

Impact of coronavirus disease 2019 pandemic on breast cancer screening and detection of high-risk mammographic findings

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SUMMARY

OBJECTIVE: The coronavirus disease 2019 pandemic has disrupted cancer screening worldwide. This study aims to analyze the changes in the rates of screening mammograms and BIRADS 4 or 5 mammograms during the coronavirus disease 2019 pandemic in the opportunistic scenario.

METHODS: We integrated three different public databases from the state of São Paulo, Brazil, to obtain the rate of screening mammograms per 1,000, and the rate of BIRADS 4 or 5 mammograms per 100,000 women aged from 50 to 69 years in the years from January 2017 to December 2020.

RESULTS: The mean monthly screening mammograms decreased from 14.8/1,000 in 2019 to 9.25/1,000 in 2020, with the lowest rates being recorded in May 2020 (3.1/1,000). The mean monthly high-risk mammograms decreased from 12.8/100,000 in 2019 to 9.1/100,000 in 2020, with the lowest rates being recorded in April 2020 (4.3/100,000).

CONCLUSIONS: Coronavirus disease 2019 pandemic significantly decreased mammography screening in an opportunistic scenario, a warning sign for decreasing diagnosis of breast cancer in early stages, and increasing advanced stage diagnosis and mortality in the future.

KEYWORDS: Breast neoplasms. Early detection of cancer. COVID-19. Mammography.

INTRODUCTION

In December 2019, in Wuhan, China, an epidemic of a pneumonic viral disease named coronavirus disease 2019 (COVID-19) began. The novel coronavirus (SARS-CoV-2) presents rapid interpersonal spread and may cause severe acute lung injury^{1,2}. In Brazil, the first COVID-19 case was reported in the city of São Paulo in March 2020³. Based on the international recommendations, the state government adopted social distancing measures and prioritized health resources to face the pandemic^{4,5}. These policies and the general fear of the population in seeking healthcare have lowered breast cancer screening^{6,7}.

Interruption of mammographic screening, even for a short period, may result in lower diagnosis of early-stage cancers and a higher risk of mammographic findings in the future, leading to an overload on the healthcare system, with demands of diagnosis and treatment procedures^{8,9}. The Brazilian Ministry of Health has an early detection breast cancer program for women aged from 50 to 69 years and recommends mammographic screening for every 2 years. The program is opportunistic; therefore, women are not invited to participate. They need to seek healthcare to have their examinations performed¹⁰. In this

context, we proposed to evaluate the impact of the COVID-19 pandemic in the state of São Paulo, considering overall and high-risk finding (BI-RADS 4 and 5) rates.

METHODS

Study design

We performed a retrospective and descriptive study of public records, using data available in the following databases: Cancer Information System (SISCAN), The Brazilian Institute of Geography and Statistics (IBGE), and The Supplementary Health National Agency (ANS). We extracted data on the number of screening mammograms in the public health system (SUS) among women aged from 50 to 69 years, in each city of the state of São Paulo, from January 2017 to December 2020. In addition, we obtained the numbers of BIRADS 4 or 5 mammograms. We also obtained data of the female resident in each city and the female population with private health insurance. This manuscript follows the STROBE guideline.

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Ethics approval and consent to participate

Research that involves exclusively the public domain data and does not identify research participants does not need ethical approval. We followed the Declaration of Helsinki.

Data source and variables

Cancer Information System is a public database that contains information regarding all mammograms performed in the SUS. We extracted tables with the number of screening mammograms of women aged between 50 and 69 years, from January 2017 to December 2020, in all the cities of the state of São Paulo (<http://tabnet.datasus.gov.br/>).

The IBGE system contains public information about population census and expected population. We extracted tables with the female expected annual population, aged from 50 to 69 years, in all the cities of the state of São Paulo in the years from 2017 to 2020 (<https://www.ibge.gov.br/>).

The ANS system contains information about the private health system in Brazil. We extracted tables with the annual female population having private health insurance, aged from 50 to 69 years, in all the cities of the state of São Paulo in the years from 2017 to 2020 (<http://www.ans.gov.br/anstabnet/index.htm>).

The target women population, female users of the SUS, aged between 50 and 69 years, was obtained by subtracting the users of the private health system from the estimated total population in the same age interval.

The state of São Paulo has 17 Regional Health Departments (RHDs). The monthly screening mammograms per 1,000 target women and BIRADS 4 or BIRADS 5 mammograms per 100,000 target women were grouped by RHD.

Statistical analysis

We carried out the statistical analysis using the software R version 4.1.1 (2021-08-10). There were no missing data. We used the chi-square test to compare the changes in insured and public system users from 2017 to 2020, time-series graphical analyses to evaluate the changes in the monthly rate of screening mammograms, and a heatmap to evaluate the impact of the COVID-19 pandemic across the RHDs.

RESULTS

Table 1 summarizes the target population for breast cancer screening in the state of São Paulo from 2017 to 2020. The estimated women population, aged from 50 to 69 years, dependent on the public health system was 64% of the total

Table 1. Distribution of women population aged between 50 and 69 years in the São Paulo state from 2017 to 2020.

Year	Private system	Public system	Total
2017	1,737,588	3,053,427	4,791,015
2018	1,737,196	3,171,960	4,909,156
2019	1,739,061	3,283,524	5,022,585
2020	1,745,572	3,386,350	5,131,922

in 2017 and increased to 66% in 2020 (X-squared = 6,183.2, df = 3, $p < 0.0001$).

The mean monthly screening mammograms per 1,000 target women was 12.5 in 2017, 13.3 in 2018, 14.8 in 2019, and 9.25 in 2020. Figure 1A shows the time-series representation of the monthly rate throughout this period. April 2020 (3.4/1,000) and May 2020 (3.1/1,000) had the lowest rates.

Figure 1B shows the time series for high-risk mammograms per 100,000 target women. The monthly mean of BIRADS 4 or BIRADS 5 per 100,000 women was 8.1 in 2017, 11.2 in 2018, 12.8 in 2019, and 9.1 in 2020. In April 2020, the rate was 4.3/100,000, and in May 2020, the rate was 4.8/100,000.

Figure 2 shows the monthly distribution of screening mammograms per 1,000 women aged between 50 and 69 years across the 17 departments of health in the state of São Paulo from 2017 to 2020. Mammographic coverage was heterogeneous, but there was a substantial decrease in all health departments in April and May 2020.

DISCUSSION

We observed a substantial reduction in the rates of screening mammograms and results of high-risk mammogram in the state of São Paulo with the onset of COVID-19 pandemic. The decrease in the rates occurred across the entire state. The rates slowly increased; however, there was no compensation for the initial decrease. This behavior may result in an increase in the rate of advanced tumors in the following months.

The strength of our study was the large number of mammograms analyzed in a well-defined scenario. As we used population-based datasets, the main limitations were selection bias and the impossibility of analyzing non-reported confounding variables.

In Brazil, breast cancer screening is opportunistic. Several authors discuss the differences between organized and opportunistic breast cancer screening programs. Organized screening programs have higher attendance and rate of detection of in situ breast cancer screening^{11,12}. There are several barriers

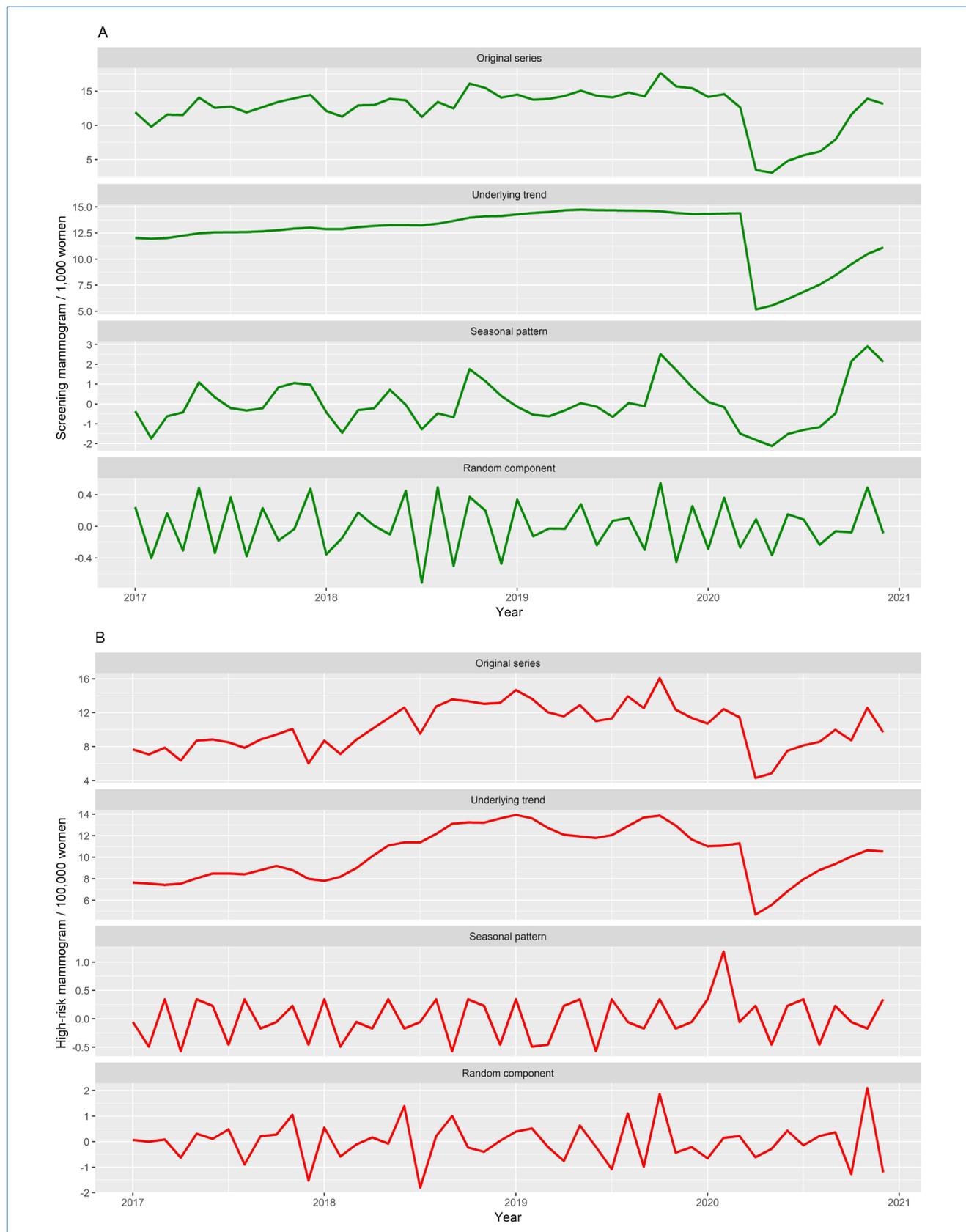


Figure 1. Time-series analysis of the monthly rate of screening mammograms (A) and high-risk mammograms (B) in the state of São Paulo from 2017 to 2020, showing a substantial decrease in April and May 2020.

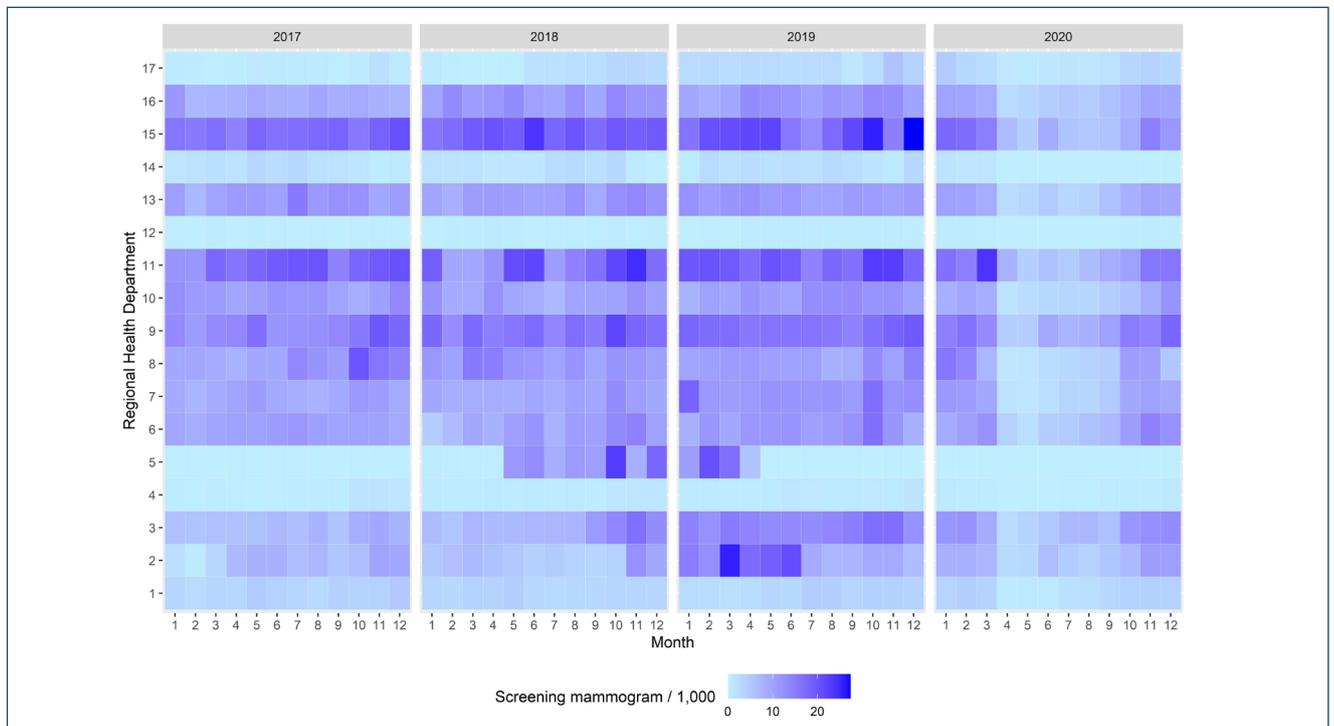


Figure 2. Heatmap of the monthly screening mammograms in the São Paulo state from 2017 to 2020.

to access to mammographic services in developing countries, such as travel distance, educational, financial, and social inequalities^{13,14}. Also, in an opportunistic screening scenario, patient behavior is determinant for mammographic screening coverage. Many women, especially those assisted by the public health system, receive a mammography recommendation after visiting a physician and trust their doctors know the best time to request screening^{10,15,16}. Health assistance disruptors, such as those from COVID-19 pandemic, make the weakness of an opportunistic breast cancer screening more evident. Even for a short period, the reduction in screening mammograms can reduce breast cancer diagnosis in the early stages and thus increase mortality^{8,9}.

We also noted a reduction in screening mammograms with BIRADS 4 or 5 results. This fact, associated with the screening mammograms returning only to pre-pandemic levels, suggests that a more significant number of mammograms with high-risk findings may appear in the future, with the potential to overload the public health system with demands of diagnosis procedures, such as biopsies¹⁷. Our results are similar to data previously reported in Southern Taiwan and Northern Italy^{18,19}. Millions of breast cancer cases are diagnosed through breast screening in the world every year, and the reduction of screening may also increase mortality^{7,20}. Some authors warn for a potential increase in advanced-stage

breast cancers and mortality in the next decade related to the time of screening interruption^{9,21}.

New waves of COVID-19 may occur in the following months. Moreover, disruptors of health assistance may happen in the future by other causes. Health systems must be prepared to maintain screening programs in such a situation and avoid increasing advanced-stage breast cancer and mortality.

In conclusion, we reported a substantial reduction in mammographic screening related to the COVID-19 pandemic, which happened in all regional health departments in the state of São Paulo. However, the volume of mammograms is returning to pre-pandemic levels, but it is not enough to compensate for the disruption. We may have an increase in advanced-stage breast cancer diagnosis and even mortality in the following years.

AUTHORS' CONTRIBUTIONS

NJWMJ: Data curation, Formal Analysis, Investigation, Writing – review & editing. **VCM:** Validation, Writing – review & editing. **LBBGM:** Data curation, Validation, Writing – review & editing. **FFP:** Data curation, Validation, Writing – review & editing. **FJCR:** Conceptualization, Formal Analysis, Funding acquisition, Methodology, Supervision, Writing – original draft.

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