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Breast reconstruction during the COVID-19 pandemic: Single institution experience from the pandemic's epicenter in the United States

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KEYWORDS

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Summary Introduction: The coronavirus disease-19 (COVID-19) pandemic dramatically changed the delivery of breast cancer care. The objective of this study was to quantify the effect of the pandemic on breast cancer screening, treatment, and reconstruction at a single institution in New York City.

Methods: A retrospective chart review was conducted to determine the number of mammograms, lumpectomies, mastectomies, and breast reconstruction operations performed between January 1, 2019 and June 30, 2021. Outcomes analyzed included changes in mammography, oncologic surgery, and breast reconstruction surgery volume before, during and after the start of the pandemic.

Results: Mammography volume declined by 11% in March-May of 2020. Oncologic breast surgeries and reconstructive surgeries similarly declined by 6.8% and 11%, respectively, in 2020 compared with 2019, reaching their lowest levels in April 2020. The volume of all procedures increased during the summer of 2020. Mammography volumes in June and July 2020 were found to be at pre-COVID levels, and in October-December 2020 were 15% higher than in 2019. Oncologic breast surgeries saw a similar rebound in May 2020, with 24.6% more cases performed compared with May 2019. Breast reconstruction volumes increased, though changes in the types of reconstruction were noted. Oncoplastic closures were more common during the pandemic, while two-stage implant reconstruction and immediate autologous reconstruction decreased by 27% and 43%, respectively. All procedures are on track to increase in volume in 2021 compared to that in 2020.

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Conclusion: The COVID-19 pandemic reduced the volume of breast cancer surveillance, surgical treatment, and reconstruction procedures. While it is reassuring that volumes have rebounded in 2021, efforts must be made to emphasize screening and treatment procedures in the face of subsequent surges, such as that recently attributable to the Delta and Omicron variants.

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Introduction

The coronavirus disease-19 (COVID-19) pandemic has had a profound impact on the medical community both nationally and internationally. Screening, detection, and treatment for cancer faced numerous challenges and delays across the United States and world.¹ These effects were apparent in the detection, diagnosis, and management of breast cancer. Faced with persistent news and threats of the spread and infectivity of COVID-19 across a wide array of media outlets, analyses revealed reduced public interest in cancer screening during the COVID-19 pandemic.² The effects of this are presumed to extend far beyond the initial peaks of the pandemic, as predictive modeling has suggested that delays in breast cancer screening, diagnosis, and treatment will lead to increases in subsequent breast cancer mortality over the ensuing decade.³

Our institutional experience is unique given the both the size of the population served in New York City and that our hospital was located in the epicenter of the COVID-19 pandemic in the United States. This included a strict month-long moratorium on elective consultations, imaging, procedures, and surgeries to preserve healthcare resources and divert personnel and attention to caring for patients with COVID-19.⁴

It is critically important to understand how screening delays created by the COVID-19 pandemic may affect both short- and long-term oncologic outcomes for patients with breast cancer. Furthermore, it is important to characterize how these delays affected breast reconstruction in these patients. With the previous threat of the COVID-19 Delta variant and now looking to the looming Omicron variant causing surging case numbers both globally and domestically, any insights that may be gleaned from the initial wave of COVID-19 may provide utility in determining safe mechanisms to continue breast cancer screening, treatment, and both oncologic and reconstructive breast surgery. The objective of this study was to quantify the effect of the COVID-19 pandemic on breast cancer screening, primary oncologic breast operations, and subsequent breast reconstruction practices at a single institution at the epicenter of the pandemic.

Methods

A retrospective review of a single institution, large academic center was performed to identify all mammograms, lumpectomies, mastectomies, and breast reconstruction operations performed from January 1, 2019 to June 30, 2021. Mammogram, lumpectomy, and mastectomy data were extracted from an institutional database within the

electronic health record to determine the number of each of these imaging studies and procedures performed at the institutional level. Furthermore, all index breast cancer operations that involved plastic surgery were recorded by review of the operating room schedules. Only reconstructive procedures performed in conjunction with an initial breast cancer operation were recorded to provide consistency throughout the study interval. The predominant source of referrals for our breast reconstructive surgeons is derived from within the same institution.

Wilcoxon signed-rank tests were used to compare the number of total number of mammograms, oncologic, and reconstruction cases between March and May for 2019 vs. 2020, 2019 vs. 2021, and 2020 vs. 2021. The number of oncoplastic closures was also compared in the aforementioned way. SPSS Version 25 (IBM Corp., Armonk, NY) was used to perform statistical analyses and $p < 0.05$ was considered statistically significant.

Results

A total of 180,813 mammograms were performed at our institution in 2019 and 160,343 in 2020, representing an 11.3% decline. In the first 6 months of 2021, there have been 87,343 mammograms, with the institution on pace to complete 174,686 for the entire year. Comparing the first 6 months of each year, there was a 36.0% decline from 2019 to 2020, but the volume of mammography in 2021 nearly returned to pre-COVID-19 levels (0.8% difference). The most precipitous decrease in mammography occurred in March, April, and May of 2020. The number of mammograms performed in April 2020 was 95.5% lower than April 2019. June and July 2020 saw mammograms being performed at levels similar to those pre-COVID-19. October, November, and December 2020 had 114.7% of the mammogram volume of those same 3 months in 2019. This increase in volume continued into the first 3 months of 2021, as January, February, and March saw 9.4% increase in volume compared with pre-COVID-19 levels (Figure 1).

The total number of oncologic breast surgeries performed within our institution was 742 in 2019 and 691 in 2020, representing a 6.9% decrease in volume. In the first half of 2021, there have been 400 surgeries performed and with a pace of 800 total cases being completed by year end 2021. Across the first 6 months of each calendar year, there was a 14.5% reduction in cases from 2019 to 2020, accompanied by a complete return to pre-COVID-19 levels in 2021. The lowest level of oncologic breast surgeries performed was in April 2020. Interestingly, May 2020 saw 24.6% more cases than pre-COVID-19 in May 2019 (Figure 2).

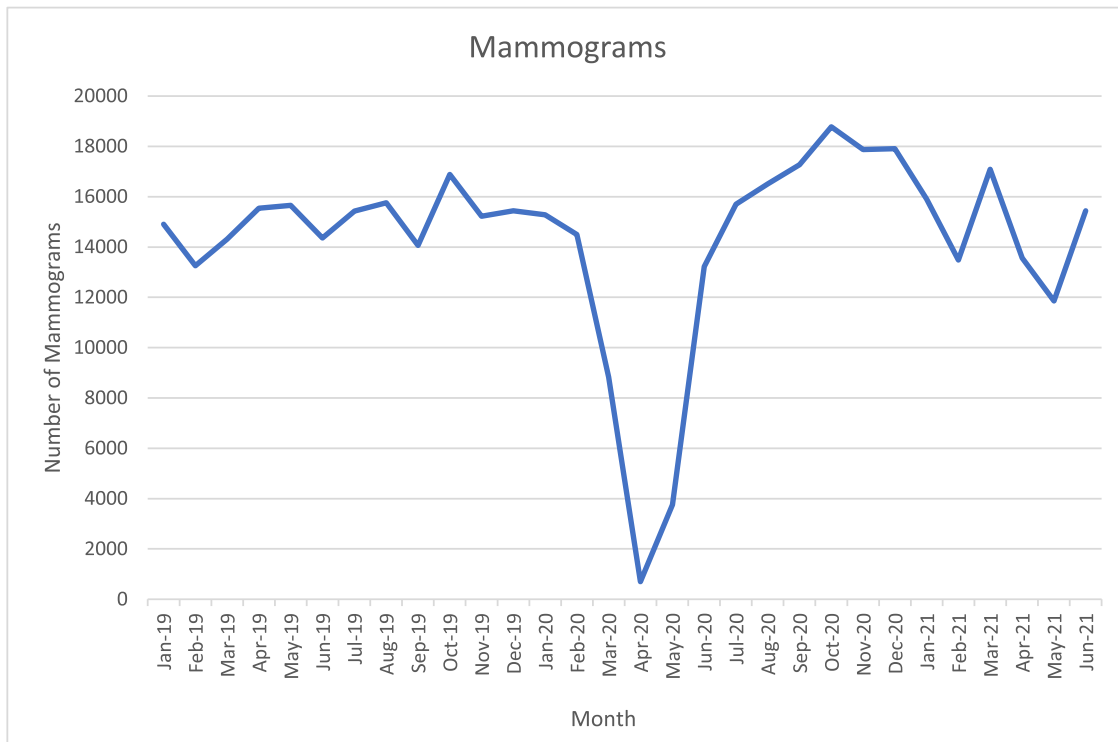


Figure 1 Monthly number of mammograms performed across a single institution from January 2019 to June 2021. Mammograms performed dramatically declined from March to May 2020.

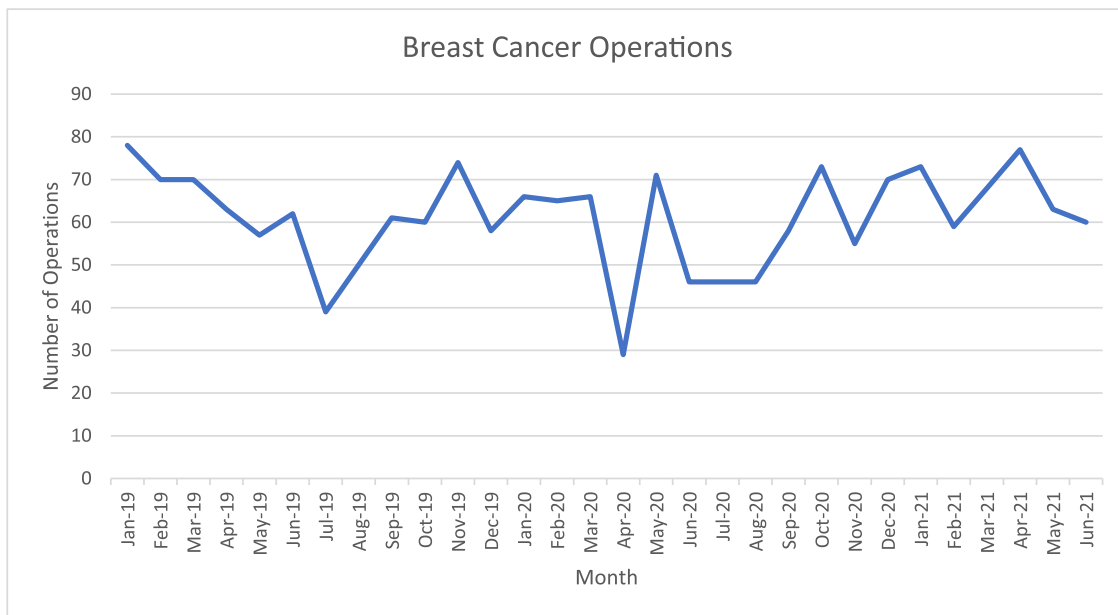


Figure 2 Monthly number of lumpectomies and mastectomies performed across a single institution from January 2019 to June 2021.

There were a total of 320 index breast reconstructive surgeries performed in 2019. In 2020, there was a 10.9% decline in volume (285 cases). In the first 6 months of 2021, 153 index breast operations have been performed with a pace of 306 for the year which represents a 7.4% increase from the 2020 level (Figure 3). The fewest number of breast reconstruction cases performed was in April

2020 (nine cases). During this 30-month timespan, the highest number of breast reconstruction cases were performed in the month immediately following the peak of the pandemic in New York City, May 2020 (38 cases). The types of breast reconstructive cases changed drastically from 2019 to 2020. Oncoplastic closures of mastectomy and lumpectomy defects rose 62.5% in volume from 2019 to 2020. Im-

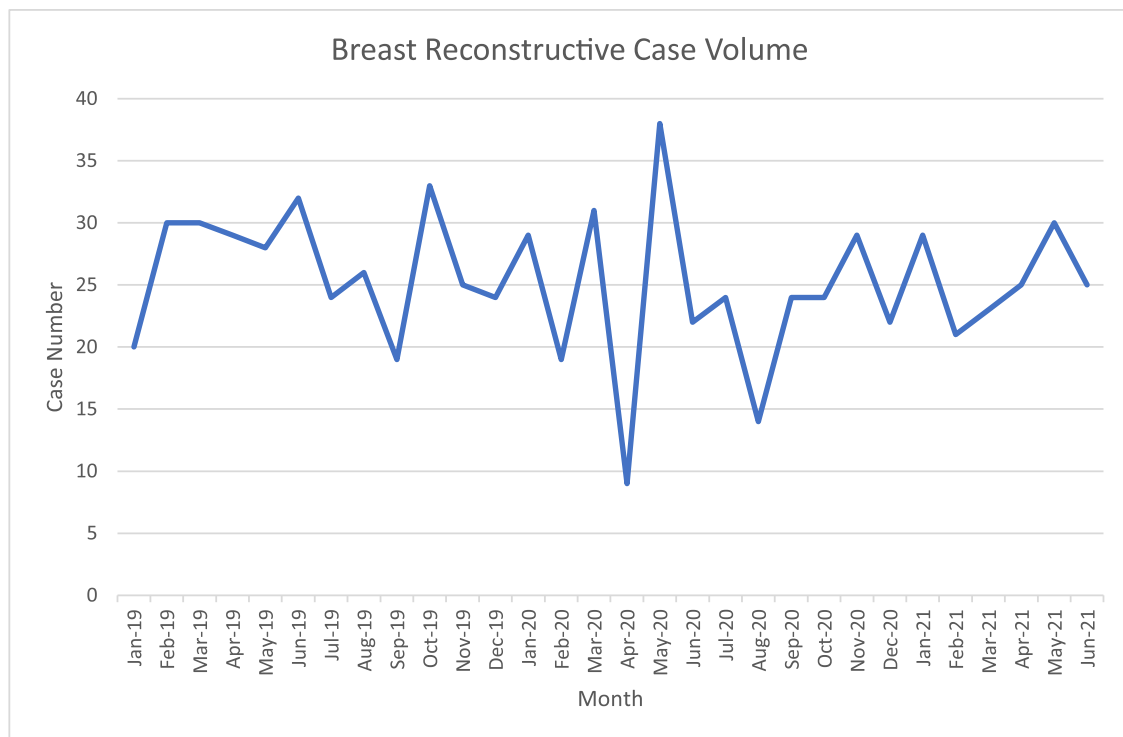


Figure 3 Number of breast reconstruction cases performed across a single institution from January 2019 to June 2021. The lowest level of volume was observed in April 2020 and the highest volume of cases was observed in the subsequent month, May 2020.

Table 1 Details of breast reconstructive cases performed.

Variable	2019	2020	2021 (2021 Projection)
Type of Reconstruction			
Autologous	70	40	21 (42)
Closure	56	91	47 (94)
Tissue Expander	159	116	62 (124)
Direct to Implant	33	34	22 (44)
Latissimus	2	4	1 (2)
Closures			
Mastectomies	12	18	17 (34)
Lumpectomies	44	73	30 (60)
Direct	23	57	22 (44)
Oncoplastic reduction	19	16	11 (22)
Laterality			
Unilateral	134	140	81 (162)
Bilateral	186	145	72 (144)

mediate autologous breast reconstruction declined by 42.9% and tissue expanders placement decreased by 27% across this same timeline. The proportion of cases in 2021 are similar to 2020 levels, with the exception of direct to implant reconstruction on pace to increase by 29.4% (Table 1).

There was no significant difference in the number of mammograms, breast cancer surgeries, and breast reconstruction cases performed between March and May in 2019, 2020, and 2021 ($p > 0.05$ for all pairwise comparisons). With respect to the type of breast reconstruction performed, there were no significant differences in the number of oncoplastic closures performed ($p > 0.05$ for all pairwise comparisons).

Discussion

Given the drastic nature of the COVID-19 pandemic in New York City, this study sought to quantify the impact of the COVID-19 pandemic on breast cancer screening, surgical treatment, and reconstruction at a single institution. As many parts of the country and world are beginning to reduce and cancel elective surgical cases secondary to the rapid spread of the Delta variant, this study hopes to provide insight as to the ramifications of these policies on patients with breast cancer. Furthermore, given the Omicron variant's high transmissibility, subsequent moratoriums on elective surgeries may occur in the near future.

The largest decline in mammography took place in March, April, and May 2020. This timeframe corresponded to the peak wave of the pandemic in New York City. A statewide state of emergency was declared on March 7, 2020. Social distancing protocols and government mandated stay home orders soon followed. The close correlation of the decline in mammography with the surge of COVID-19 cases suggests an immense impact of the COVID-19 pandemic on breast cancer screening at our institution. With such a decline in breast cancer screening, there was concern that many patients may have delay in detection and subsequent treatment of breast cancer. This finding is corroborated nationally by a recent survey of 77 breast imaging centers, nearly, 100% of facilities reported reduced capacity and complete closures during the COVID-19 pandemic. Furthermore, diagnostic studies were prioritized over screening mammography.⁵ Interestingly, the 11% decline in mammography observed at our institution is less than the near 90% decline observed nationally.⁶

As the vaccine emerged and New York City cautiously reopened, mammography surged in the last quarter of 2020, up to 13% from volume at our institution before the COVID-19 pandemic. The first quarter of 2021 likewise saw a nearly 10% increase in breast imaging compared with pre-COVID-19 vol. Given the backlogs and high volume of patients behind on screening and diagnostic breast studies caused by the COVID-19 pandemic, there appears that there was a noticeable “catch-up” phenomenon observed. Given the delay in screening and diagnosis, it will be interesting to observe if patients present with more advanced breast pathologies in the ensuing months.

Mastectomy and lumpectomy volume decreased 6.8% in 2020 compared with 2019. At our institution, there was a 30-day moratorium on elective operative procedures in which no breast surgeries were performed from late March through late April. The purpose of this policy was to preserve healthcare resources for patients hospitalized with COVID-19 and limit both patient and surgical team risk of transmission of the virus. Furthermore, the breast surgery and plastic surgery teams at our institution were diverted to care for patients with COVID-19. Once elective cases were permitted, there was a stark increase in the volume of oncologic breast surgeries performed in May 2020. There was a clear objective to treat as many patients as possible that had postponed or canceled cases secondary to hospital policies directed at preserving resources and focusing on critically ill patients with COVID-19. Garcia and colleagues suggest that delays in surgical treatment of just 4 weeks for both ductal carcinoma in situ and invasive breast cancer are associated with adverse oncologic outcomes with up to a 10% increase in mortality.^{7,8} In the event that the COVID-19 Delta variant provokes subsequent stay at home mandates and diversion of hospital resources, it is critical for healthcare systems to find innovative mechanisms to maintain breast cancer screening initiatives and treatment while prioritizing patient safety and limiting the spread of COVID-19. As others have noted, breast cancer treatment saw a relatively lower decline in volume compared with mammograms at our institution suggestive that treatment for breast cancer was differentially prioritized over breast cancer screening in the context of severely limited healthcare resources.⁵

Correlating with the decline in breast cancer operations, breast reconstructive procedures also declined in 2020 compared with the 2019 vol. The nadir of breast reconstruction observed in April 2020 was subsequently followed by the highest volume of breast reconstructive cases being performed in May 2020 to address the backlog of case volume. With only 6 months of data, the pace of breast reconstruction cases is nearly on pace to return to pre-pandemic breast reconstruction volume in 2021. Outside of case volume fluctuations, the initial type of breast reconstruction performed also varied amongst our patient population. Operations that require increased contact with healthcare facilities either as an inpatient (autologous breast reconstruction) or outpatient (tissue expander reconstruction) declined markedly during 2020. This finding was likely multifaceted, including preferences from both healthcare teams and patients to limit prolonged exposure to healthcare settings in favor of social distancing protocols. The majority of this volume was diverted to direct closures. While we focused our analysis on index breast reconstructive operations, it would be interesting to further assess whether these patients elect for delayed reconstruction after the resolution of the COVID-19 pandemic.

Worldwide, these phenomena were observed. Several studies compared the results of pre-pandemic breast reconstruction versus rates during the COVID-19 pandemic. In Italy, a study comparing March-April 2020 to March-April 2019, showed that fewer women underwent immediate breast reconstruction during the pandemic.⁹ Another study in Italy demonstrated that among patients who underwent immediate reconstruction, the rate of postoperative hospitalization time and complication rates were similar.¹⁰ In British Columbia, reconstruction was also altered during the COVID-19 pandemic as compared with the same time period in 2019.¹¹ Deep inferior epigastric perforators (DIEP) reconstruction was halted at their institution, however, similar numbers of patients underwent implant-based and transverse rectus abdominis myocutaneous (TRAM) reconstruction, though no statistical analysis was conducted. In Scotland, the rate of breast-conserving therapy was lower during lockdown, however, oncoplastic conservation breast surgery was significantly higher during COVID-19 quarantine as a means of reducing the mastectomy rate. Notably, no immediate reconstruction was performed during the height of the COVID-19 pandemic.

There were no significant differences identified in the volume of mammograms, breast cancer surgeries, and breast reconstruction cases performed in any comparison performed. While there was a 3-month period in 2020 where volume markedly fluctuated compared with 2019 and 2021, subsequent months had an increase in volume offsetting this effect. That there was no significant change in breast cancer screening, treatment, and reconstruction volume is encouraging as it implies that despite the COVID-19 pandemic, patients were still able to receive the oncologic care they needed. Given surges in hospitalizations related to the COVID-19 Delta and Omicron variants through parts of the country and world, it is important that physicians continue to find ways to safely care for patients with breast cancer.

This study is limited by its retrospective design in addition to the reliance on institutional databases for mammogram and mastectomy data. Errors in coding may inad-

vertently affect the number of studies or cases observed. Furthermore, this study relies on a single institution experience and findings may not be well generalized to other institutions, particularly those differentially affected by the COVID-19 pandemic. Short-term oncologic outcomes and reconstructive outcomes were not assessed in this study as there was inadequate time to appropriately assess follow-up in these patients at the time of review. Subsequent analysis is crucial to analyze the impact of the COVID-19 pandemic and associated delays in care on the short- and long-term oncologic and reconstructive outcomes in these patients. This study is also limited by the time period in the study cohort (2.5 years). This interval may be inadequate to appropriately illuminate the complete effect of the pandemic on breast cancer screening, surgery, and reconstruction, particularly given the ongoing nature of the pandemic. Long-term assessment of these trends will eventually be required. However, this initial report is important for informing providers and patients to equip them with this information for addressing subsequent surges in COVID-19 cases across the country and world.¹²

Conclusions

The COVID-19 pandemic significantly reduced the volume of breast cancer screening, breast cancer surgeries, and breast reconstructive cases. However, volume quickly returned to pre-pandemic levels after a nadir in April 2020. As subsequent surges of COVID-19 cases may continue to affect the healthcare communities, a collaborative effort must be made to minimize the risks of delayed detection and treatment of breast cancer and the psychosocial impact of deferred breast reconstruction.

Ethical approval

This study was conducted with approval from the institutional review board.

Conflict of Interest

None.

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