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Breast Biopsy Recommendations and Breast Cancers Diagnosed during the COVID-19 Pandemic

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Conflicts of interest are listed at the end of this article.

See also the editorial by Heller in this issue.

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Background: The COVID-19 pandemic reduced mammography use, potentially delaying breast cancer diagnoses.

Purpose: To examine breast biopsy recommendations and breast cancers diagnosed before and during the COVID-19 pandemic by mode of detection (screen detected vs symptomatic) and women's characteristics.

Materials and Methods: In this secondary analysis of prospectively collected data, monthly breast biopsy recommendations after mammography, US, or both with subsequent biopsy performed were examined from 66 facilities of the Breast Cancer Surveillance Consortium between January 2019 and September 2020. The number of monthly and cumulative biopsies recommended and performed and the number of subsequent cancers diagnosed during the pandemic period (March 2020 to September 2020) were compared with data from the prepandemic period using Wald χ^2 tests. Analyses were stratified by mode of detection and race or ethnicity.

Results: From January 2019 to September 2020, 17728 biopsies were recommended and performed, with 6009 cancers diagnosed. From March to September 2020, there were substantially fewer breast biopsy recommendations with cancer diagnoses when compared with the same period in 2019 (1650 recommendations in 2020 vs 2171 recommendations in 2019 [24% fewer], $P < .001$), predominantly due to fewer screen-detected cancers (722 cancers in 2020 vs 1169 cancers in 2019 [38% fewer], $P < .001$) versus symptomatic cancers (895 cancers in 2020 vs 965 cancers in 2019 [7% fewer], $P = .27$). The decrease in cancer diagnoses was largest in Asian (67 diagnoses in 2020 vs 142 diagnoses in 2019 [53% fewer], $P = .06$) and Hispanic (82 diagnoses in 2020 vs 145 diagnoses in 2019 [43% fewer], $P = .13$) women, followed by Black women (210 diagnoses in 2020 vs 287 diagnoses in 2019 [27% fewer], $P = .21$). The decrease was smallest in non-Hispanic White women (1128 diagnoses in 2020 vs 1357 diagnoses in 2019 [17% fewer], $P = .09$).

Conclusion: There were substantially fewer breast biopsies with cancer diagnoses during the COVID-19 pandemic from March to September 2020 compared with the same period in 2019, with Asian and Hispanic women experiencing the largest declines, followed by Black women.

Online supplemental material is available for this article.

In spring of 2020, the COVID-19 pandemic led to an unprecedented decrease in the use of preventive health care services due to safety concerns for patients, providers, and staff. Some of the greatest reductions were seen in cancer screening services, including mammography (1–5). In April 2020, a near-total cessation of screening mammography was observed at facilities in the United States (4–8) and internationally (9–11). By early summer, women were generally encouraged to return for mammography (12), and monthly screening volumes normalized (6,13,14). However, despite the swift return to prepandemic monthly volumes, as of July 2020 year-to-date screening and diagnostic mammography examinations in the Breast Cancer Surveillance Consortium (BCSC) were only 66% and 80% of expected volumes, respectively (6), indicating a substantial deficit in breast cancer screening accumulated during the early stage of the pandemic. Moreover, these deficits were largest in Hispanic and Asian women (6), adding to existing evidence that the COVID-19 pandemic has disproportionately impacted racial and ethnic minority groups (15).

Abbreviations

BCSC = Breast Cancer Surveillance Consortium, BI-RADS = Breast Imaging and Reporting Data System, DCIS = ductal carcinoma in situ

Summary

There were substantially fewer breast cancer diagnoses from March to September 2020 versus the same period in 2019, with the largest declines occurring in Asian and Hispanic women, followed by Black women.

Key Results

- In this secondary analysis of prospectively collected Breast Cancer Surveillance Consortium data, 24% fewer breast cancers were diagnosed from March to September 2020 compared with the same period in 2019 (1650 diagnoses vs 2171 diagnoses), largely due to fewer screen-detected cancers.
- Declines were largest among Asian (67 diagnoses in 2020 vs 142 diagnoses in 2019 [53% fewer]) and Hispanic (82 diagnoses in 2020 vs 145 diagnoses in 2019 [43% fewer]) women, followed by Black women (210 diagnoses in 2020 vs 287 diagnoses in 2019 [27% fewer]).

Less is known about the downstream impact of these observed delays in breast cancer screening, and it is not yet clear how these delays will ultimately impact breast cancer outcomes. Simulation models have predicted breast cancer screening delays due to the pandemic will lead to 2487 excess deaths from breast cancer in the United States over 10 years (0.5% increase) (16). While the true impact on breast cancer mortality will not be known for many years, intermediate metrics, such as cancer diagnosis rates, are important indicators that warrant evaluation. One analysis from a large national clinical laboratory database reported a 52% reduction in breast cancer diagnoses in March and April 2020 during the pandemic onset (17). However, it is not known whether delays in diagnosis resolved after the normalization of breast imaging volumes in early summer 2020.

Pandemic-related decreases in breast cancer diagnoses in the United States by mode of detection and woman-level characteristics previously have not been well established in the literature. In this study, we examine breast biopsy recommendations and breast cancers diagnosed at BCSC facilities before and during the COVID-19 pandemic through September 2020. We specifically examine cancers diagnosed by mode of detection (screening vs diagnostic evaluation), type of cancers detected, and women's characteristics.

Materials and Methods

Study Sample

Clinical, imaging, and pathologic data were prospectively collected by seven breast imaging registries within the BCSC: Carolina Mammography Registry, Kaiser Permanente Washington Registry, Metropolitan Chicago Breast Cancer Registry, New Hampshire Mammography Network, Sacramento Area Breast Imaging Registry, San Francisco Mammography Registry, and Vermont Breast Cancer Surveillance System. For this study, facilities with complete imaging data through September 2020 and pathology capture through December 2020 were included. This study was compliant with the Health Insurance Portability and Accountability Act. All registries and the statistical coordinating center received institutional review board approval for study procedures (including either a written opt-out process [three registries] or waiver of informed consent [four registries]) and a federal Certificate of Confidentiality to protect the identities of women, physicians, and facilities.

Each registry collects woman- and examination-level information from academic and community breast imaging facilities within their catchment area. Examination-level information included modality, examination date, clinical indication, and Breast Imaging and Reporting Data System (BI-RADS) (18) assessment category. Woman-level information included age and race or ethnicity taken from the electronic medical record or collected via a self-reported questionnaire completed at the time of breast imaging. Benign and malignant breast diagnosis data were provided by imaging facilities and were linked to local pathology databases.

Outcomes and Measures

Each registry provided monthly counts of breast biopsy recommendations with biopsy performed in women aged at least 18 years between January 2019 and September 2020. Women were recommended for biopsy if their diagnostic mammograms or breast US images revealed BI-RADS category 4 (suspicious) or 5 (highly suggestive of malignancy) findings (18). Pathology linkage was used to identify biopsy results within 90 days of the biopsy recommendation and biopsy outcome (malignant breast carcinoma vs benign). If multiple biopsies were performed within 90 days, the most severe outcome was assigned (with invasive carcinoma being most severe, followed by ductal carcinoma in situ [DCIS], followed by benign), as in prior work (19).

Cancers diagnosed were deemed *screen detected* if the woman had a screening mammogram with an abnormal assessment (BI-RADS categories 0, 3, 4, or 5) within the 90 days before diagnostic evaluation or if the diagnostic examination indication was "additional evaluation of an abnormal screen." Cancers diagnosed were deemed *symptomatic* if the examination indication was "breast problem" or if the woman had no abnormal screening mammogram within the preceding 90 days.

Statistical Analyses

In all analyses, the index month was defined as the month of biopsy recommendation. Monthly counts of biopsies recommended and cancers diagnosed were pooled across registries, and 2020 volumes were compared with 2019 volumes by using Wald χ^2 tests, with $P < .05$ considered to indicate a significant difference. To account for clustering within BCSC registries, we estimated 95% CIs using Poisson regression with overdispersion. Analyses for biopsy recommendations and cancers diagnosed were stratified by age group (<40, 40–49, 50–59, 60–69, ≥70 years) and race or ethnicity (non-Hispanic White, non-Hispanic Black, Hispanic, Asian, more than one or other race or ethnicity, or unknown). Cancer diagnoses were also stratified by mode of detection (screen detected vs symptomatic) and cancer type (invasive carcinoma

or DCIS). Finally, given the small sample sizes for some racial and ethnic groups, we performed a sensitivity analysis of our results stratified by race or ethnicity using a leave-one-out approach comparing results after removal of each registry one at a time. Statistical analyses were performed with SAS statistical software (version 9.4; SAS Institute).

Results

Characteristics of Study Sample

Of 71 facilities across the seven registries, 66 were included in the analysis (one facility that only performed screening mammography and four facilities that were unable to provide data for the entire study period were excluded). Between January 2019 and September 2020, there were 20 790 biopsy recommendations after mammography or US, with 17 728 biopsies performed (85.5%) and 6009 cancers diagnosed within 90 days of the recommendation. Most women (11 766 [66%]) were at least 50 years old; 11 240 (62%) were non-Hispanic White, 2097 (11%) were non-Hispanic Black, 1395 (9%) were Hispanic, 1252 (8%) were Asian, and 303 (2%) were more than one race or were another race or ethnicity; race or ethnicity was unknown in 1441 (9%) women (Table 1).

Table 1: Characteristics of the Study Population

Characteristic	No. of Findings*
Overall	17 728 (100)
Age	
<40 years	1898 (11)
40–49 years	4064 (23)
50–59 years	4234 (24)
60–69 years	4029 (23)
≥70 years	3503 (20)
Race	
Non-Hispanic White	11 240 (69)
Non-Hispanic Black	2097 (13)
Hispanic	1395 (9)
Asian	1252 (8)
Other or multiracial	303 (2)
Missing	1441 (8)
Indication	
Abnormal screen	9562 (54)
Symptomatic	7660 (43)
Short interval follow-up	497 (3)
Missing	9 (0)
Result type	
Benign	11 710 (66)
Ductal carcinoma in situ	1081 (18)
Invasive	4874 (81)
Missing	63 (1)

Note.—Data in parentheses are percentages.

* Percentages for known data are expressed as proportion of non-missing. For missing values, percentages are expressed as proportion of total.

Monthly Volumes of Biopsies Recommended and Cancers Diagnosed

Monthly volumes were lowest in April 2020, with 236 biopsies recommended in 2020 versus 1000 in 2019 (76% fewer in 2020; 95% CI: −81, −70; $P < .001$); 93 breast cancers were diagnosed following biopsies recommended in April 2020 versus 323 breast cancers diagnosed in 2019 (71% fewer in 2020; 95% CI: −79, −60; $P < .001$) (Fig 1). These volumes increased in May and June 2020, and by July 2020, monthly biopsy volumes were similar to those in 2019 (905 biopsies in 2020 vs 945 biopsies in 2019 [4% fewer]; 95% CI: −17, +11; $P = .56$); volumes of biopsies with cancer diagnoses in July 2020 were also similar to volumes in July 2019 [270 biopsies with cancer diagnoses in 2020 vs 295 biopsies with cancer diagnoses in 2019 [8% fewer]; 95% CI: −28, +16; $P = .54$). Biopsy and cancer volumes subsequently decreased from July through September 2020: in September 2020, 803 biopsies were recommended versus 887 in 2019 (9% fewer; 95% CI: −22, +5; $P = .20$), and 281 biopsies were recommended with cancers diagnosed versus 305 in 2019 (8% fewer; 95% CI: −27%, +16%; $P = .49$).

Monthly volumes of screen-detected cancers were lowest in April 2020 (11 cancers in 2020 vs 181 cancers in 2019 [94% fewer]; 95% CI: −97, −86; $P < .001$) but subsequently increased. In June 2020, 130 cancers were diagnosed following screening versus 165 cancers diagnosed in 2019 (21% fewer in 2020; 95% CI: −43, +8; $P = .14$). By September 2020, the number of monthly screen-detected cancers increased to 168 versus 151 in 2019 (11% higher in 2020; 95% CI: −18, +51; $P = .49$). Symptomatic cancers also were also lowest in April 2020, with 82 cancers in 2020 versus 138 in 2019 (41% lower in 2020; 95% CI: −69, −14; $P = .006$). Symptomatic cancer diagnoses increased to 121 in May 2020 versus 139 in 2019 (13% fewer in 2020; 95% CI: −37, +21; $P = .41$) and subsequently exceeded the number of 2019 diagnoses in June (168 diagnoses in 2020 vs 126 diagnoses in 2019 [33% higher in 2020; 95% CI: −2, +82; $P = .07$]) and July (145 diagnoses in 2020 vs 120 diagnoses in 2019 [21% higher in 2020; 95% CI: −13, +67; $P = .25$]). By September 2020, symptomatic cancer diagnoses decreased to 110 versus 146 in 2019 (25% fewer in 2020; 95% CI: −46, +5; $P = .10$).

Cumulative Volumes of Biopsies Recommended and Cancers Diagnosed

From March to September 2020, a cumulative total of 4908 biopsies were recommended and performed compared with 6395 biopsies for this same period in 2019 (23% fewer in 2020; 95% CI: −28, −18; $P < .001$) (Fig 2). Only 1650 cancers were diagnosed from March to September 2020 versus 2171 cancers diagnosed from March to September 2019 (24% fewer in 2020; 95% CI: −31, −17; $P < .001$). Differences in breast cancer diagnoses were predominantly due to fewer screen-detected cancers (Fig 3, Table 2). There were only 722 screen-detected cancers from March to September 2020 versus 1169 during the same period in 2019 [38% fewer in 2020; 95% CI: −45, −31; $P < .001$). During the same period, 895 symptomatic cancers were diagnosed in 2020 versus 965 in 2019 (7% fewer in 2020; 95% CI: −19, +6; $P = .27$) (Fig 3, Table 3). Diagnoses of both invasive breast carcinoma and DCIS were lower in 2020 than in 2019

(Table 3). The total number of invasive breast cancer diagnoses from March to September was 1362 in 2020 versus 1754 for this same period in 2019 (22% fewer in 2020; 95% CI: −32, −11; $P < .001$), while there were 273 DCIS diagnoses in 2020 versus 405 in 2019 (33% fewer in 2020; 95% CI: −50, −9; $P = .01$) (Table 3).

Race or Ethnicity and Age Distribution of Biopsies and Cancers Diagnosed

Women aged 40 or more years had fewer biopsies performed and fewer cancers diagnosed between March and September 2020 compared with the period between March and September 2019 ($P <$ .001 for all groups) (Table 4). In women younger than 40 years, 91 cancers were diagnosed from March to September 2020 versus 75 cancers diagnosed from March to September 2019 (21% higher in 2020; 95% CI: −17, +78; $P = .32$). Decreases in the number of biopsies and breast cancer diagnoses in the prepandemic period versus the pandemic period varied widely across racial and ethnic groups. The largest decreases in biopsies recommended and performed occurred in Asian (303 biopsies in 2020 vs 509 biopsies in 2019; 40% fewer in 2020; 95% CI: −66, +6; $P = .08$) and Hispanic (324 biopsies in 2020 vs 554 biopsies in 2019; 42% fewer in 2020; 95% CI: −76, 2; $P = .06$) women, followed by Black women (568 biopsies in 2020 vs 746 biopsies in 2019; 24% fewer in 2020; 95% CI: −51, +19; $P = .23$). The smallest decrease occurred in non-Hispanic White women (3233 biopsies in 2020 vs 3926 biopsies in 2019; 18% fewer in 2020; 95% CI: −32, 0; $P = .04$). Similarly, decreases in breast cancer diagnoses during the pandemic period were largest in Asian [67 diagnoses in 2020 vs 142 biopsies in 2019; 53% fewer in 2020; 95% CI: −79, +5; $P = .06$) and Hispanic [82 diagnoses in 2020 vs 145 biopsies in 2019; 43% fewer in 2020; 95% CI: −73, +19; $P = .13$) women, followed by Black women (210 diagnoses in 2020 vs 287 biopsies in 2019; 27% fewer in 2020; 95% CI: −55%, +19%; $P = .21$). Decreases were smallest in non-Hispanic White women (1128 diagnoses in 2020 vs 1357 biopsies in 2019; 17% fewer in 2020; 95% CI: −33, +3; $P = .09$). In our sensitivity analysis, these results were generally similar after leaving each registry out, one at a time, for non-Hispanic White (range, 13%–26% fewer biopsies with cancer diagnoses in 2020 vs 2019), Asian (range, 37%–58% fewer in 2020), and Hispanic (range, 40%–47% fewer in 2020) women, while differences for Black women varied more widely (range, 30% fewer to 10% more than 2020) (Tables E2, E2 [online]).

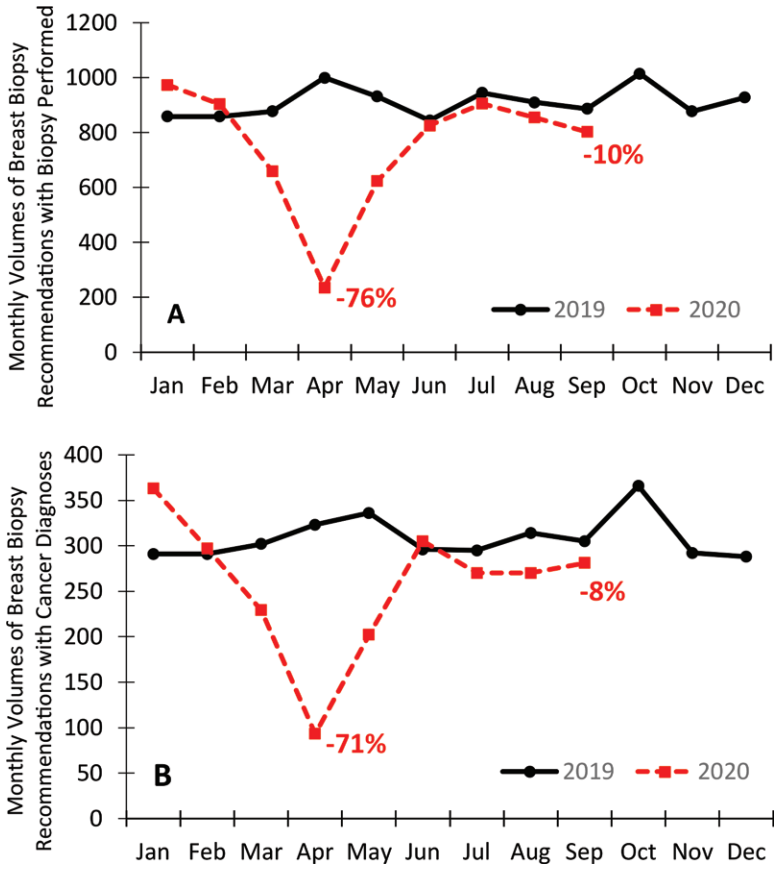

Figure 1: Monthly volumes of breast biopsy recommendations **(A)** with biopsy performed and **(B)** with cancer diagnosed within 90 days of January 2019 to September 2020. Percentages indicate monthly changes from 2019 to 2020.

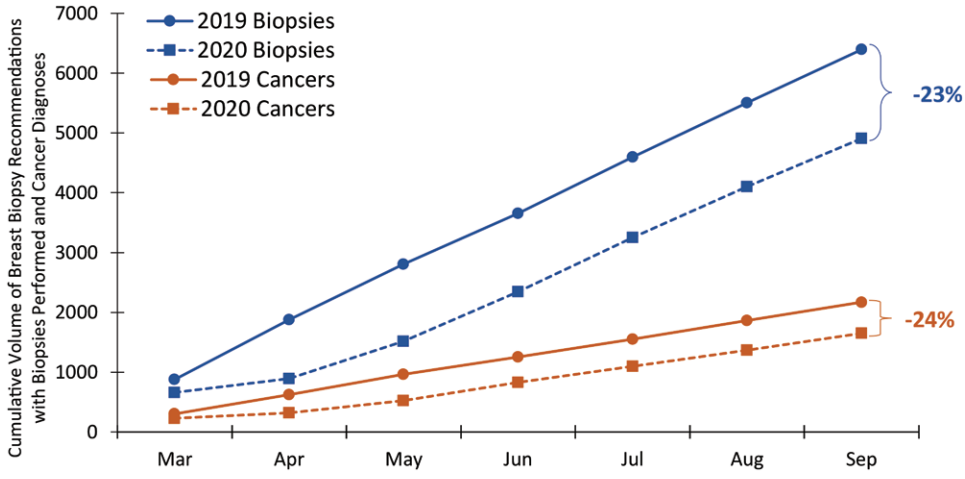

Figure 2: Cumulative volumes of breast biopsy recommendations with biopsies performed and cancers diagnosed within 90 days between March and September in 2019 and 2020. Percentages indicate cumulative changes from 2019 to 2020.

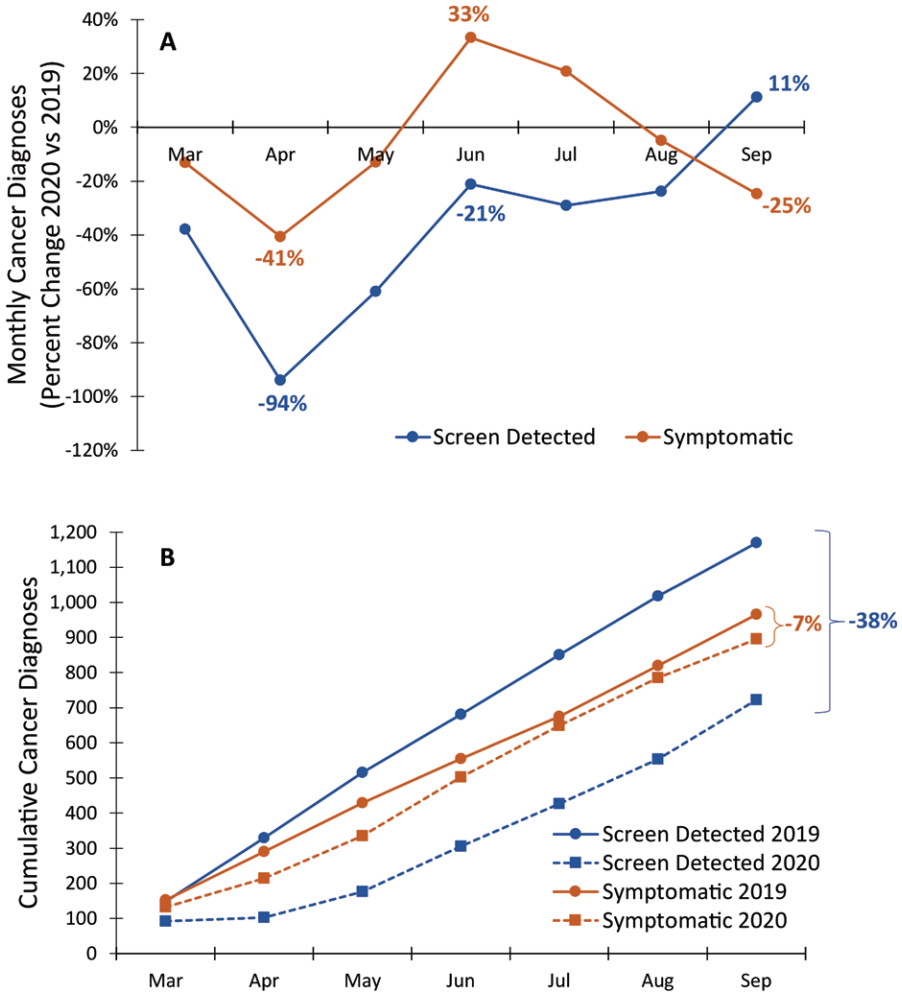

Figure 3: **(A)** Monthly and **(B)** cumulative volumes of biopsy recommendations with breast cancers diagnosed in 2020 versus 2019 stratified by mode of detection (screen-detected vs symptomatic cancers). Percentages indicate monthly and cumulative changes from 2019 to 2020.

Discussion

Although the impact of the COVID-19 pandemic on breast cancer mortality will not be known for many years, intermediate outcomes, including breast cancer diagnoses, can provide important insight into the magnitude of pandemic-related delays in breast cancer care and the populations most likely to be impacted. In this analysis of data from 66 facilities in seven Breast Cancer Surveillance Consortium registries, breast cancer diagnoses decreased sharply during the initial phase of the COVID-19 pandemic (71% fewer cancer diagnoses in April 2020 compared with April 2019), but by June 2020 the number of breast cancer diagnoses was similar to that in June 2019. However, as of September 2020, substantially fewer total breast cancers were diagnosed since the start of the COVID-19 pandemic (24% fewer in 2020 than in 2019), predominantly due to reductions in the number of screen-detected cancers (38% fewer). Decreases in breast cancer diagnoses during the pandemic period versus the prepandemic period varied substantially by racial and ethnic group, with the largest differences occurring in Asian (53% fewer) and Hispanic (43% fewer) women, followed by Black women (27% fewer).

Table 2: Monthly Volumes of Breast Cancers Diagnosed at Breast Cancer Surveillance Consortium Breast Imaging Facilities in 2019 and 2020 Overall and by Mode of Detection

	All Cancers Diagnosed*				Screen-detected Cancers Diagnosed				Symptomatic Cancers Diagnosed			
Month	2019	2020	Change in 2020 vs 2019 (%)	*P* Value	2019	2020	Change in 2020 vs 2019 (%)	*P* Value	2019	2020	Change in 2020 vs 2019 (%)	*P* Value
January	291	363	+25 (0, 55)	.049	139	204	+47 (9, 98)	.012	148	154	+4 (–23, 41)	.80
February	291	297	+2 (–19, 29)	.86	148	133	–10 (–35, 24)	.52	140	155	+11 (–19, 51)	.52
March	302	229	–24 (–41, –3)	.03	148	92	–38 (–57, –11)	.010	152	132	–13 (–37, 19)	.38
April	323	93	–71 (–79, –60)	<.001	181	11	–94 (–97, –86)	<.001	138	82	–41 (–59, –14)	.006
May	336	202	–40 (–53, –23)	<.001	187	73	–61 (–73, –43)	<.001	139	121	–13 (–37, 21)	.41
June	296	305	+3 (–18, 29)	.80	165	130	–21 (–43, 8)	.14	126	168	+33 (–2, 82)	.07
July	295	270	–8 (–28, 16)	.46	169	120	–29 (–49, –2)	.04	120	145	+21 (–13, 67)	.25
August	314	270	–14 (–32, 8)	.20	168	128	–24 (–45, 5)	.09	144	137	–5 (–31, 30)	.76
September	305	281	–8 (–27, 16)	.49	151	168	+11 (–18, 51)	.49	146	110	–25 (–46, 5)	.10
October	366	NA	NA	NA	208	NA	NA	NA	147	NA	NA	NA
November	292	NA	NA	NA	148	NA	NA	NA	140	NA	NA	NA
December	288	NA	NA	NA	148	NA	NA	NA	131	NA	NA	NA

Note.—Unless otherwise indicated, data are numbers of cancers diagnosed. Data in parentheses are 95% CIs. NA = not applicable.

* This group is greater than the screen-detected and symptomatic cancer groups due to a small number of cases that did not meet the criteria for either mode of detection (eg, short interval follow-up or diagnostic evaluation not otherwise specified).

Table 3: Breast Biopsy Recommendations with Cancers Diagnosed at Breast Cancer Surveillance Consortium Facilities in 2019 and 2020 by Mode of Detection and Type of Cancer Diagnosed

	All Cancers Diagnosed				Screen-detected Cancers Diagnosed				Symptomatic Cancers Diagnosed			
Cancer Type	2019	2020	Change from 2020 to 2019 (%)	*P* Value	2019	2020	Change from 2020 to 2019 (%)	*P* Value	2019	2020	Change from 2020 to 2019 (%)	*P* Value
All malignancies*	2171	1650	−24 (−31, −17)	<.001	1169	722	−38 (−45, −31)	<.001	965	895	−7 (−19, 6)	.27
DCIS	405	273	−33 (−50, −9)	.01	274	167	−39 (−55, −18)	.001	119	99	−17 (−45, 27)	.39
Invasive	1754	1362	−22 (−32, −11)	<.001	889	548	−38 (−48, −27)	<.001	841	788	−6 (−20, 9)	.40

Note.—Unless otherwise indicated, data are numbers of cancers diagnosed. Data in parentheses are 95% CIs. DCIS = ductal carcinoma in situ.
*A total of 27 cancers (12 in 2019, 15 in 2020) had missing cancer type.

Table 4: Cumulative Volume of Breast Biopsy Recommendations with Biopsy Performed and Cancers Diagnosed at Breast Cancer Surveillance Consortium Facilities in 2019 and 2020 by Age and Race or Ethnicity

	Biopsies Recommended with Biopsy Performed within 90 days				Biopsies Recommended with Cancer Diagnosis within 90 days			
Characteristic	2019	2020	Change from 2020 to 2019 (%)	*P* Value	2019	2020	Change from 2020 to 2019 (%)	*P* Value
All biopsies	6395	4908	−23 (−28, −18)	<.001	2,171	1,650	−24 (−31, −17)	<.001
Age group								
<40 years	601	582	−3 (−20, 17)	.73	75	91	+21 (−17, 78)	.32
40–49 years	1520	1071	−30 (−38, −20)	<.001	286	227	−21 (−36, −1)	.04
50–59 years	1529	1157	−24 (−33, −14)	<.001	483	358	−26 (−38, −12)	<.001
60–69 years	1450	1100	−24 (−33, −14)	<.001	605	457	−24 (−35, −12)	<.001
≥70 years	1277	997	−22 (−32, −11)	<.001	715	510	−29 (−38, −18)	<.001
Race or ethnicity								
Non-Hispanic White	3926	3233	−18 (−32, 0)	.04	1357	1128	−17 (−33, 3)	.09
Non-Hispanic Black	746	568	−24 (−51, 19)	.23	287	210	−27 (−55, 19)	.21
Hispanic	554	324	−42 (−66, 2)	.06	145	82	−43 (−73, 19)	.13
Asian	509	303	−40 (−67, 6)	.08	142	67	−53 (−79, 5)	.06
Multiracial or other race or ethnicity	125	90	−28 (−76, 117)	.56	39	26	−33 (−83, 160)	.56
Unknown race or ethnicity	514	387	−25 (−56, 29)	.30	197	130	−34 (−64, 21)	.18

Note.—Unless otherwise indicated, data are numbers of biopsies. Data in parentheses are 95% CIs. Small discrepancies in counts overall and by age and race or ethnicity were due to varying degrees of missingness and the use of aggregated data.

We found that declines in cancer diagnoses were predominantly due to declines in screen-detected cancers, consistent with prior work (6,8,14) showing the pandemic had a larger impact on screening than diagnostic breast imaging. While monthly screening volumes normalized in summer 2020 (6,13,14), higher-than-typical imaging volumes would be required to overcome this deficit in cancer diagnoses by rescheduling missed mammography examinations from earlier in the pandemic. One prior analysis of screening mammography claims data estimated that clearing the queue of delayed screening mammograms would take at best 22 weeks after resumption of normal volumes (corresponding to the late Fall or early Winter of 2020), and that a full catch-up might not be attainable at all (8). Of note, we are not able to discern from our data to what extent the catch-up of cancer diagnoses is hindered by the limited capacity of breast imaging facilities versus other pandemic-related factors impacting access to health care, such as loss of employment or insurance or women's concerns about COVID-19 exposure.

In contrast to screen-detected cancers, we found that while symptomatic cancer diagnoses were lower in April and May 2020 compared with April and May 2019, there was a small catch-up period in June and July 2020; as a result, there were no differences in total symptomatic cancer diagnoses for breast imaging evaluations through September 2020. Our findings are consistent with the efforts of breast imaging facilities to prioritize women with breast cancer symptoms over screening of asymptomatic women during

periods of limited capacity (20); they also may reflect women's greater reluctance to delay evaluation of breast symptoms as opposed to a screening examination. A recent study of the Dutch national breast screening program similarly found that pandemic-related shutdowns had a smaller impact on non–screen-detected cancer incidence than on screen-detected cancer incidence (21). In a prior analysis using breast cancer models from the Cancer Intervention and Surveillance Modeling network, delays in diagnostic evaluation of symptomatic women were more detrimental to long-term outcomes than delays in screening mammography, resulting in excess breast cancer mortality (16). Thus, it is reassuring that the initial delays in breast cancer diagnoses among symptomatic women have likely largely resolved. Interestingly, we found that symptomatic breast cancer diagnoses decreased in September 2020, with 25% fewer diagnoses than in September 2019. However, this may be due to statistical noise, as this finding did not meet statistical significance, and there was no corresponding delay in screen-detected cancers.

We found variation in the magnitude of the differences in breast cancer diagnoses during the pandemic versus prepandemic periods across women of different races and ethnicities. Notably, substantially fewer cancers were diagnosed in Asian, Hispanic, and non-Hispanic Black women compared with non-Hispanic White women. These results are consistent with prior studies that have found racial and ethnic disparities in breast cancer screening and diagnostic imaging use during the pandemic (6,22,23). Greater pandemic-related delays have also been observed among Asian and Hispanic people for imaging in general (15) and for people residing in communities with high levels of poverty (15,24). While it is not possible to definitively identify the factors driving these disparities based on our results, the pandemic has disproportionately impacted racial and ethnic minority groups in many ways that could reduce access to breast cancer care. For example, Black, Hispanic, and Asian people were more likely to experience loss of employment during the pandemic (25), potentially leading to unstable health insurance coverage. Black and Hispanic populations also experienced disproportionately higher rates of COVID-19 infection, hospitalization, and mortality compared with non-Hispanic White populations (26), and these risks may have deterred women from seeking nonurgent medical care. It is also possible that breast imaging facilities serving these communities experienced more severe pandemic-related impacts on capacity, further reducing access to mammography. Concerted efforts are needed to elucidate underlying factors that may account for these differences and guide targeted interventions to prevent disparities in breast cancer outcomes for women in racial and ethnic minority groups.

Our study had limitations. First, we used aggregated data across multiple geographic regions. This data aggregation process precluded evaluation of local and regional COVID-19 burden and social distancing policies that may have further contributed to delays in breast cancer diagnosis. Second, despite our large overall sample size, the small size of racial and ethnic subgroups in our analysis led to imprecision of estimates. Third, the facilities included in our study were concentrated in the specific geographic regions of our participating registries. Thus, our findings may not be generalizable to all regions. Finally, although we included all breast cancers diagnosed within 90 days of breast imaging evaluations performed through September 2020, the full duration and impact of the COVID-19 pandemic is not yet known.

In summary, our study provides important interim estimates of the proportion of women likely to be impacted by delays in breast cancer diagnosis due to pandemic-related disruptions in health care. Our results suggest that delays in breast cancer screening and diagnostic evaluation have resulted in delays in breast cancer diagnoses, with substantially fewer screen-detected breast cancers diagnosed from March to September 2020. These differences persisted despite increases in monthly cancer diagnoses, raising concern that delays in screen-detected diagnosis may continue even if imaging facilities are operating at normal capacity. Finally, our findings highlight the ongoing need to improve cancer diagnosis rates among women in racial and ethnic minority groups especially, as they experienced greater decreases in breast cancer diagnoses during the pandemic.

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