Clinical Profile and Findings in a Breast Cancer Screening Campaign in a Brazilian State

Findings in a Breast Cancer Screening Program

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Abstract- ***Objectives:*** To describe the sociodemographic characteristics and the findings in the BC screening tests of women who signed up for a Breast Cancer Awareness Month campaign in the Brazilian state of Santa Catarina.

Methods: In this descriptive, retrospective, observational study, 638 women volunteered to participate. Sociodemographic and clinical data collection occurred between February 2020 and June 2021. Participants had mammograms and were referred to additional ultrasound exams when necessary. All participants with BI-RADS® of 4 or 5 were referred to core biopsy.

Results: In our sample, 31.2% had had a mammography longer than 5 years or had never had it. The most frequent findings in the performed mammograms were: dense breasts (37.1%), microcalcifications (12.0%) and breast lumps (10.4%). There were 17 exams classified as BI-RADS® 4 or 5 (in mammogram or ultrasound) and the core biopsy exam detected invasive ductal carcinoma in 6 patients (35.5%), invasive lobular carcinoma in 2 patients (11.8%), cystic or benign lesion without atypia in 6 patients (35.3%), proliferative lesion with atypia in 2 patients (11.8%) and phyllodes tumor in 1 patient (5.9%). The 8 (1.3%) participants diagnosed with carcinoma had the following clinical staging: 2 as T1 and 6 as T2; 7 as N0 and 1 as N1; 4 as M0, 1 as M1 and 3 as Mx.

Conclusion: The observed BC detection rate can be considered high compared to other Brazilian and USA data, reinforcing the importance of measures that favor prevention and early detection of BC, including screening tests. The information contained in this article can be useful for the elaboration of BC programs and policies in Santa Catarina and possibly in other Brazilian regions.

Keywords: breast neoplasms, early detection of cancer, mammography, mammographic breast density, ultrasonography, biopsy, retrospective studies, observational study.

I. Introduction

Breast cancer (BC) was the most commonly diagnosed type of cancer in 2020[1] and it is the leading cause of cancer death in women worldwide[2]. In Brazil, the scenario is similar: according to the National Cancer Institute (INCA), BC is the most common cancer in women, corresponding to almost 30% of new cases. In this gender, it is also responsible for more than 16% of cancer deaths, being the most lethal cancer type[3]. Moreover, a significant increase in BC morbidity and mortality rates has been observed in the past decades[4].

Less than 1% of BC occur in men, making this a mostly female disease[5]. Other risk factors besides gender, such as age, ethnicity, genetic and reproductive factors, breast density, body mass index (BMI), diet, alcohol and tobacco consumption and regularity of physical activity are worth noting. In fact, less than 10% of BC can be attributed to genetic factors, being this disease onset predominantly associated with environmental, reproductive, and lifestyle factors[6]. Regarding breast density, the risk of BC is increased in women with dense breasts. Moreover, dense breast tissue makes cancer detection more difficult since it decreases the sensitivity of traditional mammography. This characteristic is influenced by internal and external hormones and seems to be inversely correlated to age. Still, it is estimated that 40% of women aged 40 to 70 years have heterogeneously or extremely dense breasts[6].

BC prevention can be classified into primary and secondary. The primary prevention includes behavioral measures such as an active lifestyle, obesity control and decrease of high-fat food and alcohol ingestion. Primary prevention also comprises the self-palpation exam, while the clinical breast exam, performed by trained nurses and physicians, and mammography constitute secondary prevention[7]. The access to secondary prevention is decreased by several factors, such as lower socioeconomic status and income, poorer education and region of residence[8]. Furthermore, social distancing measures implemented

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in 2020 because of COVID-19 pandemic, although effective to diminish the disease transmission[9], possibly increased the burden of other diseases, such as cancer. According to the World Health Organization, to date, the only effective form of BC diagnostic in organized population-based programs is mammography screening. Women invited to attend these programs have a relative risk reduction of BC mortality by up to 20% across all age groups[10]. The Breast Cancer Awareness Month (BCAM) campaign is an initiative created in the 1990's that aims to share information regarding early diagnosis and BC prevention screening to reduce the disease's mortality. In Brazil, the first act related to the BCAM happened in 2002[11], but it was only in 2018 that the endurance of the initiative was guaranteed by the federal law number 13.733/2018[12].

Considering early detection and treatment improve BC survival rate[10], the reduction in the number of mammograms performed and the changes in the management of BC are a reason for concern. Hence, the Brazilian Society of Mastology, along with the pharmaceutical Libbs, promoted the Outubro Rosa Program (Pink October Program, in English), a Breast Cancer Awareness campaign in the Brazilian state of Santa Catarina. The initiative aimed at mitigating the COVID-19 pandemic's effects on the treatment of patients with breast cancer, as well as encouraging women's screening and diagnosis of this disease. The program took place in healthcare units in October 2020 and lasted for six months. It promoted several activities related to early diagnosis, diagnostic confirmation, treatment and follow-up of patients with BC. The objective of the present study is to describe the sociodemographic characteristics and the findings in the BC screening tests of women who signed up for the BC screening in the Pink October Program. This is a descriptive, retrospective and observational study, performed with an anonymized database.

II. Methods

This study was approved by the Ethics Committee (CEP: 4.974.425) and complies with Brazilian legislation. All participants agreed with the data safety policy and signed the informed consent form.

a) *Pink October Program*

The program took place in private health care clinics in several cities in Santa Catarina state and lasted for six months. Participants had mammograms and were referred to additional ultrasound exams when necessary. All participants with BI-RADS® of 4 or 5 were referred to core biopsy. Further information regarding its characteristics, as well as how each phase was conducted, can be found on Figure 1. Phases 1 to 4 were evaluated in this article. The treatment and follow-up phases were not the object of this study.

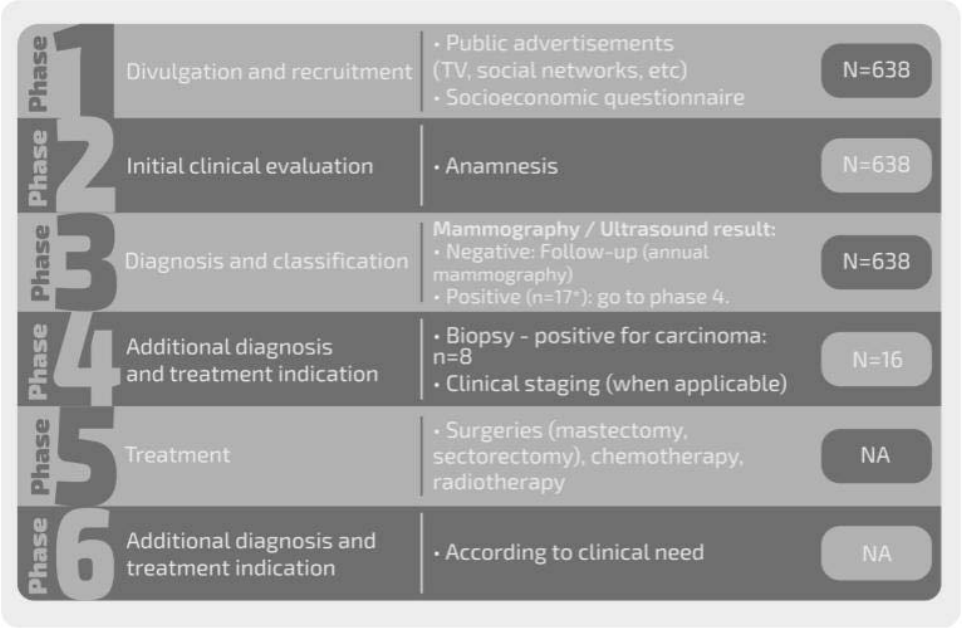

Figure 1: Flowchart of the Pink October Program 2020.

NA: not applicable in the current analysis.
**Seventeen positive breast cancer biopsies were performed from 16 patients (one patient had a bilateral suspicion of breast cancer).*

b) Subjects

The campaign targeted women 40 years of age or older, who had never had a mammography or whose last exam had been over 1 year. Women in Santa Catarina state could sign up regardless of social class or city of residence. Information from all women who participated in phase 3 of the program for mammography screening and authorized the storage and use of their data were included anonymously in the database. The sample size calculation, with 95% confidence and maximum error of 4% (precision), established a number of 600 participants.

c) Measures

Sociodemographic measures, such as age, city, ethnicity and education level were collected on phase 1 through a questionnaire. Data regarding personal and family history, gynecology and obstetrics history, physical characteristics, results of exams for BC detection and results of additional exams were also included in phase 2.

d) Statistical analysis

Data analysis was performed using the software SAS® (version 9.4). The descriptive analyses are presented for continuous variables, as mean and standard deviation, median, and minimum and maximum values. For categorical variables, the descriptive analyses are presented as frequency and percentages. Chi-squared tests were performed to assess differences in the frequencies of BC and BI-RADS® classification in women with different breast densities.

III. Results

The assessment was completed between February 2020 and June 2021, and 638 women agreed to participate in the study. Most participants were from the cities of Florianópolis (22.2%), Mafra (15.0%), Lages (13.2%) and Chapecó (10.7%). Age of participants ranged from 34 to 90 years, with mean of 57.9 ± 9.3 years and median of 56. In regard to ethnicity self-declaration, 80.3% of women were white and 73.2% had complete primary education or higher. Women had BMIs between 15.9 and 44.2 kg/m² (median = 27.5 kg/m²). Further sociodemographic information of participants can be found in Table 1.

Half of participants reported no relevant health history (50.3%), and 31.6% reported family history of breast cancer. Menarche age ranged from 7 to 20 years, with an average of 13.0 ± 1.8 years. The median number of pregnancies was 2, corresponding to 2.1 ± 1.1 children. Age at first delivery ranged from 14 to 44 years; 72.8% of them breastfed, with a median of 13 months of breastfeeding. Furthermore, 45.8% of respondents were on menopause.

Table 1: Sociodemographic characteristics of participants

	Mean ± Standard Deviation (max - min)
Age (n=618)	57.9 ± 9.3 (34 - 90)
Ethnicity (n=638)	**Number of participants (%)**
White	512 (80.3%)
Pardo*	81 (12.7%)
Black	34 (5.3%)
Yellow	2 (0.3%)
Indigenous	1 (0.2%)
Unknown	8 (1.3%)
Education (n=638)	
Illiterate	4 (0.6%)
1st degree of primary education - incomplete	69 (10.8%)
1st degree of primary education	49 (7.7%)
2nd degree of primary education - incomplete	40 (6.3%)

2nd degree of primary education	237 (37.1%)
Secondary education - incomplete	46 (7.2%)
Secondary education	136 (21.3%)
Tertiary education - incomplete	1 (0.2%)
Tertiary education	47 (7.4%)
Unknown	9 (1.4%)
City (n=635)	
Florianópolis	141 (22.2%)
Mafra	95 (15.0%)
Lages	84 (13.2%)
Chapecó	68 (10.7%)
Blumenau	52 (8.2%)
Criciúma	49 (7.7%)
Itajaí	45 (7.1%)
São José	34 (5.4%)
Palhoça	15 (2.4%)
Other**	52 (8.1%)

** Brazilian mixed ethnicities, comprising white, black and/or indigenous peoples.*
*** Navegantes, Camboriú, Balneário Camboriú, Campo Belo do Sul, São José do Cerrito, Penha, Lauro Müller, Içara, Cordilheira Alta, Barra Velha, Xanxerê, Urubici, Sombrio, Santo Amaro da Imperatriz, Saltinho, Morro da Fumaça, Laguna, Itapema, Imaruí, Correia Pinto, Cocal do Sul, Brusque, Biguaçu, and Balneário Arroio do Silva.*

Most participants (75.0%) had already had a mammography, 39.9% less than 2 years before and 26.3% between 2 and 5 years before. The most frequent reasons to get the exam were: screening tests (85.1%), breast tenderness (6.3%) and breast lumps (5.0%). The greatest part of mammograms performed by the program were carried out in private clinics (92.3%), 4.5% were carried out in units of the public healthcare system and 3.0% in hybrid clinics; most exams used digital equipment (53.4% used Computerized Radiography and 46.5%, Digital Radiology) and just one (0,1%) used analogical equipment. Regarding the mammography results, the most frequent findings were dense breasts (37.1%), microcalcifications (12.0%) and breast lumps (10.4%). Details on mammography and ultrasound results, BI-RADS® and breast density can be found in Table 2.

Table 2: Mammography history and results

This was the first mammography (n=612)*	Number of participants (%)
Yes	136 (22.2%)
No	476 (77.8%)
Time since the last exam (n=476)*	
< 2 years	254 (41.5%)
2 to 5 years	167 (27.3%)
> 5 years	55 (9.0%)
Reason (n=637)	
Screening exam	542 (85.1%)
Breast tenderness	40 (6.3%)
Breast lump	32 (5.0%)
Papillary effusion	4 (0.6%)
Other	19 (3.0%)
Mammography BI-RADS (n=637)	
0	86 (13.5%)
1	82 (12.9%)
2	446 (70.0%)
3	14 (2.2%)
4	7 (1.1%)
5	2 (0.3%)
Ultrasound BI-RADS (n=124)	
0	2 (1.6%)
1	15 (12.1%)
2	59 (47.6%)
3	31 (25.0%)
4	15 (12.1%)
5	2 (1.6%)

**Patients with known status on previously performed mammograms (24 patients had no known status on whether or not they had previously had a mammogram).*

Additional core biopsy exam was indicated for 16/638 (2.5%) patients (one of them had a bilateral biopsy), who presented BI-RADS® 4 or 5 (either in mammography or ultrasound). The investigation detected invasive ductal carcinoma in six patients (35.5%), invasive lobular carcinoma in 2 patients (11.8%), benign lesion without atypia in 5 patients (29.4%), proliferative lesion with atypia in 2 patients (11.8%), cystic lesion in 1 patient (5.9%) and phyllodes tumor in 1 patient (5.9%). Clinical staging according American Joint Committee of cancer was recommended to 8 participants (1.3% of the whole sample), of which 2 were classified as T1 and 6 as T2; 7 patients were classified as N0 and 1 as N1; besides, 4 patients were classified as M0, 1 as M1 and 3 as Mx.

Most participants had BI-RADS® 2 and heterogeneously and extremely dense breasts. Frequency of patients with different breast densities and their BI-RADS® can be found in Table 3. Participants who were diagnosed with BC had heterogeneously dense breasts or scattered fibroglandular densities; none of them had extremely dense or predominantly fatty breasts. Frequency of participants with different breast densities, with and without cancer diagnosis can be found in Table 4. The low frequency of BI-RADS® 4 and 5 and breast cancer diagnosis hindered statistical comparisons of these data with breast density. Nonetheless, there was a lower proportion of volunteers with BI-RADS® ≥1 and higher proportion with BI-RADS® 0 (inconclusive) among volunteers with heterogeneously dense breasts in comparison with the other categories of breast density (p = 0,039). Other statistically significant differences in regards to BC frequency or BI-RADS® classification were not detected.

Table 3: Frequency of patients with different breast density characteristics versus BI-RADS classification

	BI-RADS						
	0 (n=86)	1 (n=82)	2 (n=446)	3 (n=14)	4 (n=7)	5 (n=2)	Total (n=637)
Breast density							
Extremely dense	1 (4.5%)	2 (9.1%)	18 (81.8%)	1 (4.5%)	0 (0.0%)	0 (0.0%)	22 (100.0%)
Heterogeneously dense	57 (17.0%)	37 (11.0%)	227 (67.6%)	9 (2.7%)	4 (1.2%)	2 (0.6%)	336 (100.0%)
Predominantly fatty	7 (7.9%)	21 (23.6%)	60 (67.4%)	1 (1.1%)	0 (0.0%)	0 (0.0%)	89 (100.0%)
Scattered fibroglandular densities	21 (11.1%)	22 (11.6%)	141 (74.2%)	3 (1.6%)	3 (1.6%)	0 (0.0%)	190 (100.0%)
Total	86 (13.5%)	82 (12.9%)	446 (70.0%)	14 (2.2%)	7 (1.1%)	2 (0.3%)	637 (100.0%)

Table 4: Frequency of patients with different breast density characteristics, with and without breast cancer

Breast density	Number of patients (%)		
	Breast cancer (n=8)	No Breast cancer (n=629)	Total (n=637)
Extremely dense	0 (0.0%)	22 (100%)	22 (100%)
Heterogeneously dense	5 (1.5%)	331 (98.5%)	336 (100%)
Predominantly fatty	0 (0.0%)	89 (100%)	89 (100%)
Scattered fibroglandular densities	3 (1.6%)	187 (98.4%)	190 (100%)
Total	8 (1.3%)	629 (98.7%)	637 (100%)

IV. Discussion

This study aimed to characterize a sample of women who participated in a BC screening program in Santa Catarina, Brazil. Participants were, in general, in their late 50's, white, with complete primary education or higher and the majority had no relevant personal health history, although approximately a third of them had a family history of BC. Most women had children, breastfed, and almost half of them were on menopause. Their BMIs, menarche and delivery ages varied widely.

The Brazilian Ministry of Health recommends a mammography every two years for women aged between 50 and 69 years[13]. In our sample, that ranged from 35 to 90 years of age, three fourths had already had a mammography at least once, most of them in a five-year range for screening purposes. Considering only participants with known previous mammography status, although 254/612 (41.5%) women had this exam in the previous 2 years and 167/612 (27.3%) had it in a 2–5-year range, 191/612 (31.2%) women had a mammography longer than 5 years or had never had this exam. This percentage is comparable to what was observed in another Brazilian survey that took place in 2012, in which 30.3% of participants never had a mammography in their lifetime[14]. Despite this similarity with data from the entire country, Barcelos and colleagues (2018) showed there was a higher prevalence of women who have never had a mammography in the north, midwest, and northeast regions of Brazil compared to the south and southeast[14]. The number of machines available and their geographical location are estimated to be enough to guarantee access to mammograms[13], but together, these findings indicate the need of programs to increase adherence and access to BC prevention.

Breast Cancer Awareness Month campaigns increase adherence to BC primary and secondary prevention, as shown by a systematic review with information from the United Kingdom[15]. Data from Google Trends show that searches for "Breast Cancer" and "mammography" are higher during the month of October. This holds true for different countries such as the USA[16], Malaysia[17] and also for Brazil[18]. Nonetheless, the COVID-19 pandemic seem to have impacted the search volume for different types of cancer, with a 74.3% decrease in searches for "mammography" during the first peak in global weekly deaths related to COVID-19 compared to the pre-pandemic period[19].

In Brazil, data from DATASUS, an open access database of the Brazilian public healthcare system, show a progressive increase in the number of screening mammograms from 2010 to 2018[20]. However, a retrospective cohort study performed in a private hospital in São Paulo, Brazil, showed a decrease of 78.9% in the number of breast exams in the first 90 days of COVID-19 social isolation measures in comparison to the same period in the previous year[21]. Moreover, almost 70% of responders of an electronic survey with members of the Brazilian Society of Mastology declared they have changed their management approach of BC during the pandemic[22]. In 2020, the first year of the COVID-19 pandemic, there was an overall decrease of 42% in the number of mammograms performed in comparison to 2019. Specifically in the state of Santa Catarina, there was a reduction of 44% in these figures[23]. Notwithstanding, this seems to be a global tendency, since the USA faced a dramatic decrease in the number of screening and diagnostic mammograms in April of 2020. Although this decrease has been followed by a strong rebound in July, a cumulative deficit in missed mammograms can be observed, outnumbering the exams performed during the rebound and raising awareness for possible delayed diagnoses[24].

In our sample, 16 patients had mammography and/or breast ultrasound with BI-RADS® 4 or 5 and were referred to core biopsy exam (one of them had it bilaterally). The results showed that 8 (1.3%) women had

breast cancer (being 6 of them invasive ductal carcinomas and 2 invasive lobular carcinomas), and among them at least one already had metastases by the time of diagnosis. This percentage of BC detection can be considered high compared to another Brazilian study performed in the state of São Paulo, in which percentages of BC diagnoses in consecutive years were: 0,67% in 2010, 0,61% in 2011, and 0,69% in 2012[25]. The 2019 USA data show an even lower breast cancer incidence: among white women, who had the higher incidence rates, the percentage was only 0,13%[26].These findings highlight the importance of BC screening programs and of making efforts to compensate for the number of missed mammograms due to the COVID-19 pandemic. Still, when discussing BC screening, another aspect that should be accounted for is weighing the benefits of early detection versus the harms of supplemental screening, such as false-positive results that can lead to increased patient recalls, patient anxiety and false-positive biopsy findings[27].

It is estimated that, in general, 10% of women have predominantly fatty breasts, 40% of women have scattered fibroglandular densities, another 40% have heterogeneously dense breasts, and 10% have extremely dense breasts, meaning that approximately half women have dense breasts[28]. None of the participants diagnosed with BC had predominantly fatty or extremely dense breasts. Considering that these are the least frequent breast density characteristics and the low number of diagnosed women, this result can be considered as expected.

In addition to the increased BC risk that women with high breast density face[6], breast density information is relevant for BC screening because the mammography sensitivity is inversely related to breast density: in women with predominantly fatty breasts it corresponds to 88%, while in women with extremely dense breasts the sensitivity is reduced to only 62%[28]. In line with these results, our data show an increased percentage of inconclusive mammograms among women with heterogeneously dense breasts. The frequency of women in the extremely dense breasts category was too small in our sample to detect any significant difference, as it would be expected. Thus, it may be beneficial to inform patients of their breast densities after a mammography. Besides, when screening women with dense breasts, health care professionals can suggest supplemental screening modalities known to improve breast cancer detection, such as digital breast tomosynthesis (also known as 3-dimensional mammography), breast ultrasonography, molecular breast imaging (a functional nuclear imaging test that uses a tumor-avid radioactive tracer) and magnetic resonance imaging, in addition to counseling breast self-awareness, careful assessment of patient's risk factors for BC and recommendation of digital mammography rather than film mammography, since the digital exam is more accurate[27,28].

One limitation of our study lies in the use of a convenience sample composed only by women who participated in the BCAM campaign. Although our sample shares several characteristics with what was observed in other studies within the Brazilian population, these data should be interpreted carefully. Moreover, our sample size was small and, although the proportion of women diagnosed with BC can be considered high, the absolute number is noticeably limited, which prevented the accomplishment of statistical comparisons. In line with this, we highlight the need for further studies, with higher sample sizes, to better understand the relationship between breast density, BI-RADS classification and BC.

V. Conclusions

In this retrospective observational study, which aimed to describe the sociodemographic and clinical characterization of women who signed up for the BC screening mammography in the Pink October Program, around a third (191/612) had had a mammography longer than 5 years or had never had this exam. Besides, 8/638 (1,3%) cases of BC were detected, being at least one of them metastatic. The observed BC detection rate can be considered high compared to other Brazilian and USA data. Therefore, along with the significant increase in BC morbidity and mortality rates in the past decades, our findings reinforce the importance of measures that favor prevention and early detection of BC, including screening tests. The information contained in this article can be useful in the elaboration of BC programs and policies in Santa Catarina and possibly in other Brazilian regions.

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Conflicts of interest

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