



Does Pink October really impact breast cancer screening?

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ABSTRACT

Objective: This study aims to evaluate the impact of the Pink October Campaign on the increase in mammographic screening in Brazil.

Study design: Ecological observational study, based on retrospective data.

Methods: Brazilian national screening database (DATASUS/SISMAMA/Information System on Breast Cancer) was used as a data source and is publicly available for download and analysis. We report screening numbers and outcome rates from January 2017 to December 2021 comparing statistically (ANOVA test, post-Tukey test), age groups, regions of Brazil, and the four quarters of the year.

Results: During the study period, the average number of exams performed monthly over the five years was 137,400.117. An increase in the number of mammograms performed in October was identified, as well as in the two following months, respectively 33%, 39%, and 22%, with statistical significance ($p = 0.000$) in relation to the three quarters of the year. In addition, in the other months, we found values below the monthly average. Statistical difference was not found in the increase in mammograms considering age groups ($p = 0.5$) and different regions of the country ($p = 0.6$).

Conclusions: This study showed an increase in mammographic screening in the three months following the Pink October Campaign, so we should intensify similar actions throughout the year and not just in October.

1. Introduction

Breast cancer (BC) is the leading cause of cancer in most countries, accounting for 11,7% of all cancer cases and with an estimated 2,3 million new cases a year [1].

There is plenty of evidence that BC's early diagnosis initiatives save far more lives and are much more cost-effective than treatment in the late stages. From the perception of countries like Brazil, the efficacy and adherence to breast cancer screening (BCS) is still a problematic issue from the public health policy perspective [2]. Brazilian mortality rates are increasing with striking variations between geographic regions, and several factors may account for the disparities, including delays in diagnosis due to low education levels, low adherence to screening programs, and gaps in their implementation [3,4].

According to the Brazilian National Cancer Institute (INCA), it is

estimated that Brazil will have around 620,000 new cases of cancer in the 2020–2021 biennium. Among those, the most prevalent types are prostate (65,840 cases) and breast (66,280 cases) [5].

In this scenario, campaigns were created to reduce the impact of different cancer types on the population. The “Pink October” campaign has become one of the most publicized in Brazil, its aim is to share free information about breast cancer in the form of lectures, promoting awareness of the disease throughout society and not only in the female population. Thus, bringing in public and private resources for greater access to diagnostic services, and performance of mammography exams, thus contributing to the reduction of mortality. With the increase of institutions linked to the cause and the growing exposure and popularity of campaigns, it is expected greater awareness of the population and an increase in the number of breast exams.

The first initiative of the Pink October Campaign in Brazil took place

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in 2002 when a group of women who wanted to bring the movement to the country got private support to light up the Mausoleum of the Constitutionalist Soldier, known as the Obelisk of Ibirapuera, in Sao Paulo. In October 2008, several entities related to breast cancer lit up monuments and buildings in their respective cities in pink, an initiative that has been repeated annually since then. Since 2010, INCA has participated in the movement, promoting spaces for discussion about breast cancer, disseminating, and making its informative materials available to professionals and society [6]. Over the years, the campaign gained support, and other institutions like the Brazilian Society of Mastology (SBM), Association of Gynecology Federations and Obstetrics (FEBRASGO), and Brazilian College of Radiology (CBR) began to promote events and informative materials in different media.

Some studies discuss the implementation and effectiveness of these projects, especially regarding the real impact in reducing the incidence and mortality of breast cancer and generating demand that is not the focus of these exams. On the other hand, awareness campaigns regarding the incidence of the disease (as well as its main characteristics, clinical signs, diagnosis, and treatment) can be useful for a large portion of the population [4]. Therefore, this study's aim was to assess how much impact the Pink October Campaign has on the increase in mammographic screening in Brazil considering age groups and the differences between Brazilian regions.

2. Methodology

This is an ecological observational study, based on retrospective data on the Brazilian Ministry of Health's mammography screening program. The National Breast Cancer Screening Bank (DATASUS/SISMAMA/Information System on Breast Cancer) was used as a source, it is a public department that aims to provide the Brazilian health system with the necessary information for the proper planning, operation, and control of health actions. SISMAMA records requests for breast cyto/histopathological exams, mammography, results of all requested exams, and monitoring of altered exams, thus generating data that support monitoring and evaluation. In addition, this data is publicly available for download and analysis.

It is worth mentioning that in Brazil the performance of mammograms is totally opportunistic, the woman needs to seek the public health system to carry it out, making campaigns extremely necessary to reach mainly the underprivileged population.

Therefore, for this research, we used the number of exams and result rates from January 2017 to December 2021, including this period because it presents the availability in the information system about the number of exams performed per month.

The descriptive analysis was performed by calculating the monthly averages in the studied period (2017 to 2021), calculating the averages by region, and the average of mammograms per month. To analyze the regions and the age groups, we used the calculation of the percentage that each month represents against the average of the region or age group. This way, we find the increase or decrease in exams each month by region and age group.

Key inclusion criteria for the study considered: complete report of the number of mammograms for the study (missing data were excluded); age as a filter (50 to 69 years old); and only mammograms performed for screening purposes were selected for the study. The number of mammograms performed in the aforementioned period and the distribution by Brazilian regions were evaluated.

The main hypothesis from the study was that the number of mammograms performed was different in October and subsequent months. That said, we provided several analyses comparing the number of mammograms through the years.

For the statistical analysis, the information was tabulated and analyzed with the KS test to verify the normality of the sample and later performed the Anova test with Tukey's post-test.

3. Results

From 2017 to 2021, 13,040.117 were performed in all age groups, of which 325,207 (2,5%) were classified as diagnostic mammograms, thus being excluded from this analysis. Mammograms performed for screening totaled 12,714.810 (97,5%) and 4,470.785 (37%) were performed in the age group not compatible with the screening program of the Ministry of Health, excluded for not being in the inclusion criteria of this research. Therefore, according to the study's inclusion criteria, from 2017 to 2021, a total of 8,244.025 (63%) mammograms were included for analysis (Fig. 1).

During the study period, we found an increase in the number of mammograms performed in October as well as in the two following months. Table 1 shows the number of exams performed monthly in the period from 2017 to 2021. The average number of exams performed monthly during the five years was 137,400, where we observed an increase of 33% in October, 39% in November, and 22% in December. When comparing the fourth quarter of the year (October, November, December) to the first quarter (January, February, March), second quarter (April, May, June), and third quarter of the year (July, August, September), we found statistical significance respectively ($p = 0.000$; $p = 0.002$ and $p = 0.004$). In the other months of the year, we found all with values below the monthly average. Fig. 2 clearly demonstrates the increase in the number of mammograms in the last three months of the year.

There was an important increase in mammographic screening during the study period, considering the years 2017, 2018, and 2019, we have an increase of 14.6%. In 2020, the year of the COVID-19 pandemic, there was a 60.4% reduction and in 2021 there was already a reestablishment of exams, with values like 2017.

Table 2 shows the average number of exams performed monthly during the study period in each region of Brazil. The average number of mammograms is higher in the southeast region and lower in the north region, depending on the population concentration of these regions, however, when statistically analyzing the regions, we did not obtain significant differences ($p = 0.06$). The relationship between the monthly average and the average for the region shows that in all regions we have an increase in the number of exams carried out in October, November, and December, reaching an increase of 53.1% in October in the northeast and the smallest increase of 23.3% in the southeast, with significant differences in all regions when compared to the first three quarters ($p \leq 0.05$). We still notice that in some months we have a 26.4% reduction in May in the northern region.

Table 3 shows the average number of exams performed monthly

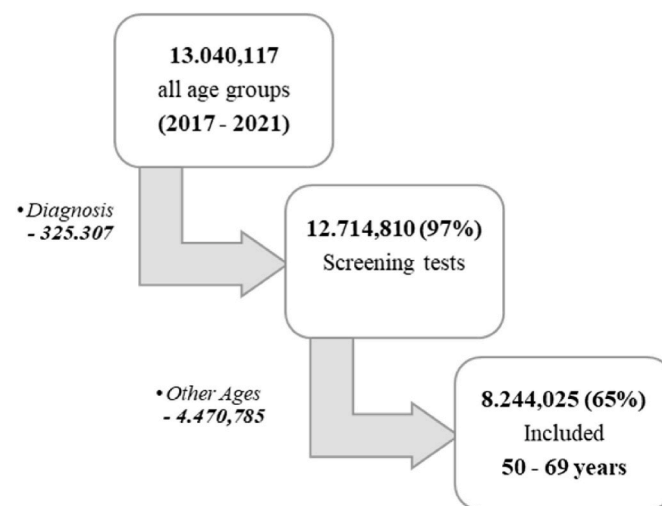


Fig. 1. - Sample Selection
Source: DATASUS – SISCAN in 02/02/2022.

Table 1
- Monthly mammography rates by year.

	Month/Year	2017	2018	2019	2020	2021	Total	Average	P-Value
First quarter	January	109.701	142.296	149.194	152.720	119.461	673.372	134.674	0,000*
	February	103.360	121.026	151.136	142.730	118.747	636.999	127.400	
	March	127.813	143.576	143.773	134.458	119.773	669.393	133.879	
Second quarter	April	116.222	141.704	153.265	36.920	99.971	548.082	109.616	0,002*
	May	143.702	141.455	154.093	27.062	114.437	580.749	116.150	
	June	137.224	132.066	139.076	36.709	117.110	562.185	112.437	
Third quarter	July	138.328	131.838	146.590	47.186	128.587	592.529	118.506	0,004*
	August	147.742	149.006	152.198	57.146	142.078	648.170	129.634	
Fourth quarter	September	137.653	131.204	156.636	78.279	143.435	647.207	129.441	-
	October	172.347	186.753	212.465	140.046	182.790	894.401	178.880	
	November	180.167	197.101	198.356	169.014	208.779	953.417	190.683	
	December	172.445	160.459	177.170	146.332	181.115	837.521	167.504	
	Average	140.559	148.207	161.163	97.384	139.690	140.559	137.400	
	TOTAL	1.686.704	1.778.484	1.933.952	1.168.602	1.676.283	8.244.025	1.648.805	-

Source: DATASUS - SISCAN accessed on 02/02/2022.

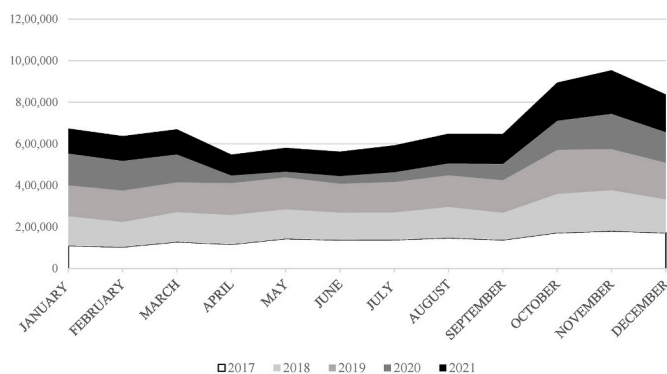


Fig. 2. - Distribution graph of mammograms performed from 2017 to 2021.
Source: DATASUS - SISCAN accessed on 02/02/2022.

during the study period in age groups. We observed an increase of 28 to 31% in October in the age groups with the continuity of increases in November and December, highlighting an increase of 44% in December for the age group from 60 to 69 years old; showing statistical significance when comparing the fourth trimester to the first three trimesters ($p \leq 0.05$), however, we did not find a statistically significant difference in the increase in mammograms between age groups ($p = 0.5$). In addition, a reduction of 22.8% was identified in April for the age group from 65 to 69 years old.

Table 2
- Monthly average by region, relation between monthly average with annual average by region.

	NORTH		MIDWEST		NORTH EAST		SOUTH		SOUTHEAST	
	Average ^c	% ^a	Average ^c	% ^a	Average ^c	% ^a	Average ^c	% ^a	Average ^c	% ^a
January	3946	1,5	7658	-2,9	37352	-7,0	32701	3,6	53017	3,6
February	3537	-9,0	8075	2,4	35412	-11,9	31095	-1,4	49281	-3,7
March	4026	3,6	8480	7,6	39083	-2,7	30719	-2,6	51571	0,8
April	3094	-20,4	6833	-13,3	31282	-22,1	26564	-15,8	41842	-18,2
May	2861	-26,4	6644	-15,7	32920	-18,1	28873	-8,5	44852	-12,3
June	3063	-21,2	6296	-20,1	30799	-23,4	27436	-13,0	44843	-12,3
July	3497	-10,0	6858	-13,0	34013	-15,4	27621	-12,5	46517	-9,1
August	3934	1,2	7613	-3,4	38503	-4,2	29284	-7,2	50300	-1,7
September	3618	-6,9	7306	-7,3	39514	-1,7	29808	-5,5	49196	-3,8
October	5437	39,9	9636	22,2	61516	53,1	39219	24,3	63073	23,3
November	5742	47,7	11314	43,5	61613	53,3	43736	38,6	68280	33,5
December	5250	35,1	10153	28,8	48818	21,5	40147	27,2	63136	23,4
Average ^b	3.887		7.883		40.182		31.550		51.161	

Source: DATASUS - SISCAN accessed on 02/02/2022.

^a Relation of the region's monthly average with the annual average for the period 2017-2021.

^b Average of the region in the period 2017-2021.

^c Monthly average in the period 2017-2021.

4. Discussion

Preventive health behaviors help to reduce the suffering and costs associated with diseases [7]. The promotion of these behaviors requires effective communication at a population level, and this efficiency requires awareness of diseases and clear descriptions of preventive health behaviors. Therefore, breast cancer screening, with its delicate balance between potential benefits and harms, demands that the periodicity and target population recommendations be respected [8,9].

In the present study, we found a high number of mammograms performed as screening in patients outside the age group recommended by INCA (50 to 69 years) [10]. Of the number of the total tests classified as screening, 35% of the tests were performed in age groups other than those recommended by INCA, it is believed that this is due to a divergent recommendation in Brazil by the Brazilian Society of Mastology (SBM), Association of Gynecology Federations and Obstetrics (FEBRASGO), and from the Brazilian College of Radiology (CBR), which recommend screening between 40 and 75 years. Other studies have already demonstrated this over-screening, explained by the important role of these societies in promoting the Pink October campaign, while INCA, lately, takes little part on it [10-13].

A systematic review that evaluated evidence regarding the harms and benefits of breast cancer screening showed that mammography for women aged 50 to 69 years results in a decrease in breast cancer mortality, but not in the mortality from all types of cancer nor from all-cause mortality. For women younger than 50 years and older than 69 years, the conclusions are not consistent regarding the reduction of mortality,

Table 3
- Monthly average by Age, relation between monthly average with annual average by Age.

	50 to 54 years		55 to 59 years		60 to 64 years		65 to 69 years	
	Average ^c	% ^a	Average ^c	% ^a	Average ^c	% ^a	Average ^c	% ^a
January	44153	-3,0	39020	-2,2	30960	-1,5	20541	-0,2
February	42452	-6,7	37041	-7,1	28931	-7,9	18976	-7,8
March	45147	-0,8	38829	-2,6	30269	-3,7	19634	-4,6
April	37141	-18,4	31833	-20,2	24761	-21,2	15880	-22,8
May	39195	-13,9	33704	-15,5	26280	-16,4	16971	-17,5
June	37977	-16,6	32694	-18,0	25402	-19,2	16364	3,0
July	40272	-11,5	34347	-13,9	26593	-15,4	17295	-15,9
August	44005	-3,3	37589	-5,7	29150	-7,2	18890	-8,2
September	43475	-4,5	37468	-6,0	29298	-6,8	19201	-6,7
October	58541	28,6	51936	30,2	41346	31,6	27057	31,5
November	60828	33,6	55444	39,0	44752	42,4	29659	44,2
December	53095	16,6	48631	21,9	39346	25,2	26432	28,5
Average ^b	45523		39878		31424		20575	

Source: DATASUS – SISCAN accessed on 02/02/2022.

^a Relation of the monthly average in age groups with the annual average for the period 2017–2021.

^b Average in age groups in the period 2017–2021.

^c Monthly average in the period 2017–2021.

with no impact of screening on all causes of reported mortality [14].

The increase in the number of mammograms performed in Brazil in October due to the Pink October campaigns shows that breast cancer awareness and health education are necessary and must be encouraged not only by medical societies but by all the media and the federal government [13]. We can therefore observe that in Brazil, the Pink October campaign has an impact on the demand for breast exams from October to December, with an increase of up to 39%. Unfortunately, it is observed in this study that they are ephemeral measures since in the other nine months of the year the average number of exams decreases by up to 20%.

Despite not showing statistical significance, the evaluation of the regions of Brazil regarding the impact of the Pink October campaign on mammographic screening found an increase in all regions, but especially in the northeast (53.3%) and north region (47.7%). Tracking and research studies on Google Trends also show these regions with greater searches during Pink October. These facts could be related to the lack of access to health care systems in these regions and the increased supply of exams during these campaigns [15].

Another important evidence observed in relation to campaigns, such as Pink October, is the population's awareness of the need for breast exams. There was a 14.6% increase over the years from 2017 to 2019, and even during the COVID-19 pandemic in 2020 and 2021, there was a significant increase in the number of mammograms in October, November, and December, with values like those of previous years.

Health promotion is part of the Brazilian public health model, also called the Unified Health System (SUS), which provides information, health education, and primary care as the first level of care. Since 2004 [16], with the creation of the National Policy for Integral Attention to Women's Health (PNAISM), campaigns to prevent the most common cancers among women have been stimulated, and with that, the impact has been positive in the increase in the number of exams.

Finally, Brazil is a continental country, it has great social, cultural, and access to health differences in its states, the search for mammography must always be carried out by the women themselves, making them co-responsible for the diagnosis of breast cancer, thus reinforcing the need for the Campaigns discussed in this research, but mainly that they are not limited to just one month.

5. Conclusion

This study showed the important role of the Pink October campaign in mammography screening in Brazil. There was an increase of exams performed throughout the years of this study and, an increase in October, November, and December of these years. No statistically

significant difference was found in the increase in mammograms considering age groups and different regions of the country.

Declaration of competing interest

I, **Marcelo Antonini**, author responsible for the manuscript "PINK OCTOBER REALLY IMPACT BREAST CANCER SCREENING IN BRAZIL?", declare that none of the authors of this study has any type of interest described below, or others that configure the so-called Conflict of Interest. I declare that the submitted manuscript did not receive any financial support, neither I nor the other authors.

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