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Featured Article

Impact of the COVID-19 breast cancer screening hiatus on clinical stage and racial disparities in New York City

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ABSTRACT

Background: The impact of the COVID-19 mammography screening hiatus as well as of post-hiatus efforts promoting restoration of elective healthcare on breast cancer detection patterns and stage distribution is unknown.
Methods: Newly diagnosed breast cancer patients (2019–2021) at the New York Presbyterian (NYP) Hospital Network were analyzed. Chi-square and student's *t*-test compared characteristics of patients presenting before and after the screening hiatus.
Results: A total of 2137 patients were analyzed. Frequency of screen-detected and early-stage breast cancer declined post-hiatus (59.7%), but returned to baseline (69.3%). Frequency of screen-detected breast cancer was lowest for African American (AA) (57.5%) and Medicaid patients pre-hiatus (57.2%), and this disparity was reduced post-hiatus (65.3% for AA and 63.2% for Medicaid).
Conclusions: The return to baseline levels of screen-detected cancer, particularly among AA and Medicaid patients suggest that large-scale breast health education campaigns may be effective in resuming screening practices and in mitigating disparities.

1. Introduction

Due to the surge of COVID-19 cases in March of 2020 in the United States, a several months-long hiatus was placed on elective healthcare such as screening mammography programs in support of shelter-in-place mandates and diversion of medical resources to pandemic management.[1–3]

Negative effects of the pandemic have been disproportionately severe on minority racial/ethnic communities, and these socioeconomic effects coupled with the cancer screening hiatus have been projected to worsen pre-existing disparities in cancer outcomes.[4,5] Pandemic severity was extensive in metropolitan New York, necessitating some of the strictest and lengthiest shelter-in-place mandates. New York-based hospital networks therefore implemented large-scale public education campaigns to promote resumption of routine health maintenance, such as cancer screening, following lifting of the restrictions. We sought to evaluate the impact of the restrictions and post-hiatus healthcare promotion efforts on breast cancer detection patterns and stage distribution in a large metropolitan New York healthcare system serving the diverse communities of Manhattan, Queens, and Brooklyn.

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2. Material and methods

2.1. Patient population

This retrospective analysis was approved by the Weill Cornell Medicine (WCM) institutional review board. For this type of study no formal consent was required. This database and its analysis were performed with the ethical standards of the institutional research committee and the Helsinki declaration.

All patients with a new diagnosis of breast cancer discussed at multidisciplinary tumor board conferences (MDC) across the New York Presbyterian (NYP) network from January 1, 2019 to June 30, 2021 were evaluated. The three network sites include New York Presbyterian – Weill Cornell Medical Center in Manhattan, New York Presbyterian Brooklyn Methodist Hospital (BMH) in Brooklyn, and New York Presbyterian Queens (NYPQ). MDC cases are representative of non-metastatic newly diagnosed breast cancer cases at each site and occur on a weekly or biweekly basis. While metastatic breast cancer cases typically are not discussed, these cases are much less frequently screen-detected. Of note, BMH MDC meetings were implemented in January 2020; therefore, BMH data from 2019 was excluded from this analysis.

The New York City mammography screening hiatus was implemented from March 15, 2020 to June 15, 2020. Patients were therefore stratified into two intervals based upon date of diagnosis. Pre-hiatus interval cases included patients diagnosed between January 1, 2019 and March 14, 2020; post-hiatus patients were diagnosed between June 16, 2020 and June 30, 2021.

The NYP hospital network launched a large-scale "Welcome Back Safely" campaign following lifting of the hiatus as a strategy to restore public confidence in resuming routine health maintenance practices while continuing to comply with social distancing measures.[6] Additionally, the NYP network hosted 246 cancer awareness events across the enterprise, including 165 health education events and 53 screening events. Of note, these events included 50 bilingual events in English and Spanish, 38 events in Spanish only, and 4 events in Chinese. We therefore also sought to examine trends in breast cancers diagnosed during three sequential short-term periods within the post-hiatus interval. The timeframes for these three intervals were chosen to distribute the number of days in each evenly.

(i) post-hiatus I: June 16, 2020–October 31, 2020;
(ii) post-hiatus II: November 1, 2020–February 28, 2021; and
(iii) post-hiatus III: March 1, 2021–June 30, 2021.

Patients were eligible for inclusion if they presented with a new diagnosis of stage 0-III breast cancer and were presented at MDC. Clinical information regarding patient age at diagnosis, self-reported race/ethnicity, insurance status, date of diagnosis (defined as date of biopsy-proven malignancy), mode of detection (mammography screen-detected or MRI screen-detected), and clinical T and N stage were abstracted from the medical record. Self-reported race and ethnicity data were utilized to categorize patients into five racial groups to evaluate for disparities: Asian American (AS), non-Hispanic white (NHW), African American/Black (AA), Hispanic/LatinX (HISP), and Other (OTH). Patients in the OTH category included patients who self-reported as Other (67.49%), Multiracial (3.94%), or biracial (28.57%).

2.2. Statistical analysis

Statistical analyses were performed to compare clinical and demographical characteristics of patients presenting prior to and after the breast cancer screening hiatus. Additionally, patients were stratified by self-reported race and insurance status to investigate disparities. Chi-square test was used to compare categorical variables and student's *t-test* was done for continuous variables. All analyses were carried out utilizing Stata IC 16.1 (StataCorp, College Station, TX).

3. Results

A total of 2298 unique patients were discussed at MDC across the NYP network from January 1, 2019 to June 30, 2021.11 patients lacked clinical stage, 19 patients presented with locoregional recurrence, and 21 patients were excluded as their self-reported race was unknown (Fig. 1). A total of 1150 patients presented pre-hiatus, and 987 post-hiatus, with 110 patients presenting during the peak of the COVID-19 pandemic from March 15, 2020 to June 15, 2020. The final study population was ultimately comprised of 2137 unique patients presenting before and after the mammography screening hiatus (Fig. 1).

3.1. Impact of the screening hiatus on patient population across the network

Table 1 demonstrates characteristics of patients presenting prior to and after the COVID-19 related mammography screening hiatus ($n = 2317$). Statistically significant differences in frequency by hospital site were noted pre- and post-pandemic ($p < 0.001$); for example, proportion of cases at BMH were 4.17% pre-hiatus and increased to 13.17% post-hiatus reflecting the later establishment of the Brooklyn-based multidisciplinary breast program compared to the other two network sites. The Brooklyn patient population also featured a higher proportion of AA patients, contributing to the overall network-wide increase in AA patients noted from 13.57% pre-hiatus to 17.53% post-hiatus ($p < 0.001$). A borderline significant difference in age was seen with younger patients presenting post-hiatus (59.52 years pre-hiatus vs. 58.53 years post-hiatus; $p = 0.089$). There was also a borderline significant difference in the insurance status of patients with more Medicaid and fewer Medicare patients seen post-hiatus ($p = 0.072$). The proportions of patients with screen-detected breast cancer, early stage (T1) or in situ (DCIS) disease, and node-negative disease was similar in the pre-hiatus and post-hiatus intervals.

3.2. Impact of the COVID-19 screening hiatus on individual network sites

Table 2 demonstrates the impact of the COVID-19 screening hiatus on patient populations at each of the three network sites. Site specific differences are seen regarding self-reported race, with BMH seeing the largest percentage of AA patients both pre- and post-hiatus (56.3% pre and 54.6% post) and NYPQ seeing the largest population of AS patients pre- and post-hiatus (44.3% pre and 45.5% post). Manhattan and Queens also observed differences in the distribution of patients by race, driven largely by an increase in OTH patients post-hiatus (3.7% pre vs. 8.4% post at WCM and 15.5% pre vs. 23.1% post at NYPQ); however, this was only statistically significant at Manhattan. There was no significant change after the hiatus with respect to payor status within each individual site. The Manhattan site had the lowest proportion of Medicaid patients both pre- and post-hiatus (11.0% and 13.3% at WCM v. 29.2% and 21.5% at BMH, 21.1% and 29.5% at NYPQ). Notably, the Queens site was comprised of more Medicaid patients overall compared to Manhattan but maintained a very high rate of screen-detected breast cancer (74.4% pre and 77.3% post). Over time, only BMH displayed a significantly increased percentage of patients with screen-detected disease (35.4% pre v. 63.8% post; $p < 0.001$) after the hiatus, as well as an increase of T1 breast cancer (27.1% pre v. 43.1%; post $p = 0.052$) and a significant increase in clinically node-negative patients (64.6% pre v. 84.6% post; $p = 0.003$). The Brooklyn-based patterns, however, reflect a relatively small overall volume of breast cancer patients seen in the pre-hiatus interval due to the initiation of its multidisciplinary breast program only a few months prior to the start of the hiatus.

3.3. Disparities in screen-detected breast cancer

Table 3 demonstrates the percentage of patients with screen-detected breast cancer before and after the screening hiatus stratified by race,

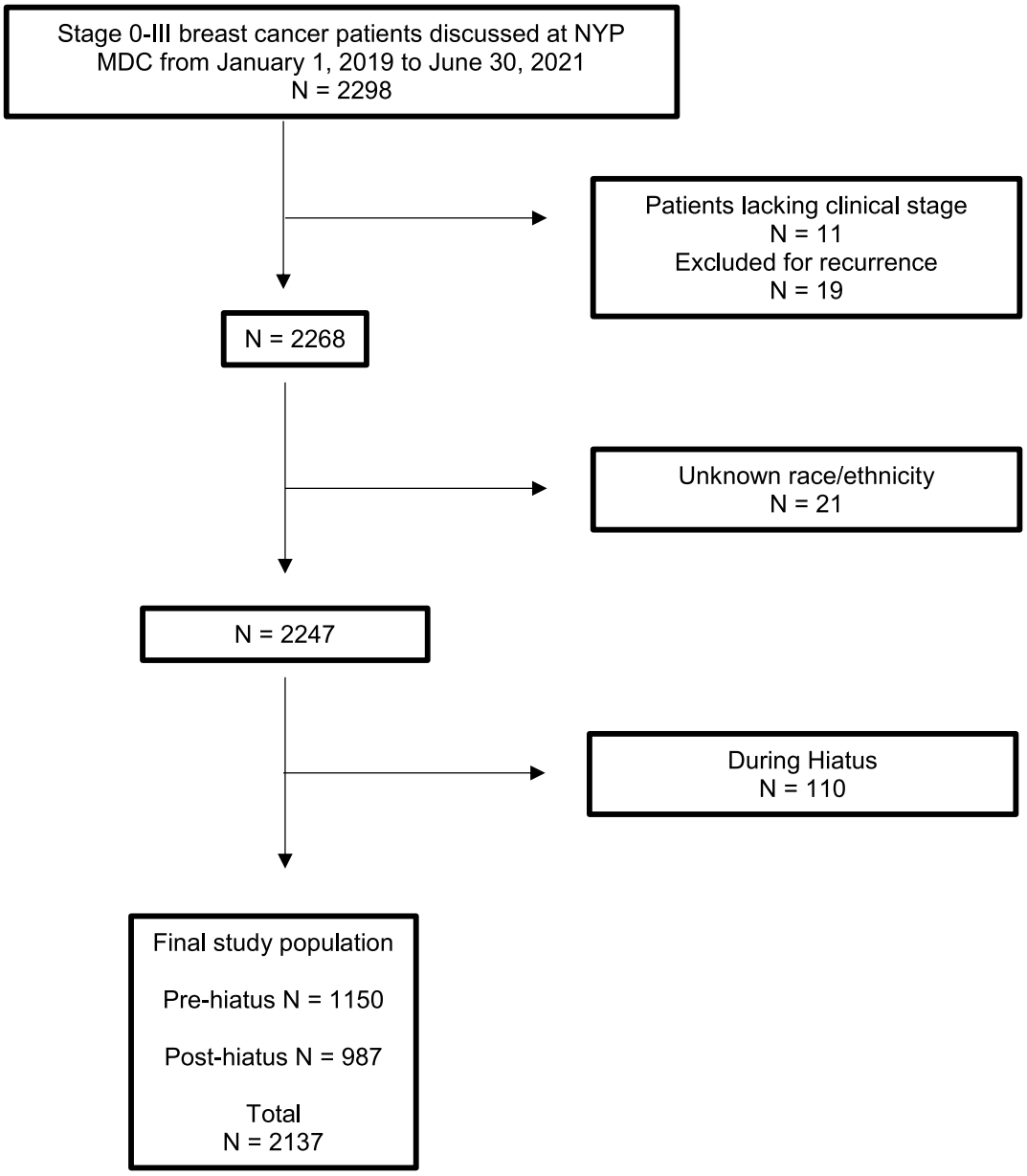

Fig. 1. Patient inclusion and reasons for exclusion.

location, and insurance status. Across all race groups, AA patients had the lowest percentage of screen-detected breast cancers pre-hiatus (57.7% v. 69.2% NHW, 63.9% HISP, 67.3% AS, and 72.4% OTH); this proportion increased in the post-hiatus interval, becoming comparable to the rates observed in the other groups, although these differences were not statistically significant. Similarly, Medicaid patients had less screen-detected disease pre-hiatus, but this percentage improved post-hiatus ($p = 0.24$). NYPQ consistently had higher proportions of screen-detected patients compared to the other sites both pre- and post-hiatus.

3.4. Comparison of patients during post-hiatus intervals

Fig. 2 displays patients presenting after the mammography screening hiatus was lifted, stratified by post-hiatus interval. The percentage of screen-detected breast cancers was lowest during the immediate interval after the screening hiatus (June 16, 2020–October 31, 2020) and gradually returned to baseline over the ensuing intervals (Post-hiatus I: 59.7%; Post-hiatus II: 69.4%; Post-hiatus III: 69.3%; $p = 0.009$). This pattern correlated with rising proportions of patients presenting with T1 tumors (Post-hiatus I: 46.1%; Post-hiatus II: 53.8%; Post-hiatus III: 58.5%; $p = 0.006$) and node-negative disease (Post-hiatus I: 84.2%; Post-hiatus II: 89.7%; Post-hiatus III: 89.5%; $p = 0.043$); however, the proportion of patients presenting with in situ disease remained relatively stable over time (Post-hiatus I: 21.9%; Post-hiatus II: 25.9%; Post-hiatus III: 21.3%; $p = 0.32$) (Fig. 2).

3.5. Disparities in screen-detected breast cancer by insurance status

Table 4 demonstrates the percentage of patients with screen-detected breast cancer stratified by insurance status. Overall, for all patients regardless of site, more than 60% of NHW patients had screen-detected breast cancer (66.9% at WCM, 63.2% at BMH and 73.6% at NYPQ). At NYPQ, more than 70% of patients had screen-detected breast cancer regardless of race (73.6% for NHW, 78.4% for AA, 86.0% for HISP, 75.2% for AS, and 72.3% for OTH). At BMH, patients had relatively low (<60%) rates of screen-detected disease regardless of race, except for NHW and OTH; however, only 7 patients were in the OTH category for

Table 1
Patients presenting across the NYP network before and after the COVID-19 related mammography screening hiatus (Pre-hiatus defined as date of diagnosis from January 1, 2019 to March 14, 2020 and Post-hiatus June 16, 2020 to June 30, 2021); WCM = Weill Cornell Medicine; BMH = Brooklyn Methodist Hospital; NYPQ = New York Presbyterian Queens; NHW = Non-Hispanic White; AA = African American/Black; HISP = Hispanic/LatinX; AS = Asian American; OTH = Other; DCIS = Ductal carcinoma in situ
*p-value reflects comparison of pre-hiatus vs. post-hiatus.

		Overall N = 2137	Pre-Hiatus N = 1150	Post-Hiatus N = 987	p-value*
Location	**WCM n = 1320**	1320 (61.77%)	727 (63.22%)	593 (60.01%)	<0.001
	BMH N = 178	178 (8.33%)	48 (4.17%)	130 (13.17%)	
	NYPQ N = 639	639 (29.90%)	375 (32.61%)	264 (26.75%)	
Race/Ethnicity	**NHW N = 904**	904 (42.30%)	504 (43.83%)	400 (40.53%)	<0.001
	AA N = 329	329 (15.39%)	156 (13.57%)	173 (17.53%)	
	HISP N = 207	207 (9.69%)	122 (10.61%)	85 (8.61%)	
	AS N = 494	494 (23.12%)	281 (24.43%)	213 (21.58%)	
	OTH N = 203	203 (9.50%)	87 (7.57%)	116 (11.75%)	
Mean Age		59.06	59.52	58.53	0.089
Insurance	**Medicaid N = 358**	358 (16.75%)	173 (15.04%)	185 (18.74%)	0.072
	Medicare N = 738	738 (34.58%)	419 (36.34%)	319 (32.32%)	
	Private N = 1035	1035 (48.43%)	555 (48.26%)	480 (48.63%)	
	Other N = 6	6 (0.28%)	3 (0.3%)	3 (0.3%)	
Screen-detected breast cancer N = 1419		1419 (66.40%)	769 (66.87%)	650 (65.86%)	0.62
T1 breast cancer N = 1114		1114 (52.13%)	597 (53.59%)	517 (46.41%)	0.83
DCIS N = 497		497 (23.26%)	269 (23.39%)	228 (23.10%)	0.87
Node-negative N = 1879		1879 (87.93%)	1014 (88.17%)	865 (87.64%)	0.71

Table 2
Impact of the COVID-19 mammography screening hiatus on the three NYP network sites; WCM = Weill Cornell Medicine; BMH = Brooklyn Methodist Hospital; NYPQ = New York Presbyterian Queens; NHW = Non-Hispanic White; AA = African American/Black; HISP = Hispanic/LatinX; AS = Asian American; OTH = Other.

		WCM			BMH			NYPQ		
		Pre-Hiatus N = 727	Post-Hiatus N = 593	p-value	Pre-Hiatus N = 48	Post-Hiatus N = 130	p-value	Pre-Hiatus N = 375	Post-Hiatus N = 264	p-value
Race/ Ethnicity	**NHW N = 904**	419 (57.6%)	337 (56.8%)	0.005	11 (22.9%)	27 (20.8%)	0.98	74 (19.7%)	36 (13.6%)	0.052
	AA N = 329	85 (11.7%)	72 (12.1%)		27 (56.3%)	71 (54.6%)		44 (11.7%)	30 (11.4%)	
	HISP N = 207	86 (11.8%)	57 (9.6%)		3 (6.3%)	11 (8.5%)		33 (8.8%)	17 (6.4%)	
	AS N = 494	110 (15.1%)	77 (13.0%)		5 (10.4%)	16 (12.3%)		166 (44.3%)	120 (45.5%)	
	OTH N = 203	27 (3.7%)	50 (8.4%)		2 (4.2%)	5 (3.8%)		58 (15.5%)	61 (23.1%)	
Insurance	**Medicaid N = 358**	80 (11.0%)	79 (13.3%)	0.27	14 (29.2%)	28 (21.5%)	0.67	79 (21.1%)	78 (29.5%)	0.060
	Medicare N = 738	235 (32.3%)	165 (27.8%)		18 (37.5%)	57 (43.8%)		166 (44.3%)	97 (36.7%)	
	Private N = 1035	410 (56.4%)	347 (58.5%)		16 (33.3%)	44 (33.8%)		129 (34.4%)	89 (33.7%)	
	Other N = 6	2 (0.3%)	2 (0.3%)		0 (0%)	1 (0.8%)		1 (0.3%)	0 (0%)	
Screen-detected breast cancer N = 1419		473 (65.1%)	363 (61.2%)	0.15	17 (35.4%)	83 (63.8%)	<0.001	279 (74.4%)	204 (77.3%)	0.41
T1 breast cancer N = 1114		383 (52.7%)	329 (55.5%)	0.31	13 (27.1%)	56 (43.1%)	0.052	201 (53.6%)	132 (50%)	0.37
Node-Negative N = 1879		643 (88.4%)	516 (87.0%)	0.43	31 (64.6%)	110 (84.6%)	0.003	340 (90.7%)	239 (90.5%)	0.95

BMH. When only Medicaid patients were analyzed, there were no statistically significant differences for each race group by site, except at BMH, where AS patients were less likely to present with screen-detected disease ($p < 0.001$) (Table 4).

4. Discussion

In this study of a large population of breast cancer patients presenting to three academic medical centers across the NYP network during and after the peak of the COVID-19 pandemic, our data document the plummeting of screen-detected disease during the mammography hiatus followed by a gradual recovery to pre-hiatus proportions of screen-detected disease by one year later. We also found no significant shift occurred in the percentage of patients presenting with clinical T1 and node-negative disease after the hiatus was lifted.

We speculate that promotional efforts to encourage patients to resume healthcare routines (including cancer screening) in the post-hiatus period had a favorable impact on decreasing breast cancer disparities, as proportions of mammography screen-detected breast cancers increased among AA and Medicaid patients compared to their pre-hiatus rates, reaching incidence comparable to other subsets. This suggests that breast cancer screening and breast health awareness programs were an effective intervention to reduce disparities in early detection.

However, our results must be interpreted with caution. The COVID-19 related socioeconomic effects were disproportionately severe in the AA community, and it is possible that many of the patients most heavily impacted by the economic toll of the pandemic have yet to return to clinical breast evaluations. Outreach efforts for screening therefore must continue. Our data are also limited by the lack of information on patients presenting with metastatic/Stage IV breast cancer, as our network triages these patients directly to the medical oncology service, while our MDC program focuses on patients presenting with non-metastatic disease.

We also noted interesting patterns regarding patients in the OTH category for racial-ethnic identity, as patients with mixed race/ethnicity were included in this group. As the American population becomes more admixed, it will be increasingly important to evaluate the racial/ethnic identity more precisely, such as by use of Ancestry Informative Markers to quantify ancestral heritage. These germline genetic patterns may provide meaningful clues regarding hereditary susceptibility for breast cancer associated with racial/ethnic identity.

To date, little is known regarding the impact of the COVID-19

Table 3
Percentage of patients with screen-detected breast cancer pre and post-hiatus, stratified by race, location, and insurance status; NHW = Non-Hispanic White; AA = African American/Black; HISP = Hispanic/LatinX; AS = Asian American; OTH = Other; WCM = Weill Cornell Medicine; BMH = Brooklyn Methodist Hospital; NYPQ = New York Presbyterian Queens.

		No. with Screen-Detected Disease (%)		
		Pre-Hiatus	Post-Hiatus	p-value
Race/ Ethnicity	NHW N = 904	349/504 (69.2%)	262/400 (65.5%)	0.23
	AA N = 329	90/156 (57.7%)	113/173 (65.3%)	0.16
	HISP N = 207	78/122 (63.9%)	51/85 (60.0%)	0.57
	AS N = 494	189/281 (67.3%)	144/213 (67.6%)	0.94
	OTH N = 203	63/87 (72.4%)	80/116 (69.0%)	0.59
Location	**WCM N = 1320**	473/727 (65.1%)	363/593 (61.2%)	0.15
	BMH N = 178	17/48 (35.4%)	83/130 (63.8%)	<0.001
	NYPQ N = 639	279/375 (74.4%)	204/264 (77.3%)	0.41
Insurance	**Medicaid N = 358**	99/173 (57.2%)	117/185 (63.2%)	0.24
	Medicare N = 738	288/419 (68.7%)	225/319 (70.5%)	0.60
	Private N = 1035	382/555 (68.8%)	306/480 (63.8%)	0.084

pandemic on the diagnostic stage distribution of breast cancer patients in the United States. International data have shown mixed results with respect to patients presenting with later stage disease as a result of temporary suspensions in screening and national lockdowns. For example, one study utilizing data from the Netherlands Cancer Registry compared patients diagnosed during weeks 2–17 of 2020 to the same period of 2018 and 2019. Eijkelboom et al. found a shift in cancer incidence, with reduced incidence of all tumor stages, except for stage IV, from 2018/2019 to 2020.[7] More recently, the investigators analyzed the impact of the suspension of the Dutch national screening breast program on the incidence of screen-detected tumors, similar to our study. In this analysis, the incidence of screen-detected breast tumors decreased by nearly 70% during early 2020 but by August 2020 there was no indication of a shift toward more advanced stage breast cancers after screening programs resumed.[8] In another study examining the impact of the two-month mammography screening hiatus in Italy, the investigators found a decrease in in-situ breast cancer by 10.4%, an increase of 11.2% of node-positive patients, and a 10.3% increase in clinical stage III patients. However, the rate of clinical T1, T2, and T3 tumors diagnosed during May to July of 2020 did not significantly differ from tumors diagnosed in the same period of 2019.[9] In another Italian study that analyzed 432 breast cancer patients undergoing surgery for breast cancer prior to and during the lockdown, the authors found no

Table 4
Proportion of all payor and Medicaid patients with screen-detected breast cancer stratified by site and race/ethnicity; NHW = Non-Hispanic White; AA = African American/Black; HISP = Hispanic/LatinX; AS = Asian American; OTH = Other; WCM = Weill Cornell Medicine; BMH = Brooklyn Methodist Hospital; NYPQ = New York Presbyterian Queens
*p-value denotes comparison of patients within each racial group across sites, regardless of insurance status
**p-value denotes comparison of only Medicaid patients within each racial group across sites.

		Overall	p-value*	Medicaid	p-value**
NHW	WCM	506/756 (66.9%)	0.31	31/66 (47%)	0.40
	BMH	24/38 (63.2%)		3/8 (37.5%)	
	NYPQ	81/110 (73.6%)		9/14 (64.3%)	
AA	WCM	89/157 (56.7%)	0.004	15/32 (46.9%)	0.65
	BMH	56/98 (57.1%)		8/19 (42.1%)	
	NYPQ	58/74 (78.4%)		6/10 (60%)	
HIS	WCM	78/143 (54.5%)	<0.001	11/23 (47.8%)	0.14
	BMH	8/14 (57.1%)		3/4 (75%)	
	NYPQ	43/50 (86.0%)		9/11 (81.8%)	
AS	WCM	112/187 (59.9%)	<0.001	19/28 (67.9%)	<0.001
	BMH	6/21 (28.6%)		1/8 (12.5%)	
	NYPQ	215/286 (75.2%)		85/104 (81.7%)	
OTH	WCM	51/77 (66.2%)	0.44	4/10 (40%)	0.63
	BMH	6/7 (85.7%)		2/3 (66.7%)	
	NYPQ	86/119 (72.3%)		10/18 (55.6%)	

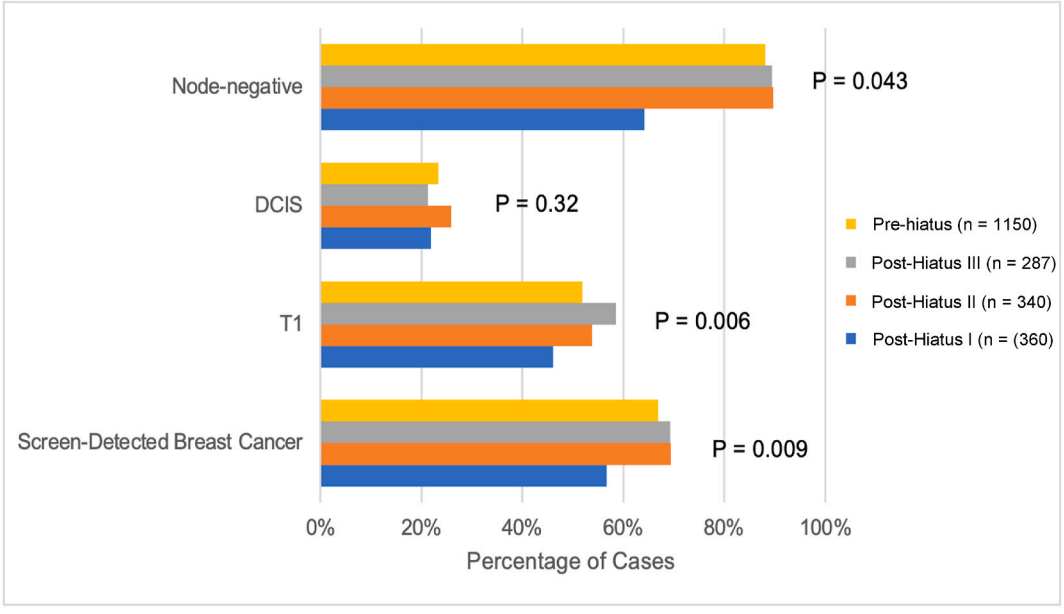

Fig. 2. Characteristics of patients presenting before and after the mammography screening hiatus was lifted, stratified by post-hiatus interval (Post-hiatus I: patients diagnosed between June 16, 2020–October 31, 2020; Post-hiatus II: November 1, 2020–February 28, 2021; Post-hiatus III: March 1, 2021–June 30, 2021); DCIS = Ductal carcinoma in situ
*p-value denotes comparison of Post-Hiatus I, Post-Hiatus II and Post-Hiatus III.

difference in the distribution of pathologic T stage but did see a statistically significant increase in node-positivity, which is likely to impact outcomes.[10,11] Recent data from the Mayo Clinic of 390 patients pre-COVID and 81 patients post-COVID found nearly identical rates of breast cancer detection by imaging before and after the pandemic (66% vs. 65% after; $p = 0.80$). However, they found that the percentage of patients presenting with clinical stage II-IV was 42% during-COVID compared to 37% pre-COVID, although this difference was not statistically significant ($p = 0.27$).[10]

While the aforementioned studies suggest a significant shift in the presentation of breast cancer as a result of the pandemic, all of these studies are limited by the inclusion of patients over a narrow period of time. Our study is the first to our knowledge that examines patients in a large, racially diverse, metropolitan area, and it spans the course of the pandemic, including patients presenting in the first half of 2021, coinciding with the widespread availability of the COVID-19 vaccine in the United States.

To further elucidate the return to baseline levels of mammography screen-detection and stage distribution, patients presenting after the hiatus was lifted were stratified into three post-hiatus intervals. An increase in the proportion of screen-detected breast cancer was seen over time, from 59.7% during post-hiatus interval I to 69.3% in post-hiatus interval III. This evolution may be due to several factors, such as patient willingness to resume regular screening, increased confidence due to widespread availability of the COVID-19 vaccine, and effectiveness of public health messages to encourage a return to routine health visits. At our institution, several changes were made at our women's imaging centers to accommodate for the anticipated surge in patients seeking resumption of breast cancer screening in a safe manner after lockdowns were lifted. For example, weekday hours were extended with screening appointments opened on weekends and screening mammogram durations were extended from 15 min to 30 min to allow the time for adequate disinfection of facilities.

The COVID-19 pandemic has been predicted to worsen pre-existing cancer disparities through several mechanisms that also have led to disparities seen with COVID-19 infection and mortality.[12] While a reduction in the volume of cancer screenings has been documented, few studies have examined cancer screenings by race before and after COVID-19. A recent study examining socioeconomic and racial inequities in breast cancer screening in Washington state, examining 55, 678 screening mammograms before the pandemic and 27,522 screenings after, found an overall reduction in screenings of 49%. When stratified by race, the largest reduction in the number of breast cancer screening from 2019 to 2020 was for Hispanic (−64.2%), American Indian/Alaska Native (−60.9%), mixed race (−56.2%), Native Hawaiian or Pacific Islander (−54.5%), Asian (−54.4%), and Black (−53.9%) women compared to White (−49.2%).[13] Another study reported on trends in breast cancer screening at a safety-net hospital prior to and during the pandemic, further stratified by intervals according to regional stay-at-home orders and reopening phases. In their analysis of 9291 screening mammograms from 2019 to 2021, Velazquez and colleagues found a significant reduction of screening volumes and proportion of completed mammograms from pre-COVID to the second stay-at-home order (defined as December 2020 to January 2021) across all racial groups; however, the largest absolute reductions were seen in Black (−21%) and Latinx (−20%) women. Furthermore, they found that the proportion of completed mammograms was lowest among Black women at all time points.[14] Another study by Marcondes et al. found no significant improvement or worsening of racial and ethnic disparities for any cancer screening after the hiatus was lifted.[15] Our data show similar findings and suggest a trend toward a mitigation of these disparities.

In our study, we found that pre-pandemic, AA patients had the lowest percentage of screen-detected breast cancer. However, our data show an improvement in the rate of screen-detected breast cancer among AA patients in the post-pandemic interval. One rationale for this effect is the increase in targeted public health messages provided in and around the COVID-19 pandemic to increase screening.[16] Additionally, the highest percentage of AA patients are seen at BMH, and the implementation of BMH MDC in early 2020 may have increased access to care for this vulnerable patient population.

By analyzing a large population of patients across a racially diverse area, our study helps to characterize the impact of the COVID-19 pandemic on populations within each borough. New York City is a unique geographic location in that it is comprised of five boroughs that are racially and socioeconomically diverse. For example, among Manhattan, Brooklyn, and Queens, Brooklyn has the highest percentage of AA individuals, while Queens has the highest percentage of AS.[17] These geographical differences were also observed among our network wide data, where we saw the highest percentage of AA patients presenting to our Brooklyn site (55.1%) and the highest percentage of AS patients presenting to our Queens site (44.8%). Regarding breast cancer burden, recent New York State Department of Health data also demonstrate borough-specific differences in both incidence and mortality rates for breast cancer. For example, Manhattan has the highest incidence rate of breast cancer at 141 cases per 100,000 females per year, compared to 120.5 in Brooklyn and 121.9 in Queens. Additionally, Queens has the lowest breast cancer mortality rate at 16.2 deaths per 100,000 females compared to 20.2 in Brooklyn and 19.8 in Manhattan.[18]

Breast cancer disparities are driven not only by racial factors but also by socioeconomic factors.[19] Our data show that across our network, Medicaid patients had less screen-detected disease pre-hiatus, and that this percentage improved in the post-hiatus interval. Additionally, while NYPQ has the highest proportion of Medicaid patients, they maintained a high level of screen-detected breast cancers both before and after the screening hiatus. These findings suggest that a combination of widespread public health campaigns with community engagement efforts to encourage a resumption of routine screening can succeed at enhancing early breast cancer detection after a disruptive event.

There are limitations inherent to this retrospective cohort study. Our data does not contain pathologic staging data but is based on clinical stage of presenting patients. Additionally, our dataset does not contain phenotype, which limits the ability to include updated stage according to the American Joint Committee on Cancer's eighth edition of the *AJCC Cancer Staging Manual.* The primary outcomes we examined were based on presenting features and do not apply to differences in treatment outcomes that may also have resulted from the COVID-19 pandemic. However, by characterizing the clinical presentation of breast cancer patients prior to and after the screening hiatus, our data provide valuable insight into the early effects of the pandemic and may be a marker of success of post-pandemic public health campaigns to encourage a resumption of routine health care.

5. Conclusions

In this study comprised of over 2000 patients across the NYP network spanning a broad range of time before and after the peak of the COVID-19 pandemic, our data demonstrate an initial decline in the percentage of early stage and screen-detected breast cancers immediately after the COVID-19 related mammography screening hiatus, with a resumption of our baseline levels seen prior to the pandemic by mid-2021. Additionally, our data demonstrate that while racial disparities were seen prior to the screening hiatus, across our network we observed an increase in screen-detection among both AA and Medicaid patients post-hiatus. Further studies are needed to characterize the treatment patterns of patients presenting at the height of the pandemic as well as oncologic outcomes.

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Data statement

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declaration of competing interest

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