of 39,165 mammograms were performed annually, compared with an average of 22,367 exams in each year between 2020 and 2021. The data presented in this study indicate a significant decrease in the number of exams performed, associated with a decline in the absolute number of diagnoses, as well as delayed diagnoses. **Conclusions:** The scenario described in this study suggests the possibility of developing an epidemiological emergency related to breast cancer, both due to the structural incapacity of the state of Piauí to provide adequate assistance to patients and the increasing observation of more advanced cases. Therefore, we highlight the need for intensified efforts to strengthen breast cancer management and early diagnosis strategies in the state of Piauí.

KEYWORDS: Breast Neoplasms; Mammography; Mass Screening; COVID-19

RESUMO

Introdução: A pandemia da COVID-19 trouxe para todo o mundo uma nova realidade epidemiológica que foi responsável por modificar toda a dinâmica de enfrentamento aos problemas de saúde no mundo. As políticas de enfrentamento ao câncer foram diretamente prejudicadas, levando a uma possível queda na identificação precoce de casos e ao futuro aumento da morbimortalidade para os pacientes oncológicos. **Objetivo:** Analisar os impactos da pandemia sobre as medidas de rastreio do câncer de mama no estado do Piauí. **Método:** Trata-se de um estudo epidemiológico com dados secundários disponibilizados pelo Departamento de Informática do Sistema Único de Saúde sobre a realização de mamografias e diagnósticos de câncer de mama no estado do Piauí entre 2017 e 2021. **Resultados:** Entre os anos de 2017 e 2019, foram realizadas em média 39.165 mamografias por ano, contra uma média de 22.367 exames em cada ano entre 2020 e 2021. Os dados trazidos apontam uma significativa queda no quantitativo de exames realizados, associados a uma queda também no número absoluto de diagnósticos realizados, bem como a realização de diagnósticos mais tardios. **Conclusões:** O cenário descrito sugere a possibilidade de desenvolvimento de uma emergência epidemiológica relacionada ao câncer de mama, tanto pela incapacidade estrutural do estado do Piauí de fornecer assistência adequada às pacientes, quanto pela observação cada vez maior de casos mais avançados. Demonstramos, portanto, que é necessária a intensificação de esforços no sentido de fortalecer as estratégias de enfrentamento e o diagnóstico precoce do câncer de mama no estado do Piauí.

PALAVRAS-CHAVE: Neoplasias da Mama; Mamografia; Programas de Rastreamento; COVID-19

INTRODUCTION

The advent of the COVID-19 pandemic has led to a worldwide need to change people's habits and lifestyles[1]. The response to the disease, however, was not homogeneous across countries and, given the lack of an effective treatment and the absence of a widely available vaccine for a long period[2], there was a consensus that the institution of measures to prevent contagion, such as wearing masks and practicing social distancing, was the most effective measure to contain the spread of the virus.[3]

The Brazilian health system, despite its wide coverage, has shortcomings in several aspects, and the rapid spread of the pandemic has seriously exposed these problems. The supply of health services in Brazil is unable to provide adequate care to a considerable part of the population, due to shortcomings in its structure, such as an insufficient number or poor distribution of hospital beds, an insufficient supply of medicines and equipment, and low pay and a lack of professionals.[4]

In addition, the denialist stance adopted by the federal government at the time contributed to the spread of the virus reaching levels that were unique in the world and increased all the harmful effects of the pandemic in Brazil. In terms of cancer care, there has been a significant drop in the number of cancer diagnoses. This is already proving to be a major problem in the short term, since late diagnosis of cancer is directly associated with reduced survival rates and patients' quality of life, due to the progression to more aggressive neoplasms.[5]

In Brazil, breast cancer, excluding non-melanoma skin cancers, is the most common malignant neoplasm in the female population, with more than 73,610 thousand cases expected between 2023 and 2025[6]. Breast cancer screening has the capacity to reduce mortality by up to 40% for women at average risk and aged between 40 and 74, and there is a recommendation for mammography every one to two years for women in this group.[7]

Cancer screening consists of testing asymptomatic individuals for screening tests with the aim of identifying neoplastic lesions or cancer precursors at less advanced stages, thus modifying the prognosis of these patients[8]. Breast cancer screening is part of the Breast Cancer Early Detection Program and is based on bilateral mammography due to its impact on reducing mortality, targeting women aged 40 and over at high risk (individualized periodicity) and women aged 50 to 69 (every two years).[9]

Breast cancer screening strategies have been severely hampered by various factors related to the COVID-19 pandemic, especially in states with fewer financial and technological resources such as Piauí. Until now, the state of Piauí has had no study analyzing the reality of breast cancer screening and the impacts of the pandemic in the current scenario, which therefore justifies this study. Therefore, the aim of this study was to analyze the impacts of the COVID-19 pandemic on mammograms and breast cancer diagnosis in the state of Piauí, from 2017 to 2021.

METHOD

Study design and data source

This is an epidemiological, retrospective, and analytical study with a quantitative approach that used data from the Department of Information Technology of the Unified Health System (DATASUS), through the database of the Outpatient Information System of the Unified Health System (SIA/SUS) and PAINEL-Oncologia. In addition, data on population estimates for the state of Piauí during the period covered by the study, prepared by the Brazilian Ministry of Health, was also collected from DATASUS. The data was collected in May 2023.

Population and variables

This study gathered and analyzed data on the authorization and performance of bilateral screening mammograms, corresponding to SUS Procedure Code 02.04.03.018-8, carried out on individuals living in the state of Piauí between 2017 and 2021, whose data was recorded in the SIA/SUS. Pre-pandemic years were considered to be from 2017 to 2019 and during the pandemic, from 2020 to 2021, all with data including periods between January and December. In order to extract the data and improve reliability, the current recommendations for defining the target population for screening mammograms were taken into account. In the PAINEL-Oncologia, data was extracted on breast cancer diagnoses in the same period, classified according to the International Classification of Diseases (ICD-10) by the code C50.

All data relating to bilateral screening mammograms authorized and carried out within the defined period in the state of Piauí was aggregated. For the research, the following were defined as filter variables: procedure performed, year of procedure, age group of patients, and gender of patients. In the age and gender cut-off, we considered women at usual risk aged between 50 and 69, the target population for breast cancer screening according to the Ministry of Health[10]. For the data on breast cancer diagnoses, the following variables were defined: federative unit (FU) of residence, detailed diagnosis, age group, and staging. The breast cancer staging provided by the PAINEL-Oncologia System is based on the protocol of the American Board of Cancer Staging.

Demographics and territorial divisions

The state of Piauí is one of the nine states that make up the Northeast Region of Brazil. With an estimated population of 3,289,290 people in 2021 and an average *per capita* income of R$ 1,110, the state ranks among the states with the smallest population and lowest average earnings in the country. The

territory of the state of Piauí is subdivided into four health macro-regions: the Semi-arid, located in the southeast; Cerrado, in the south; Meio-Norte, in the north-central region of the state; and Litoral, further north.

Processing the results and analyzing the data

After collecting the data on the selected platforms, all the results were tabulated using *Microsoft Excel 2016*. The data was organized in the same program to create the tables included in this article, as well as calculating averages and comparative data analysis.

Data from the Ministry of Health's population estimates by age group were cross-referenced with annual data on mammograms in the period analyzed to determine the average coverage percentage of the target population of screening policies in the pre-pandemic period, for later comparison with the results achieved during the pandemic. The data obtained from these analyses was used to define the variables included in this study:

a. Actual number: the number of patients who make up the population of screening age for breast cancer according to the Ministry of Health who have actually had screening mammograms;

b. Percentage reached: percentage of the target population that was reached by breast cancer screening measures in the defined period.

Ethical aspects

Since this study used a public domain database, whose information makes it impossible to identify individual patients, it did not require approval by a Research Ethics Committee, as required by Resolution No. 510 of April 7, 2016, of the National Health Council (CNS).

RESULTS

A total of 162,229 mammograms were carried out in the state of Piauí during the analysis period, 72.4% in the years preceding the COVID-19 pandemic and 27.6% during the pandemic. Between 2017 and 2019, an average of 39,165 mammograms were performed per year, compared to an average of 22,367 exams each year between 2020 and 2021, representing a significant drop. Table 1 shows all the data regarding the actual number of mammograms performed and the percentage achieved according to the population estimated by DATASUS for the reference year, by age group. Considering the age brackets, there was a homogeneous drop in the reach of screening policies in all the brackets included in this study, with the greatest impact on patients aged between 65 and 69, who showed an average percentage drop from 10.45% to 5.35%.

When evaluating the geographical distribution of mammograms carried out on the target population in the state of Piauí during the period analyzed, it can be seen that the Litoral macro-region, located in the north of the state, had a high and constant percentage of coverage for breast cancer screening, although there was a significant drop in 2020, the first year of the COVID-19 pandemic. In contrast, the Semi-arid macro-region, in 2020 and 2021, the years of the pandemic, had the worst coverage rates in the state, reaching only a minimal portion of the population targeted by screening policies. Table 2 details the data on the geographical distribution of screening mammograms.

The Figure shows the curve of breast cancer diagnoses in the state of Piauí during the period defined in this study for the entire female population. The graph shows a clear and significant drop in the number of diagnoses in 2020, which corresponds to the start of the COVID-19 pandemic. This drop interrupted an upward trend that had been underway in previous years. On the other hand, the number of diagnoses rose again in 2021.

Table 1. Distribution of bilateral screening mammograms in the state of Piauí in total quantity and percentage of the population by age group according to estimates by the Brazilian Institute of Geography and Statistics (IBGE), 2017-2021.

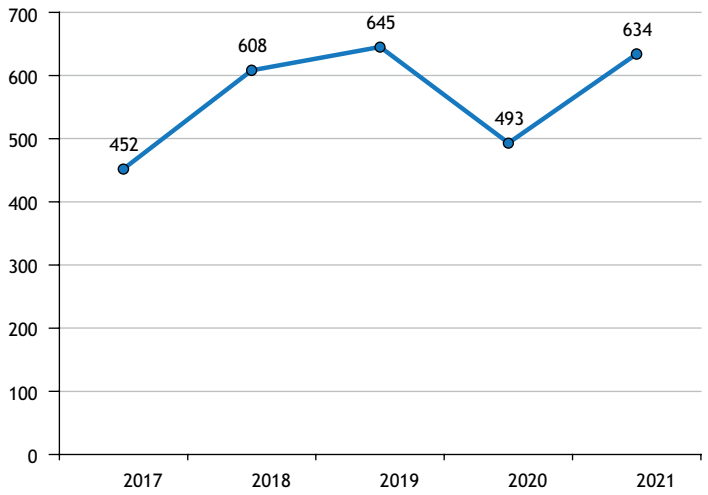
Year		Age group				Total
		50 to 54 years old	55 to 59 years old	60 to 64 years	65 to 69 years	
2017	QR (n)	15,660	14,133	9,329	6,512	45,634
	PA (%)	17.22	18.03	14.23	12.44	15.89
2018	QR (n)	12,210	9,817	7,317	4,898	34,242
	PA (%)	13.20	12.19	10.90	9.04	11.63
2019	QR (n)	12,864	11,143	8,084	5,528	37,619
	PA (%)	13.70	13.49	11.75	9.88	12.49
2020	QR (n)	5,592	4,681	3,453	2,188	15,914
	PA (%)	5.88	5.54	4.89	3.80	5.17
2021	QR (n)	9,912	8,517	6,296	4,095	28,820
	PA (%)	10.31	9.87	8.68	6.91	9.17

Source: TABNET DATASUS and IBGE.
QR: Actual quantity; PA: Percentage reached of the target population according to the population estimated by the IBGE.

Table 2. Distribution of bilateral screening mammograms by Health Macro-Regions in the state of Piauí in total quantity and percentage of the population according to estimates by the Brazilian Institute of Geography and Statistics (IBGE), 2017-2021.

Health macro-region		Year				
		2017	2018	2019	2020	2021
Semi-arid	QR (n)	7,179	5,077	4,726	2,293	1,338
	PA (%)	13.32	9.19	8.35	3.96	2.26
Middle North	QR (n)	16,775	17,636	14,764	6,593	12,781
	PA (%)	13.01	13.31	10.87	4.74	8.99
Coast	QR (n)	15,263	6,862	13,598	3,341	8,322
	PA (%)	27.30	12.01	23.30	5.61	13.72
Cerrado	QR (n)	6,417	4,667	4,531	3,687	6,379
	PA (%)	13.24	9.44	8.99	7.18	12.21

Source: TABNET DATASUS and IBGE.
QR: Actual quantity; PA: Percentage reached of the target population according to the population estimated by the IBGE.



Source: TABNET DATASUS.

Figure. Breast cancer diagnoses in the state of Piauí in women aged within the target age group for screening between 2017 and 2021.

Table 3. Distribution of breast cancer diagnoses in the state of Piauí, in total quantity, by age group and staging at the time of diagnosis, 2017-2021.

Variable	Year of diagnosis				
	2017	2018	2019	2020	2021
Age group					
< 50 years	159	213	232	194	216
50-69 years	236	301	301	235	318
> 69 years	57	94	112	64	100
Staging					
0	10	11	6	7	13
1	69	76	82	52	86
2	170	199	240	145	144
3	123	181	176	163	227
4	35	42	34	37	46
Not applicable	35	37	43	44	35
Ignored	10	62	64	45	83

Source: TABNET DATASUS.

Within the period evaluated, the year with the highest number of diagnoses was 2019, with 645 new cases identified. 2017, on the other hand, was the year with the lowest absolute value. When the averages and trends were analyzed, there was a 23.5% drop from 2019 to 2020.

Table 3 details the data on breast cancer diagnoses according to staging at the time of diagnosis and their distribution by age group. The 50-69 age group, which corresponds to the target group for screening policies, accumulated the highest number of diagnoses, with an average of 279 new cases before the pandemic and 276 new cases during the pandemic. The high average during the pandemic period was boosted by the number observed in 2021, which was the year with the highest number of cases identified.

About the staging of the new cases of breast cancer diagnosed, there has been a significant increase in the number of diagnoses with stages 3 and 4, a classification that represents more advanced cases with a worse prognosis compared to current

therapeutic possibilities. The data on this variable shows that, in the years prior to the COVID-19 pandemic, the distribution of breast cancer diagnoses by stage followed a trend of staging predominance of stage 2. In 2020, the first year of the pandemic, there was a significant drop in diagnoses in this group, with a consequent and significant increase in stage 3. In 2021 alone, 227 diagnoses of stage 3 breast cancer were made, representing an increase of 41.6% in relation to the average number of diagnoses made in the pre-pandemic years. There was no associated drop in the groups that make up the other stages.

DISCUSSION

The data presented in this study indicate a significant negative impact of the COVID-19 pandemic on the measures employed in breast cancer screening in the state of Piauí. This scenario is represented primarily by the drop in the absolute number of mammograms in the population targeted for screening. Although the year 2021 will see a return to standards close to those of the past, the data on the severity of the cases diagnosed and the still low percentage of the population targeted for screening demonstrate the seriousness of the local epidemiological scenario. North American studies have shown a similar context, describing falls in all indicators related to breast cancer diagnosis and screening, with falls in the absolute number of mammograms exceeding 90%.[11,12]

In addition, the data presented also shows a significant drop in the absolute number of diagnoses and an interruption in the trend shown in the years prior to the pandemic. This drop, however, is not due to an objective fall in the population becoming ill, but rather to a reduction in the health system's ability to identify new cases, a scenario that can be explained by various factors related to the development of the COVID-19 pandemic. This same pattern was observed in national[13] and international[14] studies, corroborating the findings described in this study.

The fight against breast cancer in the state of Piauí has historically shown much lower results than those considered ideal, a pattern common to the vast majority of states in Brazil, as evidenced by studies prior to the pandemic[15,16,17]. The World Health Organization (WHO) states that cancer screening programs should aim to reach a percentage of at least 70% of the population defined as the target of the policies, in order to ensure a real impact on the health-disease process and the demand on health systems[18]. The state of Piauí, however, as demonstrated by the data shown in this study, already had much lower than ideal results even in periods prior to the COVID-19 pandemic, a reality that was impacted even more negatively by the epidemiological pressure imposed during this period.

The population's access to cancer screening measures is directly related to sociodemographic and economic factors inherent to each region. Health inequalities are capable of negatively influencing the care process, consequently increasing costs and the demand for spaces in more complex services[19]. In this context, Piauí stands out negatively as one of the poorest states in the Federation, with worrying indicators in relation to access to health, both public and private. Associated with this, the low income and low level of education of a significant part of the population add to the structural flaws, creating a chronic effect of under-assistance in all areas of health care, especially due to the lack of access to information about self-care needs. [20]

This context also corroborates the findings of this study regarding the distribution of impacts on screening seen through the lens of the health macro-regions that make up the state of Piauí. As Furlam et al. point out[21], the lower rate of development in infrastructure and technology found in the state of Piauí and other states in the North and Northeast regions, when compared especially to states in the South and Southeast regions, has hindered adherence to pandemic control mechanisms, further increasing the impact of COVID-19. Within the state itself, the discrepancies between the macro-regions are evident, which we hypothesize as the main cause of the greater impact on the results of the screening policies described in the Cerrado and Semi-arid macro-regions.

The impacts of the pandemic on breast cancer screening policies have been the result of multiple factors, including the very measures that have been necessary to control the transmission of COVID-19. The completely new environment created by the pandemic was responsible for the drop in the demand for non-emergency care, both due to the overload of health services and professionals and the imposition of local measures to restrict the movement of people. Ribeiro et al.[5] proposed that the drop in cancer-related indicators in women during the pandemic may have been due to women choosing to delay seeking care, the overload of outpatient services, the suspension of elective procedures, and the reduction in screening measures by the services themselves. All these aspects may also explain the data observed in this study.

Ayala et al.[20], in a national study investigating the 10-year survival of women diagnosed with breast cancer in a SUS service, found that women with stages 1 and 2 had significantly higher survival rates than those with stages 3 and 4 at the time of diagnosis. National and international studies carried out with the aim of analyzing the relationship between breast cancer staging at the time of diagnosis and patient survival also found similar results, demonstrating that delay in diagnosis, which is related to disease progression, promotes worse treatment expectations.[25,26,27]

The data shown in this study point to a significant increase in the number of cases classified as stage 3, while in pre-pandemic periods there was a predominance of stage 2. This finding shows that, due to the various factors involved in dealing with the pandemic, there was a significant delay in the time until diagnosis. During the COVID-19 pandemic, international studies showed data that already pointed to a scenario of a reduction in the number of diagnoses, which appeared as a warning of the possible evolution to more serious cases[11]. Thus, the data presented suggests that the pandemic has had a serious and important impact on the care provided to breast cancer patients in

the state of Piauí, generating late diagnoses and, consequently, worse prognoses and impacts on the follow-up of these patients.

The main limitation of this study is its dependence on the reliability of the Ministry of Health's public domain databases. It is widely known that there is a significant deficit in the recording of epidemiological information and data in Brazil, which may act as a limiting bias in this study. In any case, as a pioneering study, the results presented are already relevant enough for government measures to be implemented to change the reality shown.

CONCLUSIONS

We can therefore see that the COVID-19 pandemic has had a particularly significant impact on cancer care in the state of Piauí. The difficulties generated by the changes in the dynamics of dealing with cancer have brought with them difficulties whose effects are being and will be felt for a long time to come, especially due to the delay in diagnosis and the reduction in the ability to identify cases of breast cancer in the early stages. In view of this, it is essential to prioritize the re-establishment and reinforcement of breast cancer screening programs, seeking to speed up the performance of mammography exams and ensure that women in the at-risk age group can have access to early diagnosis, as well as investing in campaigns to raise awareness and educate the population about the importance of carrying out preventive exams, in addition to promoting the expansion of cancer treatment capacity in the state.

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Authors' Contribution

Silva PHS - Conception, planning (study design), acquisition, analysis, data interpretation, and writing of the paper. Silva FBF - Data interpretation and writing of the paper. All the authors approved the final version of the paper.

Conflict of Interest

The authors inform that there is no potential conflict of interest with peers and institutions, political or financial, in this study.