

ECOLOGICAL STUDY ON BREAST CANCER SCREENING IN THE CENTRAL-WEST REGION: AN EPIDEMIOLOGICAL ANALYSIS OF MAMMOGRAPHIES PERFORMED BY THE THE BRAZILIAN UNIFIED HEALTH SYSTEM

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ABSTRACT

Breast cancer is a major public health concern, and mammography plays a fundamental role in its early detection. This study aimed to analyze the epidemiological profile of mammograms performed within the Brazilian Unified Health System in the Central-West Region of Brazil between 2017 and 2025, considering temporal, regional, and sociodemographic aspects. This ecological time-series study, with a descriptive and analytical design, was based on secondary data from the Cancer Information System (SISCAN/DATASUS) and included the states of Goiás, Mato Grosso, and Mato Grosso do Sul, as well as the Federal District. The variables analyzed were age group, race/skin color, screening interval, and BI-RADS classification, according to period and federative unit of residence. During the study period, 1,713,676 mammograms were recorded, with Goiás accounting for the highest absolute number. A marked decline in examinations occurred in 2020, followed by a recovery in subsequent years, reaching the highest volume in 2023. Women aged 50–59 and 40–49 years accounted for 38.02% and 32.35% of examinations, respectively. Differences were observed in the distribution of records according to race/skin color, while BI-RADS categories 2, 1, and 0 predominated. These findings demonstrate temporal, regional, and sociodemographic variations in mammography records within the Brazilian Unified Health System in the Central-West Region and reinforce the importance of improving data quality, expanding access to mammography, and ensuring appropriate follow-up of inconclusive or suspicious findings to strengthen the breast cancer care pathway.

Keywords: Ecological studies, Mammography, Breast neoplasms, Mass screening; Unified health system.

INTRODUCTION

According to the International Agency for Research on Cancer (IARC), breast cancer (BC) is the most prevalent neoplasm worldwide, excluding non-melanoma skin cancer, and this increasing trend has been observed since the end of the 20th century. This higher prevalence is associated with an increase in risk factors,

including population aging, obesity, greater use of hormone therapy with estrogen and progesterone, early menarche, late menopause, nulliparity, physical inactivity, and alcohol consumption.¹ In addition, BC is the leading cause of death from neoplastic diseases among the Brazilian female population, with mortality being proportional to age group². Due to its epidemiological and clinical importance, measures on a global scale have prioritized early detection and management of breast cancer, with emphasis on clinical and imaging examinations, particularly mammography². It is known that the Brazilian Society of Mastology recommends one mammogram per year for women aged 40 to 74 years, except in particular cases of hereditary cancer or genetic mutations detected through genetic testing.³

Despite its effectiveness in reducing mortality from BC, factors related to the socioeconomic conditions of individuals and of the country in which they live influence the quality of the structure and organization of healthcare systems in promoting screening and early detection of this disease, access to mammography, and awareness of its importance, and this applies to all countries, including Brazil.^{1,2} In addition, active case finding and the development of measures and public policies aimed at encouraging early detection have a global scope and, considering the particularities of each country's healthcare system, have proven effective in reducing costs associated with BC morbidity and mortality⁴.

The lack of studies addressing the relationship between the number of mammograms performed in a population and its comparison with specific socioeconomic factors indicates a gap that needs to be investigated and filled in order to understand whether this inequality has a significant impact and how it is expressed, with emphasis on social determinants.

OBJECTIVES

The study aimed to analyze the epidemiological profile of mammograms performed by the Brazilian Unified Health System in the Central-West region of Brazil from 2017 to 2025, based on records from the Cancer Information System. It sought to describe the temporal and regional distribution of examinations according to federative unit of residence, as well as to characterize the records according to age group, race/skin color, examination periodicity, and BI-RADS classification, in order to identify screening patterns, possible inequalities in access, and relevant aspects for the organization of the breast cancer care pathway in the region.

METHODS

This is an ecological time-series study with a descriptive and analytical design, using data from the Central-West region of Brazil from 2017 to 2025, separated by Federative Units (FUs), namely Goiás, Mato Grosso, Mato Grosso do Sul, and the Federal District. Data were extracted from the Cancer Information System (SISCAN) of the Department of Informatics of the Brazilian Unified Health System (DATASUS), through TabNet, together with the most recent sociodemographic data from the Brazilian Institute of Geography and Statistics (IBGE), including the estimated population for 2025.^{5,6}

All individuals who underwent mammography during the study period were included. The variables collected were age group, ethnicity, periodicity, and Breast Imaging Reporting and Data System (BI-RADS), all stratified by FU of residence and race/skin color.

The rate of examinations performed within a specific time period, generally 2025, was calculated and expressed per 100,000 inhabitants, using the ratio between the number of mammograms performed and the estimated resident population in the respective year, multiplied by 100,000.

As this study was based exclusively on secondary, aggregated, publicly available data, without nominal identification or risk of breach of participant confidentiality, submission to and prior approval by a Research Ethics Committee were not required, in accordance with the guidelines of Resolution No. 510/2016 of the National Health Council.

RESULTS AND DISCUSSION

The number of mammography examinations performed by the SUS and recorded in SISCAN/DATASUS was analyzed, totaling 1,713,676 examinations performed in the Central-West region between 2017 and 2025. As shown in Table 1, a higher proportion of mammograms was observed in the state of Goiás, considering that it has the largest absolute population, at 7.42 million in July 2025 (IBGE). Although Mato Grosso is the second most populous state, with 3.89 million inhabitants, it has fewer mammography examination records than Mato Grosso do Sul.

Table 1: Number of Mammograms per Year According to Federative Unit of Residence (2017–2025).

FU of residence	2017	2018	2019	2020	2021	2022	2023	2024	2025	Total
MS	33,860	43,244	59,989	26,908	51,431	57,117	58,753	61,959	52,334	445,595
MT	29,782	30,719	34,468	17,083	27,056	47,035	44,967	41,701	40,711	313,522
GO	79,369	80,268	94,483	50,100	81,037	100,631	113,855	107,963	102,887	810,593
DF	364	7,878	15,034	13,153	16,754	12,476	28,649	23,534	26,124	143,966
Total	143,375	162,109	203,974	107,244	176,278	217,259	246,224	235,157	222,056	1,713,676

Regarding age group, Table 2 shows a higher volume of examinations among individuals aged 50 to 59 years (38.02%) and 40 to 49 years (32.35%), consistent with the recommendations of Brazilian guidelines for mammographic screening of breast diseases. From the age of 60 years onward, there is a decrease in the number of examinations performed, since routine large-scale mammographic screening is no longer recommended from this age group onward, except in specific cases according to the patient's clinical condition.

Table 2: Number of Mammograms by Age Group According to Federative Unit of Residence (2017–2025).

FU of residence	Up to 9 years	10 to 19 years	20 to 29 years	30 to 39 years	40 to 49 years	50 to 59 years	60 to 69 years	70 to 79 years	Over 79 years	Unkn own	Total
MS	90	246	1,054	7,768	159,991	164,197	97,093	13,611	3,803	-	445,595
MT	113	122	912	8,775	98,128	121,535	68,496	14,114	1,324	3	313,522
GO	208	224	1,805	20,569	266,080	301,212	177,556	38,937	10,803	8	810,593
DF	26	28	388	3,468	30,179	64,610	37,655	6,886	1,850	-	143,966

Regarding distribution by race/ethnicity, there is a predominance of White and Asian individuals, with examination rates per thousand inhabitants of 12.76 and 1,330.46, respectively, as shown in Table 3. Despite this, according to the IBGE, there is a predominance of mixed-race individuals (9.033 million) in the region compared with White individuals (6.378 million) and Asian individuals (69,000), but the examination rate among mixed-race individuals is 4.00. This may be explained by greater access to mammography among certain populations, encompassing possible factors such as socioeconomic conditions and awareness of breast cancer, as well as by the higher frequency of examinations performed within the same year, with this latter factor explaining why the Asian population had more examinations despite its smaller absolute population, as shown in Table 4.

Table 3: Number of Mammograms by Race from 2017 to 2025.

Race/Skin colour	2017	2018	2019	2020	2021	2022	2023	2024	2025	Total
White	56,165	63,280	79,825	39,744	65,361	82,001	91,533	88,810	81,382	648,106
Black	7,784	9,029	11,006	5,739	9,512	11,380	13,525	12,496	12,280	92,751
Asian	42,984	50,315	66,776	37,863	64,461	80,561	97,781	94,833	91,802	627,376
Brown	30,422	32,190	38,058	19,634	30,941	37,805	41,840	38,598	36,137	305,628
Indigenous	208	192	388	239	208	265	459	415	453	2,827
No information	5,812	7,100	7,921	4,025	5,795	5,242	1,086	5	-	36,988

Table 4: Number of Mammograms by Screening Interval According to Race/Skin Color (2017–2025).

Race/Skin colour	Same year	1 year	2 years	3 years	4 years or more	Unknown	Total
White	22,024	152,877	139,248	68,058	117,880	148,019	648,106
Black	2,936	21,530	18,610	9,173	15,503	24,999	92,751
Asian	18,558	146,144	125,583	62,084	103,446	170,961	627,376
Brown	9,219	75,025	61,477	30,030	46,904	82,913	305,628
Indigenous	90	301	299	164	426	1,547	2,827
No information	1,297	8,476	7,558	3,779	4,195	11,683	36,988

Regarding the BI-RADS classification, based on mammograms performed through the SUS, there is a predominance of categories considered benign, in descending order, categories 2, 1, and 0. This indicates that most alterations observed on imaging examinations are benign or inconclusive, that is, they do not indicate signs of malignant neoplasia or require further investigation to rule out a diagnosis of breast cancer.

Table 5: Number of Mammograms by BI-RADS Category According to Federative Unit of Residence (2017–2025).

FU of residence	Category 0	Category 1	Category 2	Category 3	Category 4	Category 5	Category 6	Total
MS	43,519	114,570	268,457	11,733	5,951	1,026	339	445,595
MT	41,153	66,839	195,500	6,613	2,818	455	114	313,522
GO	93,188	343,413	348,787	17,737	6,241	883	344	810,593
DF	28,036	17,863	88,083	6,127	2,882	579	396	143,966

DISCUSSION

The Thus, 1,713,676 mammograms performed through the SUS were identified in the Central-West region between 2017 and 2025, with relevant temporal and regional variations. The number of examinations increased until 2019, followed by a marked decline in 2020 and progressive recovery in subsequent years, with the highest volume observed in 2023⁷. This pattern suggests an impact of the COVID-19 pandemic on the performance of screening and diagnostic examinations, a phenomenon also described in national studies reporting reductions in mammography during the pandemic period. Interruption or reduction of these actions may compromise early diagnosis and contribute to delays in the investigation of suspected cases^{8,9}. In addition, the distribution by federative unit showed the highest absolute number of examinations in Goiás, followed by Mato Grosso do Sul, Mato Grosso, and the Federal District. Although this finding is partly explained by the population size of Goiás, the fact that Mato Grosso do Sul had more records than Mato Grosso, despite having a smaller population, suggests possible differences in network organization, availability of services, access to mammography, regulation, and quality of data recording in SISCAN. Therefore, absolute analysis should be complemented by indicators standardized according to the eligible female population in order to better estimate actual screening coverage.

Regarding age group, the highest concentration of examinations occurred among women aged 50 to 59 years, a result consistent with Brazilian recommendations historically focused on biennial mammographic screening in the 50-to-69-year age group. However, the high number of examinations among women aged 40 to 49 years suggests the presence of opportunistic screening, spontaneous demand, diagnostic investigation, or requests outside the traditionally prioritized age group. In addition, the reduction in examinations among older age groups may indicate barriers to access, lower levels of active case finding, or difficulties in continuity of care among elderly women.

Analysis by race/skin color revealed a predominance of records among White and Asian women, with lower proportions among Brown, Black, and Indigenous women. This result should be interpreted cautiously because of the possibility of underreporting and inadequate completion of the race/skin color variable, but it may indicate inequalities in access to secondary prevention of breast cancer. Socioeconomic, territorial, cultural, and health service organization-related factors may influence mammography uptake, reinforcing the need for active case-finding policies and expansion of access among historically vulnerable groups.

Regarding BI-RADS, categories 2, 1, and 0 predominated, indicating a higher frequency of

benign findings, normal examinations, or inconclusive results. This pattern is expected in screening examinations, but the presence of BI-RADS 0 reinforces the need to ensure timely complementary diagnostic assessment. Categories 4, 5, and 6, although less frequent, require prompt referral for histopathological investigation and treatment. Thus, the effectiveness of screening depends not only on performing mammography but also on the system's capacity to ensure continuity of the care pathway.

The study has limitations because it uses secondary data from SISCAN/DATASUS, which are subject to underreporting, duplication, data-entry errors, and variations in record quality. In addition, the number of examinations does not necessarily correspond to the number of women screened, since the same individual may undergo more than one mammogram during the study period. As this is an ecological study, it is not possible to establish causality or assess individual factors such as income, education, family risk, presence of symptoms, and time to diagnosis. Despite these limitations, the findings contribute to understanding the regional pattern of mammography performed through the SUS in the Central-West and highlight relevant public health challenges. Heterogeneity among states, the decline during the pandemic, possible inequalities by race/skin color, and the need for follow-up of abnormal findings reinforce the importance of strengthening primary care, improving data quality, and organizing the breast cancer care pathway in order to expand equitable access to screening and early diagnosis.

CONCLUSION

The present study made it possible to characterize the epidemiological profile of mammograms performed through the SUS in the Central-West Region between 2017 and 2025, revealing relevant temporal, regional, and sociodemographic variations. A higher concentration of examinations was observed in Goiás, with a predominance among women aged 50 to 59 years and a higher frequency of BI-RADS categories 1, 2, and 0. A marked decline in the number of examinations was also identified in 2020, followed by recovery in subsequent years, suggesting an impact of the COVID-19 pandemic on mammographic screening.

The findings indicate the need to strengthen breast cancer screening actions within the SUS, with expanded equitable access, improved quality of SISCAN records, and assurance of appropriate follow-up for cases with inconclusive or suspicious findings. Thus, the study contributes to understanding the regional scenario and reinforces the importance of organizing the care pathway to promote early diagnosis and reduce health inequalities.

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