Breast Cancer Statistics, 2022

Angela N. Giaquinto, MSPH[1]; Hyuna Sung, PhD [1]; Kimberly D. Miller, MPH [1]; Joan L. Kramer, MD[2]; Lisa A. Newman, MD, MPH[3]; Adair Minihan, MPH[1]; Ahmedin Jemal, DVM, PhD[1]; Rebecca L. Siegel, MPH [1]

[1]Surveillance and Health Equity Science, American Cancer Society, Atlanta, Georgia, USA; [2]Department of Hematology and Medical Oncology, Emory University, Atlanta, Georgia, USA; [3]Department of Surgery, New York-Presbyterian, Weill Cornell Medicine, New York, New York, USA.

Correspondence Author: Angela Giaquinto, Surveillance and Health Equity Science, American Cancer Society, 3380 Chastain Meadows Pkway NW, Suite 200, Kennesaw, GA 30144-0101, USA (angela.giaquinto@cancer.org)

doi: 10.3322/caac.21754. Available online at cacancerjournal.com

Abstract: This article is the American Cancer Society's update on female breast cancer statistics in the United States, including population-based data on incidence, mortality, survival, and mammography screening. Breast cancer incidence rates have risen in most of the past four decades; during the most recent data years (2010–2019), the rate increased by 0.5% annually, largely driven by localized-stage and hormone receptor-positive disease. In contrast, breast cancer mortality rates have declined steadily since their peak in 1989, albeit at a slower pace in recent years (1.3% annually from 2011 to 2020) than in the previous decade (1.9% annually from 2002 to 2011). In total, the death rate dropped by 43% during 1989–2020, translating to 460,000 fewer breast cancer deaths during that time. The death rate declined similarly for women of all racial/ethnic groups except American Indians/Alaska Natives, among whom the rates were stable. However, despite a lower incidence rate in Black versus White women (127.8 vs. 133.7 per 100,000), the racial disparity in breast cancer mortality remained unwavering, with the death rate 40% higher in Black women overall (27.6 vs. 19.7 deaths per 100,000 in 2016–2020) and two-fold higher among adult women younger than 50 years (12.1 vs. 6.5 deaths per 100,000). Black women have the lowest 5-year relative survival of any racial/ethnic group for every molecular subtype and stage of disease (except stage I), with the largest Black–White gaps in absolute terms for hormone receptor-positive/human epidermal growth factor receptor 2-negative disease (88% vs. 96%), hormone receptor-negative/human epidermal growth factor receptor 2-positive disease (78% vs. 86%), and stage III disease (64% vs. 77%). Progress against breast cancer mortality could be accelerated by mitigating racial disparities through increased access to high-quality screening and treatment via nationwide Medicaid expansion and partnerships between community stakeholders, advocacy organizations, and health systems.

Keywords: breast neoplasms, epidemiology, health disparities, incidence, molecular subtype

Introduction

Breast cancer is the most commonly diagnosed cancer among US women excluding nonmelanoma of the skin. It is the second leading cause of cancer death among women overall, after lung cancer, but the leading cause of cancer death among Black and Hispanic women.[1,2] An estimated 30% of breast cancer cases are attributed to modifiable risk factors, such as excess body weight, physical inactivity, and alcohol intake, and thus may be preventable.[3] Secondary prevention through mammography screening can further prevent death, and alongside advances in treatment, is attributed with substantial reductions in breast cancer mortality. Herein, the American Cancer Society provides its update of the latest breast cancer statistics for women in the United States, including the estimated numbers of new cases and deaths by age in 2022; incidence and mortality rates and trends by age, race/ethnicity, stage, molecular subtype, and geography based on incidence data through 2019 and mortality data through 2020; relative survival for persons diagnosed during 2012–2018 and followed through 2019 by stage at diagnosis and breast cancer subtype; and treatment patterns in 2018. Self-reported mammography prevalence is also presented nationally (2019) and by state (2020).

Materials and Methods

Data Sources

Population-based cancer incidence data in the United States are collected by the National Cancer Institute's (NCI's) Surveillance, Epidemiology, and End Results (SEER) program and the Centers for Disease Control and Prevention's National Program of Cancer Registries. Long-term incidence trends for ductal carcinoma in situ (DCIS) and invasive breast cancer by age were based on data since 1975 from the eight oldest SEER registries, representing 8% of the US population.[4] Data from the SEER 17 registries, covering 28% of the US population, were used in analyses of breast cancer survival by stage (according to the American Joint Committee on Cancer [AJCC] *AJCC Cancer Staging Manual*, seventh and eighth editions),[5,6] race and ethnicity, and molecular subtype.[7] Data from all 22 SEER registries were used to describe the distribution of breast cancer diagnoses by grade and the probability of developing or dying from breast cancer by age.[8] Incidence trends for breast cancer by race and ethnicity used delay-adjusted data from all 22 SEER registries, whereas a subset of registries (excluding Idaho, Illinois, Massachusetts, New York, and Texas) was used for delay-adjusted incidence trends by stage (SEER Summary) and molecular subtype.[9]

Combined SEER and National Program of Cancer Registries data were provided in a customized database for cases diagnosed during 1995–2019 by the North American Association of Central Cancer Registries (NAACCR).[10] The NAACCR database includes all US states, although data are missing for some state-years, especially before 2000; population coverage during 2015–2019 only excludes Nevada and exceeds 98%. These data were the source for the projected new breast cancer cases in 2022 and contemporary incidence (2015–2019) by race and ethnicity, age, molecular subtype, state, and stage (SEER Summary).

Mortality data from 1975 to 2020 were obtained using SEER*Stat software from the National Center for Health Statistics (NCHS), covering all 50 states and the District of Columbia.[11,12] Information in death certificates on Hispanic origin was only available as of 1990. Trend analyses by ethnicity exclude data from Louisiana in 1990, New Hampshire during 1990–1992, and Oklahoma during 1990–1996 because data on Hispanic origin were not collected on death certificates in those state-years.

Information on the first course of treatment for women who were diagnosed with breast cancer in 2018 was based on data from the National Cancer Data Base and was previously presented in the article *Cancer treatment and survivorship statistics, 2022* by Miller et al published in this journal.[13] The NCDB is a hospital-based cancer registry jointly sponsored by the American Cancer Society and the American College of Surgeons and includes >70% of all invasive cancers occurring in the United States as reported by more than 1500 facilities accredited by the American College of Surgeons' Commission on Cancer.[14,15]

Prevalence data on mammography by state were obtained from the 2020 Behavioral Risk Factor Surveillance System, which is an ongoing system of telephone surveys designed to provide state-level information on health behaviors and is conducted by state health departments in cooperation with the Centers for Disease Control and Prevention.[16] The national prevalence of mammography was obtained from the 2019 National Health Interview Survey,[17] which is designed to provide national estimates of health behaviors based on in-person surveys and is conducted by the NCHS. Mammography prevalence estimates do not distinguish between examinations for screening and diagnosis.

Statistical Analyses

The overall estimated numbers of new invasive breast cancer and DCIS cases in 2022 were published previously, and the methodology was described in detail.[18] The numbers of invasive cases and deaths by age were estimated by modeling each age group individually and adjusting the resulting age-specific estimates to the overall published totals. The number of DCIS cases by age at diagnosis were estimated by applying the age-specific proportions of observed DCIS cases diagnosed during 2015–2019 in the NAACCR analytic file to the total number of estimated cases of DCIS in 2022.

The estimated number of female breast cancer deaths averted because of the reduction in breast cancer death rates since 1989 was estimated by summing the differences between the expected and observed numbers of female breast cancer deaths for each year. The expected number of deaths if the breast cancer death rate had remained at its peak was estimated by applying 5-year age-specific cancer death rates in 1989 to the corresponding age-specific female populations from 1990 to 2020.

Information on breast cancer molecular subtype has been collected by cancer registries since 2004. Missing data on estrogen receptor (ER), progesterone receptor (PR), and human epidermal growth factor receptor 2 (HER2) status were imputed using the approach of Anderson et al.,[19] which assumes that this information is missing at random, conditional on year of diagnosis, age, and race/ethnicity. Specifically, two-step imputation was performed based on the joint distribution of ER (positive, negative, and missing or borderline) and PR (positive, negative, and missing or borderline) status. In the first step, those cases with either missing ER or PR (not both) status were allocated to either negative or positive receptor status according to the distribution of known joint ER/PR status in each diagnosis year, age, and race and ethnicity. In the second step, those cases missing both ER and PR status were allocated to a hormone receptor (HR)-positive group (defined as either ER-positive or PR-positive)

TABLE 1. Estimated new ductal carcinoma in situ and invasive breast cancer cases and deaths among women by age, United States, 2022

	DCIS cases		Invasive cases		Deaths	
Age, years	No.	%	No.	%	No.	%
<40	1230	2	10,850	4	1090	3
40–49	8050	16	36,710	13	2950	7
50–59	12,830	25	65,980	23	7150	17
60–69	16,030	31	84,200	29	10,270	24
70–79	10,450	20	61,470	21	10,010	23
≥80	2810	5	28,640	10	11,780	27
All ages	**51,400**		**2 87,850**		**43,250**	

Note: Estimates are rounded to the nearest 10. Percentages may not sum to 100% because of rounding.
Abbreviation: DCIS, ductal carcinoma in situ.

and an HR-negative group (defined as both ER-negative and PR-negative) according to the updated distribution of HR status obtained in the first step. Similarly, for joint categories of HR and HER2, we first imputed HR status among cases with known HER2 status. Then, we allocated those with unknown HER2 status to the four subtypes according to their updated distributions obtained in the previous step.

All incidence and death rates were age-standardized to the 2000 US standard population (19 age groups) and expressed per 100,000 women, as calculated by the NCI's SEER*Stat software (version 8.4.0).[20] Trends in incidence and mortality rates were quantified using the Joinpoint Regression Program to calculate the annual percent change (APC) and the average APC (AAPC) during a defined time period.[21] All incidence trends were adjusted for delays in reporting to account for the additional time required for the complete registration of cases. The age-specific probability of developing or dying from breast cancer was calculated using the NCI's DevCan software (version 6.8.0).[22] Incidence and mortality rates for White, Black, American Indian/Alaska Native (AIAN), and Asian/Pacific Islander (API) women are exclusive of individuals with Hispanic ethnicity except for long-term trends. Incidence rates for AIAN women are restricted to Purchased/Referred Care Delivery Areas (PRCDA). Mortality rates for AIAN women are for the entire United States and adjusted for the high prevalence of racial misclassification on death certificates using misclassification ratios reported by Arias et al.[23]

Selected Findings

Estimated Cases and Deaths in 2022

In 2022, approximately 287,850 new cases of invasive breast cancer and 51,400 cases of DCIS will be diagnosed among US women, and 43,250 women will die from breast cancer. Eighty-three percent of invasive breast cancers are diagnosed among women aged 50 years and older, and 91% of breast cancer deaths occur in this age group; half of breast cancer deaths occur in women 70 years or older (Table 1). The median age at diagnosis for female breast cancer is 62 years overall but is slightly younger for Hispanic (57 years), API (58 years), Black (60 years), and AIAN (61 years) women than for White women (64 years),[7] partly because of differences in population age distribution. The median age at breast cancer death is 69 years overall but ranges from 70 years among White women to 62 years among Hispanic women and 63 years among API and Black women.[11] Although breast cancer is predominantly a female disease, approximately 2710 cases and 530 deaths (approximately 1% of all breast cancer cases and deaths) are expected in men in 2022.[18,24] The information provided herein applies to female breast cancer unless otherwise specified.

Estimated Number of Breast Cancer Survivors in 2022

As of January 1, 2022, there were approximately 4.1 million women with a history of breast cancer living in the United States. Approximately 4% of these women are living with metastatic disease, more than half of whom were originally diagnosed with early stage (I-III) cancers.[25]

Probability of Invasive Breast Cancer Diagnosis or Death

Approximately 13% of women (1 in 8) will be diagnosed with invasive breast cancer, and 3% (1 in 39) will die from the disease in their lifetime (Table 2). Lifetime risk reflects an average woman's risk accounting for deaths from other causes that may preempt a breast cancer diagnosis. In contrast to the risk of diagnosis for breast cancer, which peaks among women aged 70–79 years (4.1%) and declines thereafter, the risk of death from the disease continues to increase with age.

Characteristics of Breast Cancers Diagnosed in The United States

Table 3 shows the substantial racial and ethnic variation in breast cancer tumor characteristics among patients aged

TABLE 2. Age-specific 10-year probability of breast cancer diagnosis or death for women, United States, 2017–2019

Current age, years	Diagnosed with invasive breast cancer		Dying from breast cancer	
20	0.1%	(1 in 1439)	<0.1%	(1 in 18,029)
30	0.5%	(1 in 204)	<0.1%	(1 in 2945)
40	1.6%	(1 in 63)	0.1%	(1 in 674)
50	2.4%	(1 in 41)	0.3%	(1 in 324)
60	3.5%	(1 in 28)	0.5%	(1 in 203)
70	4.1%	(1 in 24)	0.7%	(1 in 137)
80	3.0%	(1 in 33)	1.0%	(1 in 100)
Lifetime risk	**12.9%**	**(1 in 8)**	**2.5%**	**(1 in 39)**

Note: Probability is among those who have not been previously diagnosed with cancer and reflects the likelihood of diagnosis/death within 10 years of current age. Percentages and "1 in" numbers may not be numerically equivalent because of rounding.

20 years and older. For example, Black, Hispanic, and AIAN women are less likely to be diagnosed with local-stage breast cancers (range, 57%–60%) compared with API and White women (65% and 68%, respectively). Likewise, Black women have a higher proportion of distant-stage breast cancer compared with other women. Moreover, Black women have the largest proportion of high-grade tumors. HR-positive/HER2-negative breast cancers are by far the most common subtype in each racial/ethnic group. However, Black women are twice as likely as other women to be diagnosed with HR-negative/HER2-negative (also called triple-negative) tumors—19% compared with 11% in Hispanic and AIAN women and 9% in White and API women. Triple-negative breast cancers have fewer treatment options and higher risk of metastasis and recurrence.

Cancer Occurrence in The Most Recent Time Period

Incidence and mortality rates

Female breast cancer incidence and mortality rates for five broad racial and ethnic groups are shown in Figure 1. Breast cancer incidence rates are highest in White women (133.7 per 100,000), followed closely by Black women (127.8 per 100,000), and are lowest in Hispanic and API women. Importantly, these aggregated rates for the broad racial and ethnic groups mask possible heterogeneity within subpopulations. For instance, breast cancer incidence rates of Native Hawaiian women are similar to those of White women.[26,27] Of the broadly defined racial and ethnic groups, Black women have the highest breast cancer death rate (27.6 per 100,000), which is 40% higher than the rate in White women (19.7 per 100,000) and more than double that in API women (11.7 per 100,000).

Racial and ethnic differences in breast cancer rates vary somewhat by age, especially for incidence (Figure 2). For example, Black women have the highest incidence rate before age 40 years, and API women have the second highest rate (after White women) in women aged 45–49 years. Black women have the highest breast cancer death rate except for women aged 70-75 years, among whom AIAN women have the highest rate. Black–White disparities in breast cancer incidence and mortality are largest in young women and decline with age (Figure 3). For example, the breast cancer death rate for Black women is 1.8–2.4 times higher than that for White women in the group aged 20–49 years versus 1.1–1.2 times higher in the group aged 70 years and older. Greater racial disparities in younger women in part reflect the higher proportion of triple-negative breast cancers,[28] which have a younger age distribution, as well as a lower likelihood of insurance coverage, which is associated with later stage diagnosis and reduced access to high-quality treatment.[29]

Incidence rates for breast cancer subtypes

Racial and ethnic variations in incidence rates by breast cancer subtype and age are shown in Figure 4. Among women aged 20 years and older, incidence rates of HR-positive/HER2-negative breast cancer are highest in White women (141 cases per 100,000), followed by AIAN and Black women (112 per 100,000). However, rates among young API women (aged 20–49 years) are only slightly lower than those in White women (50 vs. 53 per 100,000). This may partly reflect differences in risk factor prevalence among the younger API population, who are more likely to be first-generation immigrants. Triple-negative breast cancers (HR-negative/HER2-negative) are most common in Black women, with rates almost two times higher than in White women and three times higher than in API women for both younger and older women. Whereas inherited genetics may explain some of this higher risk, multiple studies have reported the additional contribution of factors associated with structural racism, such as neighborhood segregation and socioeconomic status.[30–33]

In contrast, proportions of HER2-positive tumors are similar across race and ethnicity, ranging from 4% to 6% for HR-negative disease and from 9% to 12% for HR-positive disease (Table 3). Importantly, studies suggest that the distribution of breast cancer subtypes varies within broadly defined racial and ethnic groups. For example, compared with US-born Black women, the prevalence of triple-negative breast cancer was 47% lower in women born in countries in Eastern Africa but was similar in Western Africa-born Black women.[34] In another study of women in California, those of Filipina and Vietnam descent had a higher risk of HR-negative/HER2-positive breast cancers compared with White women.[35] Differences in breast cancer subtype within and between racial/ethnic groups likely reflect variations in the prevalence of breast cancer risk factors[36,37]

TABLE 3. Characteristics of invasive female breast cancers by race/ethnicity, ages 20 years and older, United States, 2015–2019[a]

Characteristic	All races, %	White, %	Black, %	Hispanic,%	API, %	AIAN, %
Age at diagnosis						
20–29	1	<0.1	1	1	1	1
30–39	4	3	6	7	6	5
40–49	13	11	15	21	22	16
50–59	22	21	25	25	25	24
60–69	29	29	28	25	26	31
70–79	21	23	17	15	14	17
≥80	11	12	8	7	6	7
SEER Summary stage						
Local	66	68	57	60	65	60
Regional	26	24	31	31	27	29
Distant	6	5	8	6	5	7
Unknown	3	3	3	4	2	4
Tumor size, cm						
<2.0	55	58	46	48	51	48
2.0–4.9	31	30	34	34	34	34
≥5	8	7	12	10	9	9
Unknown	6	6	7	9	5	9
Grade[b]						
Low	21	23	13	17	18	22
Intermediate	42	43	36	40	43	40
High	29	26	41	34	31	29
Unknown	8	8	9	10	7	9
ER status						
Positive	80	82	69	76	80	77
Negative	16	14	27	18	16	17
Unknown	5	4	5	6	4	5
Subtype						
HR+/HER2−	68	71	57	63	66	66
HR+/HER2+	10	9	10	11	12	10
HR−/HER2+	4	4	5	5	6	5
HR−/HER2−	10	9	19	11	9	11
Unknown	8	7	8	10	7	9

Note: Percentages may not sum to 100% because of rounding.
Abbreviations: −, negative; +, positive; API, Asian/Pacific Islander; AIAN, American Indian/Alaska Native; HR, hormone receptor; HER2, human epidermal growth factor receptor 2.
[a]Individual race categories are exclusive of Hispanic origin.
[b]Data by grade were limited to cases diagnosed during 2013–2017 from the Surveillance, Epidemiology, and End Results (SEER) 22 registries because of a high portion of missing data.

and mammography use[38] but may also be related to genetic variations.[34,39–41]

Temporal Trends in Incidence and Mortality

Incidence

Breast cancer incidence rose during the 1980s and 1990s largely because of the increased detection of asymptomatic disease during the rapid uptake of mammography screening, which increased in prevalence from 29% in 1987 to 70% in 2000.[42] Consequently, among women aged 50 years and older, the rate of DCIS increased more than 10-fold, from 7 cases per 100,000 in 1980 to 73 cases per 100,000 in 2000, and the rate of invasive breast cancer increased by 40%, from 275 to 380 cases per 100,000 (Figure 5). The DCIS incidence rate continued to increase until around 2008 but has since decreased by 1.5% per year through 2019.[8,10]

Invasive breast cancer incidence dropped sharply from 2001 to 2004, largely attributed to the decreased use of menopausal hormones after publication of results from the Women's Health Initiative randomized trial linking estrogen plus progesterone menopausal hormone use to breast cancer and heart disease.[43,44] The decrease was mostly limited to White women and ER-positive disease.[44,45] Since 2004, invasive breast cancer incidence has risen slowly by 0.5% per year,[4,9,46] which a recent ecologic study attributes to increases in body mass index and continued declines in the fertility rate.[47] Body mass index and reproductive factors primarily influence risk for hormone receptor-positive tumors, which are reported (and shown herein) to be driving the increase.[48,49]

The increase in breast cancer incidence during the most recent time period largely reflects a rise in local-stage disease (Figure 6), which increased from 75 per 100,000 in 2004 to 86 per 100,000 in 2019. From 2015 to 2019, the incidence

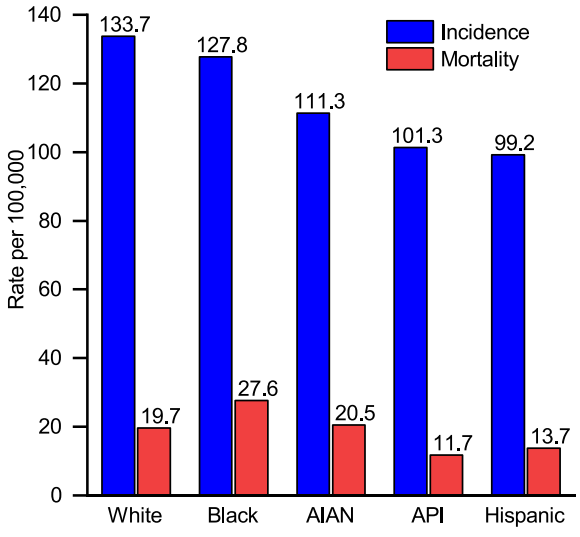

FIGURE 1. Female breast cancer incidence (2015–2019) and mortality (2016–2020) rates by race/ethnicity, United States. Note: Rates are age adjusted to the 2000 US standard population. Incidence data for American Indian/Alaska Native women are confined to PRCDA counties, whereas mortality data are for the entire United States with adjustment factors for racial misclassification. Race is exclusive of Hispanic origin. AIAN indicates American Indian/Alaska Native; API, Asian/Pacific Islander.

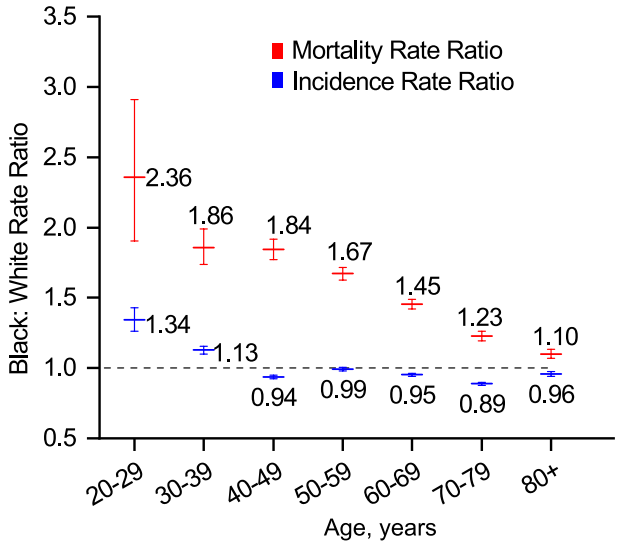

FIGURE 3. Rate ratios comparing breast cancer incidence (2015–2019) and mortality (2016–2020) rates in Black and White women by age, United States. Note: White women served as the reference group, and rate ratios are based on unrounded rates. Error bars indicate 95% confidence intervals. Race is exclusive of Hispanic ethnicity.

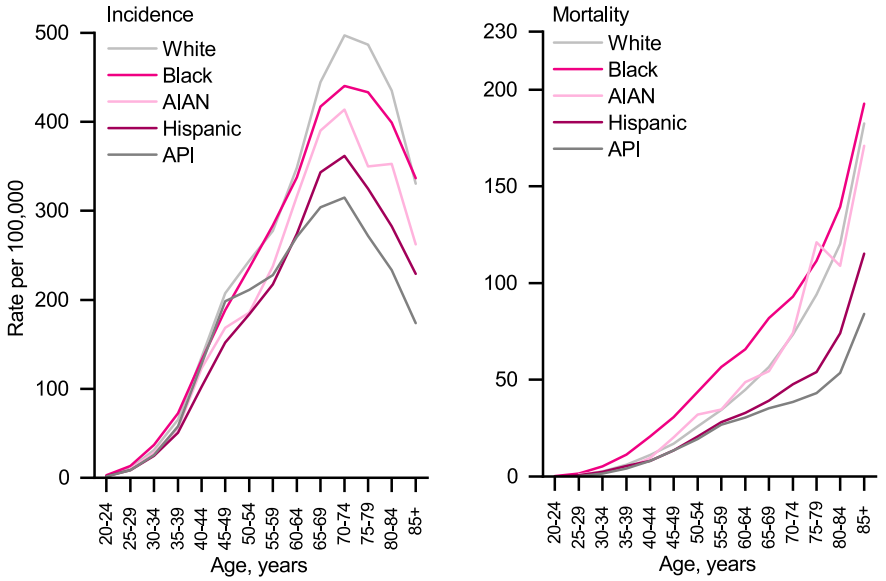

FIGURE 2. Age-specific female breast cancer incidence (2015–2019) and mortality (2016–2020) rates by race/ethnicity, United States. Note: Rates are per 100,000 and are age adjusted to the 2000 US standard population. Mortality rates for American Indians/Alaska Natives are for the entire United States with adjustment factors for racial misclassification. Race is exclusive of Hispanic origin. Data are not shown if there were <25 cases (incidence) or <10 deaths (mortality). AIAN indicates American Indian/Alaska Native; API, Asian/Pacific Islander.

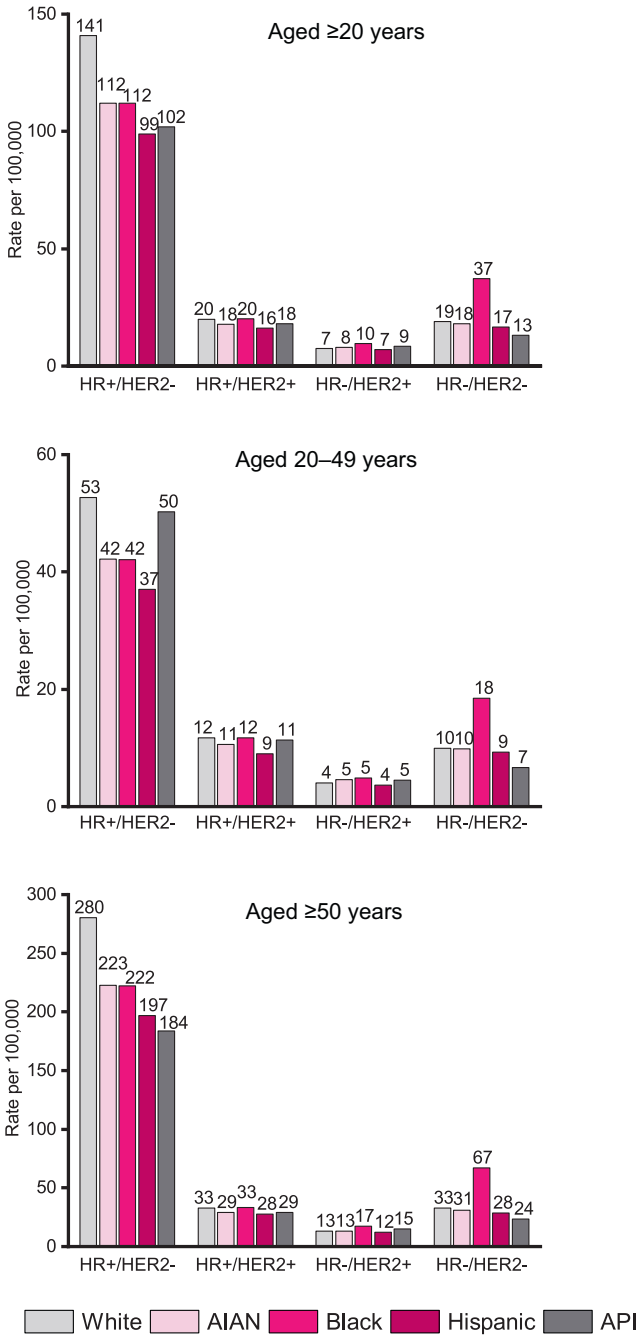

FIGURE 4. Female breast cancer incidence rates by subtype and race/ethnicity and age, 2015–2019, United States. Note: Rates are age adjusted to the 2000 US standard population. Ethnicity is exclusive of Hispanic origin. Hormone receptor (HR) status and human epidermal growth factor 2 (HER2) status were imputed for cases with missing information. –, negative; +, positive; AIAN, American Indian/Alaska Native; API, Asian/Pacific Islander.

rate increased for local-stage disease by 0.9% per year and decreased for regional disease by 0.7% per year, which may reflect a stage shift toward earlier diagnosis. The incidence rate for distant-stage disease increased by 2.4% annually during 2004–2011 but has slowed to a 0.9% per year annual increase during 2015–2019. Although this trend in part reflects improvements in classification because the rate for unknown stage declined in parallel until 2013, a study of young women concluded that some of the increase in distant-stage disease was real, particularly among Black women.[50] This trend may also reflect increased detection of asymptomatic metastases because more breast cancer patients are undergoing advanced imaging such as computed tomography and positron emission tomography-computed tomography scans.

Trends in breast cancer incidence rates vary by race and ethnicity, as shown in Figure 7. During 2015–2019, incidence rates increased across all racial/ethnic groups, although they were slower among White (0.5% per year) and Black (0.7% per year) women than among Hispanic (1.4% per year), AIAN (2.0% per year), and API (2.1% per year) women. We further examined these trends by hormone receptor status from 2000 to 2019 (Figure 8). HR-positive cancer has been increasing since at least 2005 by about 0.9% per year in White women, 1.7% per year in Hispanic women, 2.3% per year in API women, and 2.5% per year in AIAN women. In Black women, the incidence rate for HR-positive breast cancer increased by 3.1% per year during 2005–2012 but has since stabilized. In contrast, HR-negative tumors have generally declined or remained stable in all racial/ethnic groups, excluding Hispanic women.

Reasons for the divergent trends are unknown but likely reflect changes in subtype-specific breast cancer risk factors. For example, parity is associated with a lower risk of HR-positive breast cancer and a higher risk of triple-negative breast cancer,[36,40] although women who breastfeed reduce their risk of triple-negative disease.[51] In the United States, the fertility rate, which was once as high as 118 births per 1000 women aged 15 to 44 years, declined from 69.4 births per 1000 women in 2007 to an all-time low of 56.6 per 1000 women in 2021.[52] In addition, there has been a shift to later age at first birth, which is also associated with increased risk of HR-positive breast cancer.[53]

Mortality

The overall breast cancer death rate increased by 0.4% per year from 1975 to 1989 but has since declined by 43% through 2020. As a result of this decline, 460,000 breast cancer deaths have been averted in US women from 1989 to 2020. Declines in breast cancer mortality have been attributed to better and more targeted treatment and early detection through screening mammography.[54–56] In recent times, however, the decline in breast cancer mortality has slowed from an annual decrease of 1.9% during 1998–2011 to 1.3% during 2011–2020, potentially reflecting the steady increase in breast cancer incidence and stable screening mammography prevalence. Across racial and ethnic groups, the breast cancer death rate declined annually during 2016-2020 by 1.0%–1.4% in Hispanic, Black, and White women, by 0.6% in API women, and was relatively stable in AIAN women.

Breast cancer mortality rates in Black and White women were similar prior to 1980 (Figure 9), but began diverging

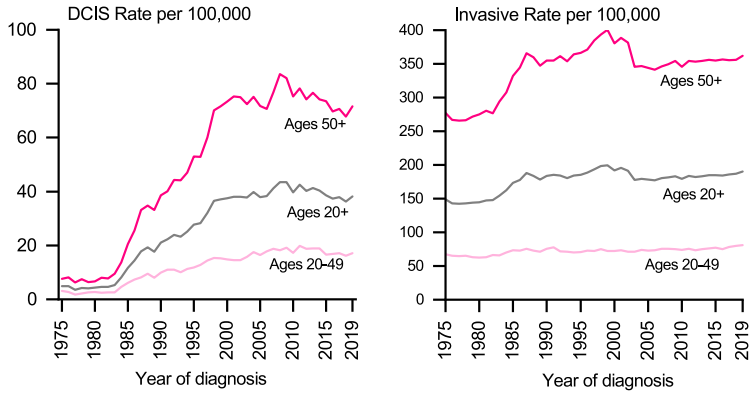

FIGURE 5. Trends in incidence rates of ductal carcinoma in situ and invasive female breast cancer by age, United States, 1975–2019. Note: Rates age adjusted to the 2000 US standard population. DCIS indicates ductal carcinoma in situ.

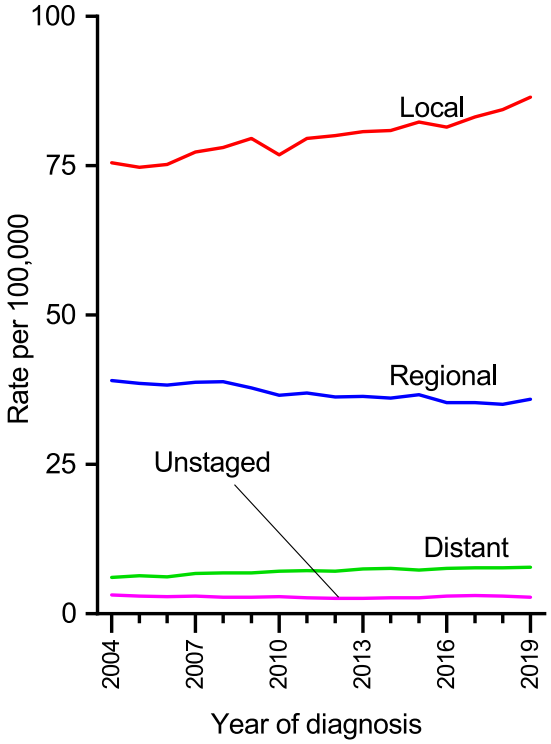

FIGURE 6. Trends in female breast cancer incidence rates by stage and race/ethnicity, United States, 2004–2019. Note: Rates age adjusted to the 2000 US standard population and adjusted for reporting delays. Race is exclusive of Hispanic origin.

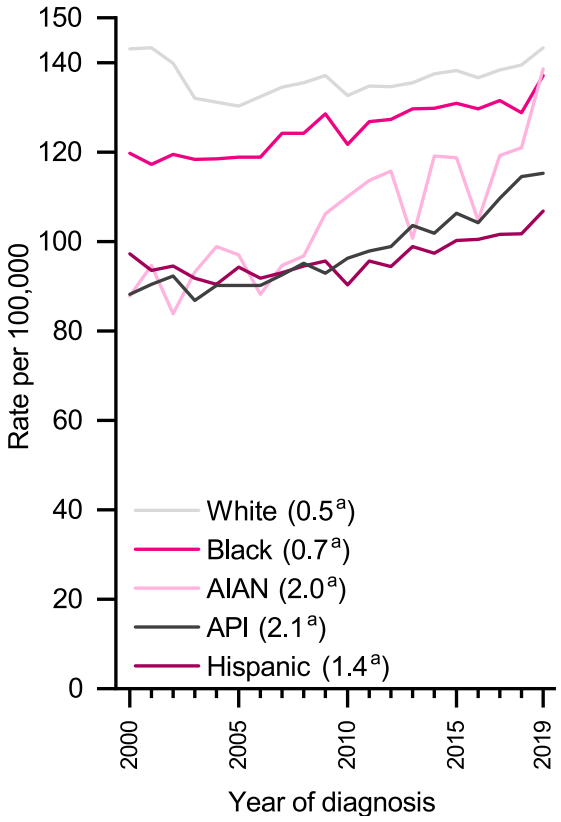

FIGURE 7. Trends in female breast cancer incidence rates by race/ethnicity, United States, 2000–2019. Note: Rates are age adjusted to the 2000 US standard population and adjusted for reporting delays. Race is exclusive of Hispanic origin. The average annual percent change (AAPC) during 2015–2019 is indicated in parentheses. [a]The trend (as measured by the AAPC) was significantly different from zero ($p < .05$). AIAN indicates American Indian/Alaska Native; API, Asian/Pacific Islander.

with the dissemination of advances in early detection and treatment. The racial disparity peaked in 2011 and has since persisted, with the rate 40% higher among Black women than White women in 2016–2020 (Figure 1). The racial gap in breast cancer mortality is largely because of historic and continued systematic racism that is reflected in breast cancer care across the continuum, from lower quality screening to substandard treatment.[57–59] The appearance of this racial chasm in breast cancer mortality coincided with the wide implementation of mammography screening and adjuvant endocrine therapy in the early 1980s that primarily benefit patients with HR-positive cancer. A recent study that quantified mortality rates according to HR status reported that Black women have a 19% higher mortality rate than White women for HR-positive cancer despite having a 22% lower incidence rate, suggesting unequal benefit from these interventions.[60]

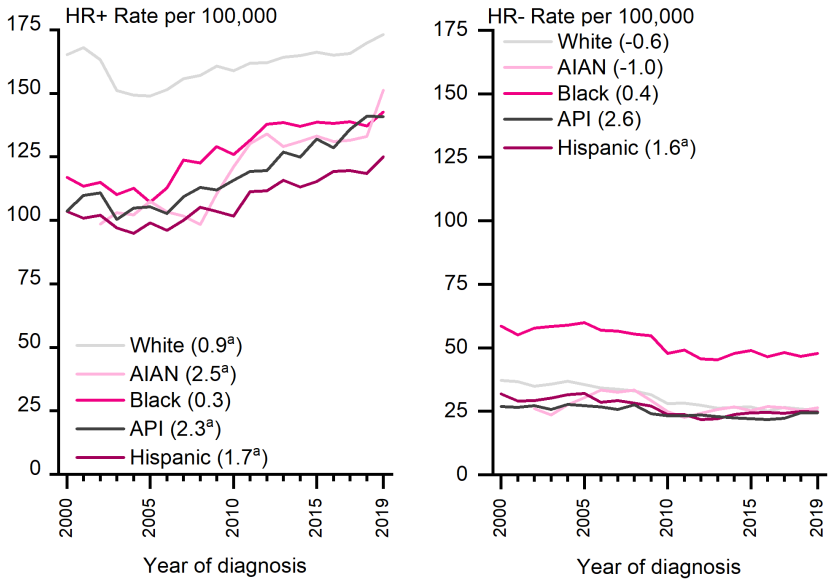

FIGURE 8. Trends in female breast cancer incidence rates by hormone receptor status and race/ethnicity among women aged 20 years and older, United States, 2000–2019. Note: Rates are age adjusted to the 2000 US standard population and adjusted for reporting delays. Ethnicity is exclusive of Hispanic origin. Hormone receptor (HR) status was imputed for cases with missing information. Rates shown for American Indian/Alaska Native women are 3-year moving averages due to sparse data.The average annual percent change (AAPC) during 2015–2019 is indicated in parentheses. [a]The trend (as measured by the AAPC) was significantly different from zero ($p < .05$). AIAN indicates American Indian/Alaska Native; API, Asian/Pacific Islander; HR–, hormone receptor negative; HR+, hormone receptor positive.

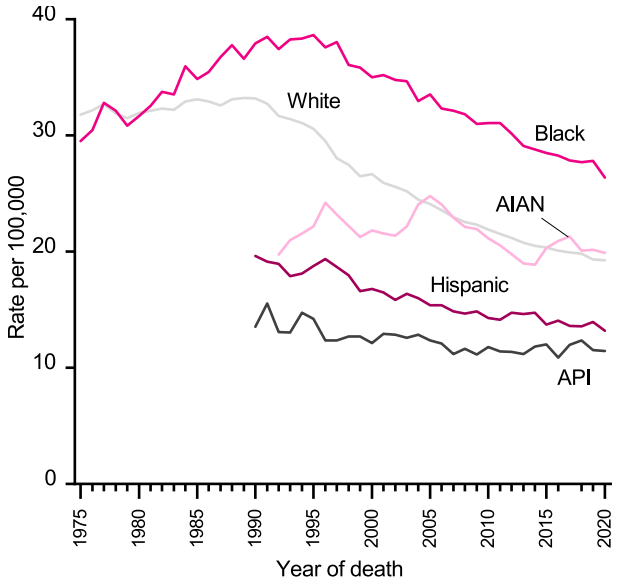

FIGURE 9. Trends in female breast cancer death rates by race/ethnicity, United States, 1975–2020. Note: Rates are per 100,000 and are age-adjusted to the 2000 US standard population. Mortality rates for American Indians/Alaska Native women are 3-year moving averages for the entire United States with adjustment for racial misclassification. Race is exclusive of Hispanic origin, except for the years 1975–1989 for Black and White women. AIAN indicates American Indian/Alaska Native; API, Asian/Pacific Islander.

In addition, although national screening rates are currently similar between Black and White women, Black women are more likely to be screened at lower resourced and nonaccredited facilities and to experience longer intervals between screening mammograms and between abnormal findings and follow-up.[57,61] The higher incidence of HR-negative breast cancer among Black women than among White women also contributes to the racial disparity in breast cancer mortality given the lower survival for these tumors. Notably, however, the racial gap in mortality for Black women with HR-negative cancers is twice as large as that for incidence, implicating less access to targeted therapies and other advances for HER2-enriched and triple negative tumors. [60]

Treatment

Breast cancer treatment patterns by stage and race are depicted in Figure 10. In 2018, 63% of patients with stage I or II disease underwent breast-conserving surgery with or without adjuvant radiation therapy, and 33% underwent mastectomy. Despite equivalent survival when combined with radiation, breast-conserving surgery–eligible patients often elect mastectomy for a variety of reasons, including reluctance to undergo radiation therapy, structural obstacles (e.g., transportation to radiation appointments), and fear of recurrence.[62,63] Younger patients (younger than 40 years) and those with larger and/or more aggressive tumor characteristics are more likely to be treated with mastectomy.[64–66] Increasing use of preoperative breast magnetic resonance imaging in patients with breast cancer has also been shown to correlate with rising rates of mastectomy in women with early stage breast cancer. The routine use of preoperative imaging is discouraged by groups like the American Society of Breast Surgeons because it can detect foci of disease

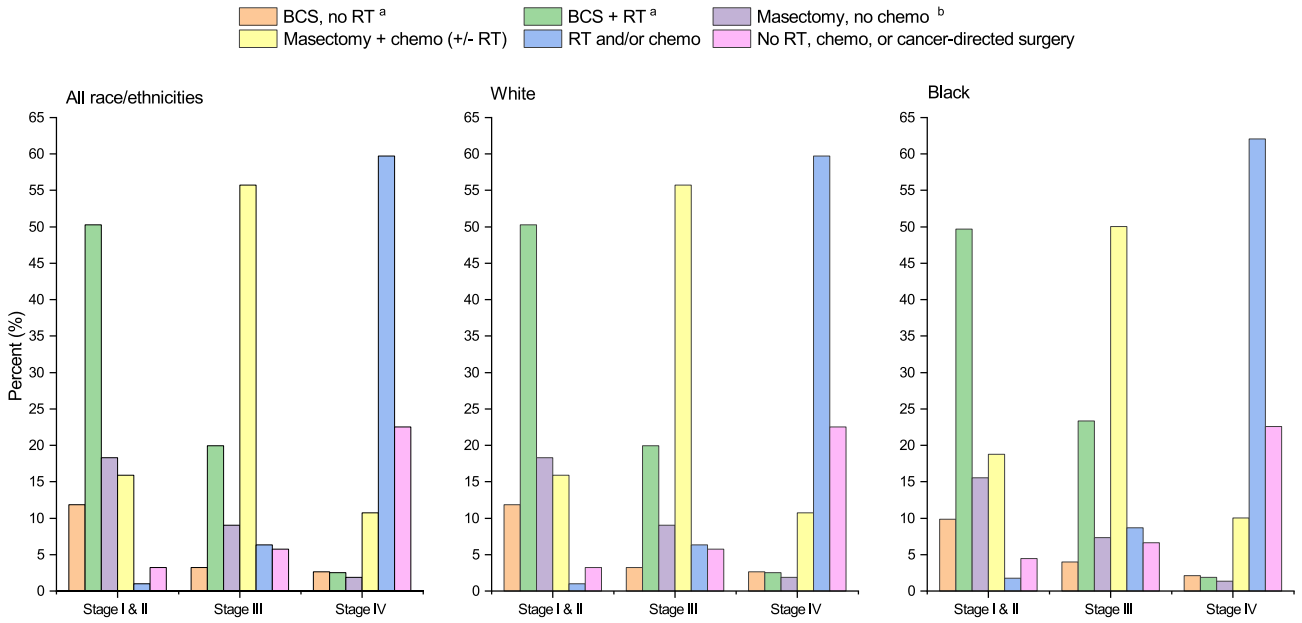

FIGURE 10. Female breast cancer treatment patterns (%) by stage, 2018. White and Black race excludes persons of Hispanic ethnicity. Stage at diagnosis is from the American Joint Committee on Cancer (AJCC) *AJCC Cancer Staging Manual*, eighth edition. Note: Many patients may have received hormone therapy in addition to the other treatments indicated. [a]A few of these patients received chemotherapy. [b]A few of these patients received RT. +/− indicates with or without; BCS, breast-conserving surgery (i.e., lumpectomy/partial mastectomy, in which only cancerous tissue plus a surrounding layer of normal tissue is removed); chemo, chemotherapy (includes targeted therapy and immunotherapy); mastectomy, surgical removal of the entire breast(s); RT, radiation therapy.

that might be biologically irrelevant and/or that would have been obliterated by adjuvant breast radiation and systemic therapy.[67,68] Although mastectomy among women with early stage tumors appears to be declining,[13,69,70] the prevalence of contralateral prophylactic mastectomy (CPM) among women with unilateral early stage breast cancer increased from <2% of all mastectomy procedures in 1998 to about 30% in 2010–2012 and is still increasing.[66,70–72] Determinants of CPM include White race, younger age, higher socioeconomic status, and treatment facilities that are teaching hospitals or provide breast reconstruction.[72] CPM increases cost and morbidity and has not been shown to improve survival. Most women with stage III disease are also treated with surgery; however, Black women are less likely than White women to receive mastectomy (57% vs. 66%, respectively). In addition, Black women are more likely to receive radiation or chemotherapy alone (9% vs. 6%) for stage III disease, for which the stage-specific survival disparity is largest.[13]

The anatomically defined level 1 and level 2 axillary lymph node dissection was historically used in the management of invasive breast cancer to achieve durable regional control of disease and also for risk-stratification/prognostic purposes. This operation is associated with substantial morbidity, such as a relatively high risk of lymphedema. Therefore, the technology of lymphatic mapping and sentinel lymph node biopsy has largely replaced axillary lymph node dissection as a staging procedure for breast cancer.[73] Although the majority of patients with invasive breast cancer require axillary staging to improve the precision of predicting benefit from adjuvant therapies, it is now widely accepted that women older than 70 years with small (T1) tumors that are ER-positive and HER2-negative can safely avoid any axillary staging surgery because the results are not likely to affect outcomes.[74,75]

Approximately 14% of White women and 21% of Black women with stage I and II disease received chemotherapy. The 21-gene recurrence-score assay, Oncotype DX, is one of several commercially available gene-expression assays that is used to predict the benefit of chemotherapy (in addition to hormonal therapy) for patients with HR-positive/HER2-negative, lymph node-negative breast cancer. Patients with high scores (regardless of age/menopausal status) are at increased risk of distant recurrence and are most likely to benefit from chemotherapy, whereas women with low scores have excellent outcomes with endocrine therapy alone. However, most women have either low or intermediate scores, and, until recently, the benefit of chemotherapy with intermediate score disease was less clear. The Trial Assigning Individualized Options for Treatment (TAILORx) clinical trial (ClinicalTrials.gov identifier NCT02050750) randomized women with intermediate scores (11–25) to receive adjuvant chemotherapy as well as endocrine therapy versus endocrine therapy alone; and, after a median follow-up of 90 months, chemotherapy was found to be beneficial only for the subset of women younger than 50 years. The overall study results regarding the relative benefit of chemotherapy correlated with the recurrence score were consistent across

racial/ethnic identity; however, the Black participants had lower overall and distant disease-free survival rates compared with the White participants, even within the recurrence score strata.[76,77]

Although most patients receive chemotherapy in the adjuvant/postoperative setting, the use of neoadjuvant therapy is increasing, particularly among patients with HER2-positive and triple-negative breast cancers.[78] Neoadjuvant therapy can render previously inoperable cancers eligible for surgery and can improve eligibility for breast-conserving surgery among women initially diagnosed with bulky breast tumors. Neoadjuvant treatment can also reduce the extent of regional breast cancer involvement, thereby improving the likelihood of patients being able to avoid the morbidity (e.g., lymphedema) of surgery, such as axillary lymph node dissection. The American Society for Clinical Oncology recently issued recommendations to guide the use of neoadjuvant systemic therapy, including endocrine therapy, in women with breast cancer.[79] For those women who do not achieve a complete pathologic response from neoadjuvant therapy, clinical trials have identified additional systemic therapies that can improve outcomes for triple-negative (HR-negative/HER2-negative) and HER2-positive tumors.[80,81]

Although treatment advances for triple-negative breast cancers have lagged behind those for other molecular subtypes,[82] recent clinical trials have demonstrated promising results with some targeted and immunotherapy drugs. For example, the combined neoadjuvant and adjuvant addition of the antiprogrammed death 1 checkpoint inhibitor pembrolizumab to standard chemotherapy was shown to prolong progression-free survival and improve rates of pathologic complete response among women with early triple-negative cancers in a 36-month follow-up of a phase 3 trial.[83,84] Clinical trials are evaluating combinations of immunotherapies and targeted therapies in all subtypes of breast cancer.[85,86]

Most patients (60%) with stage IV breast cancer receive noncurative-intent radiation and/or chemotherapy. A recent clinical trial found that surgery of the primary tumor in women with metastatic disease did not improve survival.[87] However, the expanded spectrum of targeted therapies, especially for HR-positive and HER2-positive disease, has improved survival for metastatic disease over the past 3 decades.[88–90] Advances have also been made in the treatment of refractory HER2-positive disease. For example, a new trastuzumab conjugate—trastuzumab deruxtecan—was recently found to improve overall survival in patients with treatment-resistant, metastatic, HER2-positive and HER2-low disease, albeit with substantial risk of adverse events.[91] In August 2022, the American Society of Clinical Oncology updated their guidelines for advanced HER2-positive disease to recommend trastuzumab deruxtecan as a second-line treatment in addition to new third-line treatment combinations.[92]

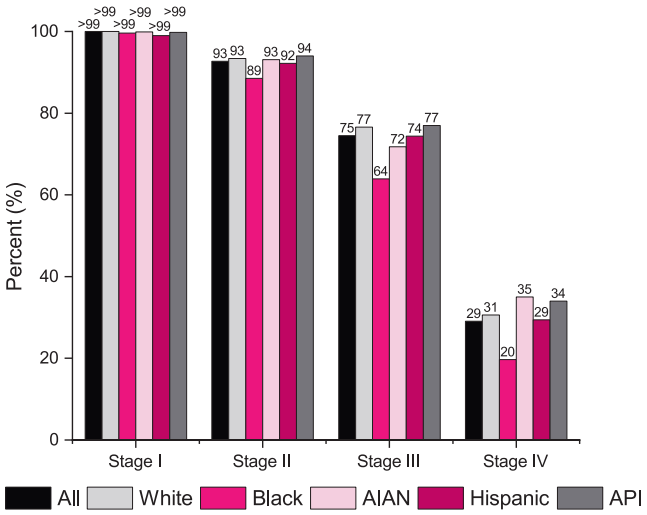

FIGURE 11. Five-year breast cancer relative survival rates (%) by stage at diagnosis and race/ethnicity, United States, 2012–2018. Note: Survival was based on patients who were diagnosed during 2012–2018 and followed through 2019. The standard error for AIAN survival is greater than 3 percentage points for stage III and IV disease. Race is exclusive of Hispanic origin. AIAN indicates American Indian/Alaska Native; API, Asian/Pacific Islander.

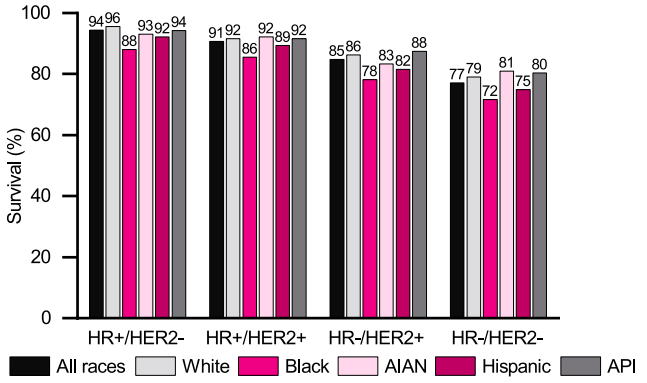

FIGURE 12. Five-year breast cancer relative survival rates (%) by subtype and race/ethnicity, United States, 2012–2018. The standard error for AIAN survival is greater than 3 percentage points for all subtypes except HR+/HER2- disease. Note: Survival was based on patients who were diagnosed during 2012–2018 and followed through 2019. Race is exclusive of Hispanic origin. – indicates negative: +, positive; AIAN, American Indian/Alaska Native; API, Asian/Pacific Islander; HER2, human epidermal growth receptor 2; HR, hormone receptor.

Survival

Breast cancer survival varies substantially by stage at diagnosis. The 5-year relative survival for patients diagnosed during 2012–2018 was >99% for stage I disease, 93% for stage II, 75% for stage III, and 29% for stage IV. Except for stage I, for which survival is similar, Black women have the lowest survival for every stage of diagnosis, with the largest Black–White disparities among those diagnosed with stages III and IV disease (Figure 11). Note that survival rates for API, AIAN, and Hispanic patients may be overestimated because of incomplete or inaccurate vital statistics information in

TABLE 4. Female breast cancer incidence and mortality rates by race/ethnicity and state and mammography screening prevalence

	Incidence rate (2015–2019)				Death rate (2016–2020)				Mammogram prevalence, %[a]	
State	White	Black	Hispanic	API	White	Black	Hispanic	API	Up-to-date (ACS), aged ≥45 years	Biennial, aged 50–74 years
Alabama	121.9	128.0	56.6	80.7	19.4	26.6	—[b]	—[b]	67	73
Alaska	122.4	98.2	133.0	80.1	17.0	—[b]	—[b]	—[b]	56	65
Arizona	124.0	104.0	95.1	85.0	18.8	28.1	14.5	13.8	63	66
Arkansas	121.0	123.9	94.2	106.7	18.7	27.6	—[b]	—[b]	66	67
California	138.9	126.1	96.5	108.4	21.5	29.3	14.1	13.0	60	69
Colorado	135.3	119.5	108.5	89.3	19.2	24.9	16.4	8.4	60	66
Connecticut	145.5	132.2	123.8	88.8	17.5	24.0	11.4	7.7	73	74
Delaware	138.2	139.6	101.9	99.6	20.4	26.8	—[b]	—[b]	68	70
District of Columbia	145.4	137.9	80.3	82.4	15.6	31.0	—[b]	—[b]	66	72
Florida	127.9	112.9	106.8	79.3	18.9	25.3	13.5	11.2	65	72
Georgia	130.0	132.0	114.8	94.9	18.9	27.0	11.3	11.8	67	70
Hawaii	139.2	126.3	165.1	141.3	21.1	—[b]	23.7	14.5	76	78
Idaho	130.7	—[b]	105.6	104.9	20.8	—[b]	7.7	—[b]	60	65
Illinois	139.2	136.6	101.7	105.5	20.0	31.6	11.6	11.0	67	76
Indiana	125.8	122.2	95.4	88.0	20.2	28.7	12.5	—[b]	62	67
Iowa	137.1	133.1	72.5	94.3	18.2	19.5	12.4	—[b]	70	75
Kansas	134.9	130.3	96.7	81.6	19.7	26.5	14.6	—[b]	64	70
Kentucky	128.7	132.9	96.2	73.7	21.6	26.7	—[b]	—[b]	66	70
Louisiana	128.2	135.6	91.7	85.3	20.2	29.1	11.3	—[b]	74	73
Maine	128.7	79.4	92.0	69.6	17.7	—[b]	—[b]	—[b]	72	76
Maryland	140.9	133.9	88.2	100.1	19.3	27.6	11.2	11.0	70	69
Massachusetts	142.9	122.4	92.3	96.8	16.6	19.5	11.7	8.6	75	80
Michigan	127.0	119.6	73.5	89.1	19.4	28.4	12.6	10.1	64	75
Minnesota	139.0	105.6	103.4	82.9	17.5	23.2	9.6	7.6	67	72
Mississippi	122.0	129.1	49.6	81.0	20.0	30.9	—[b]	—[b]	64	70
Missouri	133.3	133.0	77.1	99.1	19.1	28.4	9.4	9.8	67	72
Montana	136.8	—[b]	104.4	94.7	18.0	—[b]	—[b]	—[b]	63	69
Nebraska	134.3	121.7	103.3	69.0	20.8	29.5	—[b]	—[b]	64	72
Nevada[c]	185.5	107.1	77.7	92.9	23.9	31.4	12.1	16.9	65	71
New Hampshire	144.3	96.0	121.0	74.8	18.2	—[b]	—[b]	—[b]	67	69
New Jersey	148.6	136.0	110.3	106.1	21.1	28.0	12.8	10.3	66	68
New Mexico	123.6	114.0	106.4	87.9	22.9	26.0	17.5	—[b]	61	71
New York	146.1	127.6	109.3	106.3	18.8	25.1	12.8	9.7	71	71
North Carolina	140.6	136.5	97.5	85.3	18.8	26.3	10.4	8.6	70	76
North Dakota	136.1	—[b]	—[b]	—[b]	17.3	—[b]	—[b]	—[b]	72	76
Ohio	132.8	127.1	71.9	86.2	20.7	27.4	9.0	10.3	67	69
Oklahoma	123.4	126.2	91.8	92.4	22.5	28.9	14.6	12.4	62	66
Oregon	133.8	110.7	107.3	95.1	19.8	24.4	11.2	12.9	67	73
Pennsylvania	135.0	127.4	98.9	83.3	19.9	28.8	11.9	8.4	68	70
Rhode Island	147.5	121.0	98.5	110.5	17.7	20.7	9.1	—[b]	74	76
South Carolina	132.9	129.3	88.6	80.6	19.9	27.6	8.2	10.7	70	73

(Continues)

TABLE 4. (Continued)

State	Incidence rate (2015–2019)				Death rate (2016–2020)				Mammogram prevalence, %[a]	
	White	Black	Hispanic	API	White	Black	Hispanic	API	Up-to-date (ACS), aged ≥45 years	Biennial, aged 50–74 years
South Dakota	127.8	—[b]	74.1	107.9	18.9	—[b]	—[b]	—[b]	72	75
Tennessee	125.1	122.0	91.1	73.0	20.7	29.1	11.6	8.6	67	69
Texas	130.1	123.6	93.5	84.1	20.3	29.0	15.2	12.0	65	70
Utah	116.7	96.1	115.4	85.8	20.4	—[b]	14.5	11.2	60	66
Vermont	132.6	—[b]	—[b]	—[b]	16.7	—[b]	—[b]	—[b]	63	69
Virginia	129.3	132.3	77.9	77.9	20.0	27.9	9.0	10.4	70	72
Washington	136.7	112.0	106.5	102.6	20.2	19.1	12.2	11.3	63	67
West Virginia	122.2	122.4	70.1	89.9	21.1	30.9	—[b]	—[b]	68	75
Wisconsin	136.7	141.1	94.6	81.1	18.3	26.0	12.7	a	70	76
Wyoming	115.5	—[b]	83.2	—[b]	18.9	—[b]	—[b]	—[b]	56	60
United States	133.7	127.8	99.2	101.3	19.7	27.6	13.7	11.7	65	76

Note: Race is exclusive of Hispanic origin. Rates are per 100,000 and age adjusted to 2000 the US standard population.
Abbreviation: API, Asian/Pacific Islander.
[a]Prevalence of mammography for the entire United States is obtained from the National Health Interview Survey (2019), and state data are from the Behavioral Risk Factor Surveillance System (2020).
[b]The statistic is not displayed because there were <25 cases or deaths.
[c]Data for this state are not included in the United States combined rates because it did not meet high-quality standards for all years during 2015–2019, according to North American Association of Central Cancer Registries.

cancer registry data, which is more common among populations with a large proportion of foreign-born individuals.[93] Survival also varies within these broad racial and ethnic groups.[37] For example, one study found that Caribbean-born Black women have more favorable breast cancer survival compared with their US-born counterparts.[94]

We also examined 5-year relative survival by breast cancer molecular subtype (Figure 12). Triple-negative breast cancers have a poorer prognosis compared with other subtypes because they are more likely to be diagnosed at an advanced stage and have fewer effective treatment options.[95,96] Similar to differences by stage, Black women have the lowest survival for every subtype, with the largest Black–White gap for more treatable cancers, such as HR-positive/HER2-negative and HR-negative/HER2-positive (Figure 12).[97–101] Unequal access to timely, high-quality treatment explains much of the survival disparity, although differences in tumor biology, comorbidities, and response to treatment also contribute. In a study based on a large national sample of nonelderly patients with early stage breast cancer, insurance status explained one third of the excess risk of death among Black versus White patients.[102] A more recent study found that racial/ethnic disparities in stage IV breast cancer survival were mitigated in areas where Medicaid expansion increased access to care.[103] Studies have also shown that Black women are more likely than White women to experience treatment delay and discontinuation and are less likely to receive guideline-concordant care, even after controlling for insurance status.[104–108] Efforts to improve survival outcomes among Black women and other underserved populations require multifaceted interventions to address systemic inequalities across the continuum of breast cancer care.

Geographic Variations in Incidence, Mortality, and Mammography

State variations in breast cancer incidence and mortality are presented in Table 4. Although the national incidence of breast cancer during 2015–2019 was slightly higher in White women than in Black women, incidence rates were higher in Black women in four states (Alabama, Louisiana, Mississippi, and Virginia) and were not statistically different in 21 other states and the District of Columbia compared with White women. Incidence rates were lower among API and Hispanic women than among White women in every state except Hispanic women in Hawaii, where the rates were similar. Data for AIAN women are too sparse to provide by state; however, a recent study reported that, during 2014–2018, incidence rates among AIAN women varied greatly from 69.9 per 100,000 in the Southwest to 166.9 per 100,000 in the Souther Plains. [109]

Breast cancer death rates during 2016–2020 were statistically significantly higher among Black women than among White women in every state except Iowa, New Mexico, Oregon, Rhode Island, and Washington, where they were similar. Death rates among Black women were approximately 50% higher than among White women in Arizona, Arkansas, Illinois, Michigan, Mississippi, and Missouri and were twice as high in the District of Columbia. The foreign-born Black

population is highly concentrated in the Northeast and South and is generally healthier, with a lower risk of obesity than US-born African Americans,[110-112] which may contribute to the narrowing Black–White disparity in some states. Breast cancer death rates among API and Hispanic women did not surpass those of Black or White women in any state and were unavailable by state for AIAN women.

Table 4 also provides the reported prevalence of up-to-date mammography screening in 2020 by state and in 2019 for the total United States. The American Cancer Society recommends that women at average risk of developing breast cancer undergo annual mammography beginning at age 45 years with the option to transition to biennial mammography beginning at age 55 years; women aged 40–44 years should have the option to begin annual mammography. In general, mammographic screening should continue while overall health is good and life expectancy is ≥10 years.[113] Up-to-date screening prevalence in women aged 45 years and older ranged from 56% in Alaska and Wyoming to 76% in Hawaii. The prevalence of up-to-date screening among uninsured women (aged 45–64 years) is much lower in all states, ranging from 21% in Montana to 56% in Hawaii.[114] Screening prevalence according to the US Preventative Services Task Force, which recommends biennial screening in women aged 50–74 years,[115] ranged from 60% in Wyoming to 80% Massachusetts.

Data Limitations

Incidence rates by molecular subtype should not be compared with those published previously because of changes in the classification of borderline positive ER/PR status from positive before the SEER November 2020 data submission (i.e., in breast cancer statistics, 2019) to unknown. In addition, breast cancer incidence and mortality for broadly defined racial and ethnic groups masks differences within these heterogeneous populations.

Conclusions

Incidence rates of breast cancer continue to increase slowly in the United States, largely driven by the occurrence of localized and HR-positive disease. This trend reflects in part an increased prevalence of excess body weight and declines in the fertility rate. Nevertheless, breast cancer mortality continues to decline, albeit at a slower pace than during the 1990s and 2000s. Black women have a 40% higher breast cancer mortality than White women despite lower incidence. Further, this disparity that has remained unabated for a decade, even as awareness has grown within the oncology community. Driving this trend, Black women have the lowest survival of any racial and ethnic group for every molecular subtype and stage of disease (except stage I), with 8% lower survival than White women in absolute terms for HR-positive/HER2-negative disease and HR-negative/HER2-positive disease and a 13% gap for stage III disease (64% vs. 77%). These inequalities could be mitigated by expanding access to high-quality prevention, early detection, and treatment services to all women through nationwide Medicaid expansion and forging partnerships between community stakeholders, advocacy organizations, and health systems to address detection and treatment inequalities. ■

ACKNOWLEDGMENTS: The authors gratefully acknowledge all cancer registries and their staff for their hard work and diligence in collecting cancer information, without which this research could not have been done.

CONFLICTS OF INTEREST: Lisa A. Newman reports grants from the Breast Cancer Research Foundation, the Fashion Footwear Association of New York, Genentech, and the National Institutes of Health; personal fees from the Dana-Farber Cancer Institute and Susan G. Komen for the Cure; service on a Data and Safety Monitoring Committee at Johns Hopkins Medicine; other support from the Dana-Farber Cancer Institute, Johns Hopkins Medicine, and the Stanford University School of Medicine; and travel support from the American Association for Cancer Research, all outside the submitted work. The remaining authors made no disclosures.

References

1. Giaquinto AN, Miller KD, Tossas KY, Winn RA, Jemal A, Siegel RL. Cancer statistics for African American/Black people 2022. *CA Cancer J Clin.* 2022;72:202-229.
2. Miller KD, Ortiz AP, Pinheiro PS, et al. Cancer statistics for the US Hispanic/Latino population, 2021. *CA Cancer J Clin.* 2021;71:466-487.
3. Islami F, Goding Sauer A, Miller KD, et al. Proportion and number of cancer cases and deaths attributable to potentially modifiable risk factors in the United States. *CA Cancer J Clin.* 2018;68:31-54.
4. Surveillance, Epidemiology, and End Results (SEER) Program. SEER*Stat Database: Incidence—SEER Research Data with Delay-Adjustment, 8 Registries, Malignant Only, November 2021 Submission (1975–2019)—Linked To County Attributes—Time Dependent (1990–2019) Income/Rurality, 1969–2020 Counties. Surveillance Research Program, Division of Cancer Control and Population Sciences, National Cancer Institute; 2022. Accessed July 1, 2022. seer.cancer.gov
5. Amin MB, Greene FL, Edge SB, et al. The eighth edition AJCC Cancer Staging Manual: continuing to build a bridge from a population-based to a more "personalized" approach to cancer staging. *CA Cancer J Clin.* 2017;67:93-99.
6. Edge SB, Byrd DR, Compton C, Fritz A, Greene FL, Trotti A, eds. AJCC Cancer Staging Manual. 7th ed. Springer; 2010.
7. Surveillance, Epidemiology, and End Results (SEER) Program. SEER*Stat Database: Incidence—SEER Research Data, 17 Registries, November 2021 Submission (2000–2019)—Linked To County Attributes—Time Dependent (1990–2019) Income/Rurality, 1969–2020 Counties. Surveillance Research Program, Division of Cancer Control and Population Sciences, National Cancer Institute; 2022. Accessed July 1, 2022. seer.cancer.gov
8. Surveillance, Epidemiology, and End Results (SEER) Program. SEER*Stat Database: Incidence—SEER Research Limited-Field Data, 22 Registries, November 2021 Submission (2000–2019)—Linked To County Attributes—Time Dependent (1990–2019) Income/Rurality,

1969–2020 Counties. Surveillance Research Program, Division of Cancer Control and Population Sciences, National Cancer Institute; 2022. Accessed July 1, 2022. seer.cancer.gov

9. Surveillance, Epidemiology, and End Results (SEER) Program. SEER*Stat Database: Incidence—SEER Research Limited-Field Data with Delay-Adjustment, 22 Registries, Malignant Only, November 2021 Submission (2000–2019)—Linked To County Attributes—Time Dependent (1990–2019) Income/Rurality, 1969–2020 Counties. Surveillance Research Program, Division of Cancer Control and Population Sciences, National Cancer Institute; 2022. Accessed July 1, 2022. seer.cancer.gov
10. North American Association of Central Cancer Registries (NAACCR). SEER*Stat Database: NAACCR Incidence Data—Cancer in North America Analytic File, 1995–2019, for the NAACCR Hispanic/Latino Identification Algorithm (NHIA v2) Origin, Custom File With County, American Cancer Society Facts and Figures Projection Project (which includes data from the Centers for Disease Control and Prevention's National Program of Cancer Registries [NPCR], the Canadian Cancer Registry's Provincial and Territorial Registries, and the National Cancer Institute's Surveillance, Epidemiology, and End Results [SEER] Registries; certified by the NAACCR as meeting high-quality incidence data standards for the specified time periods). NAACCR; 2021.
11. Surveillance, Epidemiology, and End Results (SEER) Program. SEER*Stat Database: Mortality—All Causes of Death, Aggregated With State, Total U.S. (1990–2020) <Katrina/Rita Population Adjustment>. Surveillance Research Program, Division of Cancer Control and Population Sciences, National Cancer Institute; 2022. Underlying mortality data provided by the National Center for Health Statistics. Accessed July 1, 2022. seer.cancer.gov
12. Surveillance, Epidemiology, and End Results (SEER) Program. SEER*Stat Database: Mortality—All Causes of Death, Aggregated With State, Total U.S. (1969–2019) <Katrina/Rita Population Adjustment>. Surveillance Research Program, Division of Cancer Control and Population Sciences, National Cancer Institute; 2021. Underlying mortality data provided by the National Center for Health Statistics. Accessed July 1, 2022. seer.cancer.gov
13. Miller KD, Nogueria N, Devasia T, et al. Cancer treatment and survivorship statistics, 2022. *CA Cancer J Clin*. *Published online June* 23, 2022. doi:10.3322/caac.21731
14. American College of Surgeons Commission on Cancer. *National Cancer Database, 2019 Data Submission*. American College of Surgeons Commission on Cancer; 2021.
15. Mallin K, Browner A, Palis B, et al. Incident cases captured in the National Cancer Database compared with those in U.S. population based central cancer registries in 2012–2014. *Ann Surg Oncol.* 2019;26:1604-1612.
16. Centers for Disease Control and Prevention. Behavioral Risk Factor Surveillance System Survey Data 2019. US Department of Health and Human Services, Centers for Disease Control and Prevention; 2019.
17. National Center for Health Statistics. *National Health Interview Surveys, 2019* (public-use data file and documentation). National Center for Health Statistics, Centers for Disease Control and Prevention; 2022. Accessed July 1, 2022. cdc.gov/nchs/nhis/data-questionnaires-documentation.htm
18. Siegel RL, Miller KD, Fuchs HE, Jemal A. Cancer statistics, 2022. *CA Cancer J Clin.* 2022;72:7-33.
19. Anderson WF, Katki HA, Rosenberg PS. Incidence of breast cancer in the United States: current and future trends. *J Natl Cancer Inst.* 2011;103:1397-1402.
20. Surveillance Research Program, National Cancer Institute. SEER*Stat Software. Version 8.4.0. National Cancer Institute; 2022.
21. National Cancer Institute. Joinpoint Regression Program. Version 4.9.1.0. Statistical Research and Applications Branch, National Cancer Institute; 2022. Accessed August 15, 2022. surveillance.cancer.gov/joinpoint
22. National Cancer Institute. DevCan: Probability of Developing or Dying of Cancer Software. Version 6.8.0. Statistical Research and Applications Branch, National Cancer Institute; 2022. Accessed July 1, 2022. surveillance.cancer.gov/devcan
23. Arias E, Xu J, Curtin S, Bastian B, Tejada-Vera B. Mortality profile of the non-Hispanic American Indian or Alaska Native population, 2019. *Natl Vital Stat Rep.* 2021;70:1-27.
24. Yadav S, Karam D, Bin Riaz I, et al. Male breast cancer in the United States: treatment patterns and prognostic factors in the 21st century. *Cancer.* 2020;126:26-36.
25. Gallicchio L, Devasia TP, Tonorezos E, Mollica MA, Mariotto A. Estimation of the numbers of individuals living with metastatic cancer in the United States [published online ahead of print, 2022 Aug 22]. *J Natl Cancer Inst.* 2022:djac158. doi: 10.1093/jnci/djac158
26. Taparra K, Miller RC, Deville C Jr. Navigating Native Hawaiian and Pacific Islander cancer disparities from a cultural and historical perspective. *JCO Oncol Pract.* 2021;17:130-134.
27. Medina HN, Callahan KE, Morris CR, Thompson CA, Siweya A, Pinheiro PS. Cancer mortality disparities among Asian American and Native Hawaiian/Pacific Islander populations in California. *Cancer Epidemiol Biomarkers Prev.* 2021;30:1387-1396.
28. Scott LC, Mobley LR, Kuo TM, Il'yasova D. Update on triple-negative breast cancer disparities for the United States: a population-based study from the United States Cancer Statistics database, 2010 through 2014. *Cancer.* 2019;125:3412-3417.
29. Islami F, Guerra CE, Minihan A, et al. American Cancer Society's report on the status of cancer disparities in the United States, 2021. *CA Cancer J Clin.* 2022;72:112-143.
30. Barber LE, Zirpoli GR, Cozier YC, et al. Neighborhood disadvantage and individual-level life stressors in relation to breast cancer incidence in US Black women. *Breast Cancer Res.* 2021;23:108.
31. Qin B, Babel RA, Plascak JJ, et al. Neighborhood social environmental factors and breast cancer subtypes among Black women. *Cancer Epidemiol Biomarkers Prev.* 2021;30:344-350.
32. Linnenbringer E, Geronimus AT, Davis KL, Bound J, Ellis L, Gomez SL. Associations between breast cancer subtype and neighborhood socioeconomic and racial composition among Black and White women. *Breast Cancer Res Treat.* 2020;180:437-447.
33. Krieger N, Singh N, Waterman PD. Metrics for monitoring cancer inequities: residential segregation, the Index of Concentration at the Extremes (ICE), and breast cancer estrogen receptor status (USA, 1992–2012). *Cancer Causes Control.* 2016;27:1139-1151.
34. Sung H, DeSantis CE, Fedewa SA, Kantelhardt EJ, Jemal A. Breast cancer subtypes among Eastern-African–born Black women and other Black women in the United States. *Cancer.* 2019;125:3401-3411.
35. Gomez SL, Von Behren J, McKinley M, et al. Breast cancer in Asian Americans

in California, 1988–2013: increasing incidence trends and recent data on breast cancer subtypes. *Breast Cancer Res Treat.* 2017;164:139-147.

36. Gaudet MM, Gierach GL, Carter BD, et al. Pooled analysis of nine cohorts reveals breast cancer risk factors by tumor molecular subtype. *Cancer Res.* 2018;78:6011-6021.
37. Loo LWM, Williams M, Hernandez BY. The high and heterogeneous burden of breast cancer in Hawaii: a unique multiethnic U.S. population. *Cancer Epidemiol.* 2019;58:71-76.
38. Kohler BA, Sherman RL, Howlader N, et al. Annual Report to the Nation on the Status of Cancer, 1975–2011, featuring incidence of breast cancer subtypes by race/ethnicity, poverty, and state. *J Natl Cancer Inst.* 2015;107:djv048.
39. Hines LM, Sedjo RL, Byers T, et al. The interaction between genetic ancestry and breast cancer risk factors among Hispanic women: the Breast Cancer Health Disparities Study. *Cancer Epidemiol Biomarkers Prev.* 2017;26:692-701.
40. Newman LA, Kaljee LM. Health disparities and triple-negative breast cancer in African American women: a review. *JAMA Surg.* 2017;152:485-493.
41. Huo D, Hu H, Rhie SK, et al. Comparison of breast cancer molecular features and survival by African and European ancestry in The Cancer Genome Atlas. *JAMA Oncol.* 2017;3:1654-1662.
42. Breen N, Gentleman JF, Schiller JS. Update on mammography trends: comparisons of rates in 2000, 2005, and 2008. *Cancer.* 2011;117:2209-2218.
43. Coombs NJ, Cronin KA, Taylor RJ, Freedman AN, Boyages J. The impact of changes in hormone therapy on breast cancer incidence in the US population. *Cancer Causes Control.* 2010;21:83-90.
44. Ravdin PM, Cronin KA, Howlader N, et al. The decrease in breast cancer incidence in 2003 in the United States. *N Engl J Med.* 2007;356:1670-1674.
45. DeSantis C, Howlader N, Cronin KA, Jemal A. Breast cancer incidence rates in U.S. women are no longer declining. *Cancer Epidemiol Biomarkers Prev.* 2011;20:733-739.
46. Islami F, Ward EM, Sung H, et al. Annual Report to the Nation on the Status of Cancer, part 1: national cancer statistics. *J Natl Cancer Inst.* 2021;113:1648-1669.
47. Pfeiffer RM, Webb-Vargas Y, Wheeler W, Gail MH. Proportion of U.S. trends in breast cancer incidence attributable to long-term changes in risk factor distributions. *Cancer Epidemiol Biomarkers Prev.* 2018;27:1214-1222.
48. Rosenberg PS, Barker KA, Anderson WF. Estrogen receptor status and the future burden of invasive and in situ breast cancers in the United States. *J Natl Cancer Inst.* 2015;107:djv159.
49. Davis Lynn BC, Chernyavskiy P, Gierach GL, Rosenberg PS. Decreasing incidence of estrogen receptor-negative breast cancer in the United States: trends by race and region. *J Natl Cancer Inst.* 2022;114:263-270.
50. DeSantis CE, Ma J, Jemal A. Trends in stage at diagnosis for young breast cancer patients in the United States. *Breast Cancer Res Treat.* 2019;173:743-747.
51. Sanderson M, Pal T, Beeghly-Fadiel A, et al. A pooled case-only analysis of reproductive risk factors and breast cancer subtype among Black women in the southeastern United States. *Cancer Epidemiol Biomarkers Prev.* 2021;30:1416-1423.
52. Hamilton BE, Martin JA, Osterman MJK. *Births: Provisional Data for 2021*. Vital Statistics Rapid Release Report No. 20. Division of Vital Statistics, National Center for Health *Statistics*; 2022.
53. Morra A, Jung AY, Behrens S, et al. Breast cancer risk factors and survival by tumor subtype: pooled analyses from the Breast Cancer Association Consortium. *Cancer Epidemiol Biomarkers Prev.* 2021;30:623-642.
54. Berry DA, Cronin KA, Plevritis SK, et al. Effect of screening and adjuvant therapy on mortality from breast cancer. *N Engl J Med.* 2005;353:1784-1792.
55. Munoz D, Near AM, van Ravesteyn NT, et al. Effects of screening and systemic adjuvant therapy on ER-specific US breast cancer mortality. *J Natl Cancer Inst.* 2014;106:dju289.
56. Tong CWS, Wu M, Cho WCS, To KKW. Recent advances in the treatment of breast cancer. *Front Oncol.* 2018;8:227.
57. Warnecke RB, Campbell RT, Vijayasiri G, Barrett RE, Rauscher GH. Multilevel examination of health disparity: the role of policy implementation in neighborhood context, in patient resources, and in healthcare facilities on later stage of breast cancer diagnosis. *Cancer Epidemiol Biomarkers Prev.* 2019;28:59-66.
58. Emerson MA, Golightly YM, Aiello AE, et al. Breast cancer treatment delays by socioeconomic and health care access latent classes in Black and White women. *Cancer.* 2020;126:4957-4966.
59. Collin LJ, Gaglioti AH, Beyer KM, et al. Neighborhood-level redlining and lending bias are associated with breast cancer mortality in a large and diverse metropolitan area. *Cancer Epidemiol Biomarkers Prev.* 2021;30:53-60.
60. Jatoi I, Sung H, Jemal A. The emergence of the racial disparity in U.S. breast-cancer mortality. *N Engl J Med.* 2022;386:2349-2352.
61. Molina Y, Silva A, Rauscher GH. Racial/ethnic disparities in time to a breast cancer diagnosis: the mediating effects of health care facility factors. *Med Care.* 2015;53:872-878.
62. Kummerow KL, Du L, Penson DF, Shyr Y, Hooks MA. Nationwide trends in mastectomy for early-stage breast cancer. *JAMA Surg.* 2015;150:9-16.
63. Albornoz CR, Matros E, Lee CN, et al. Bilateral mastectomy versus breast-conserving surgery for early-stage breast cancer: the role of breast reconstruction. *Plast Reconstr Surg.* 2015;135:1518-1526.
64. Freedman RA, Virgo KS, Labadie J, He Y, Partridge AH, Keating NL. Receipt of locoregional therapy among young women with breast cancer. *Breast Cancer Res Treat.* 2012;135:893-906.
65. McGuire KP, Santillan AA, Kaur P, et al. Are mastectomies on the rise? A 13-year trend analysis of the selection of mastectomy versus breast conservation therapy in 5865 patients. *Ann Surg Oncol.* 2009;16:2682-2690.
66. Nash R, Goodman M, Lin CC, et al. State variation in the receipt of a contralateral prophylactic mastectomy among women who received a diagnosis of invasive unilateral early-stage breast cancer in the United States, 2004–2012. *JAMA Surg.* 2017;152:648-657.
67. Newman LA. Role of preoperative MRI in the management of newly diagnosed breast cancer patients. *J Am Coll Surg.* 2020;230:331-339.
68. American Society of Breast Surgeons. *Consensus Guideline on Diagnostic and Screening Magnetic Resonance Imaging of the Breast*. American Society of Breast Surgeons; 2017.
69. Siegel R, DeSantis C, Virgo K, et al. Cancer treatment and survivorship statistics, 2012. *CA Cancer J Clin.* 2012;62:220-241.
70. Baskin AS, Wang T, Bredbeck BC, Sinco BR, Berlin NL, Dossett LA. Trends in contralateral prophylactic mastectomy utilization for small unilateral breast cancer. *J Surg Res.* 2021;262:71-84.

71. Panchal H, Pilewskie ML, Sheckter CC, et al. National trends in contralateral prophylactic mastectomy in women with locally advanced breast cancer. *J Surg Oncol.* 2019;119:79-87.
72. Wang T, Baskin AS, Dossett LA. Deimplementation of the Choosing Wisely recommendations for low-value breast cancer surgery: a systematic review. *JAMA Surg.* 2020;155:759-770.
73. Braunstein LZ, Morrow M. Regional nodal management in the setting of up-front surgery. *Semin Radiat Oncol.* 2022;32:221-227.
74. Hughes KS, Schnaper LA, Bellon JR, et al. Lumpectomy plus tamoxifen with or without irradiation in women age 70 years or older with early breast cancer: long-term follow-up of CALGB 9343. *J Clin Oncol.* 2013;31:2382-2387.
75. Society of Surgical Oncology. *Choosing Wisely*. Society of Surgical Oncology; 2021. Accessed August 8, 2022. choosingwisely.org/clinician-lists/sso-sentinel-node-biopsy-in-node-negative-women-70-and-over
76. Sparano JA, Gray RJ, Makower DF, et al. Adjuvant chemotherapy guided by a 21-gene expression assay in breast cancer. *N Engl J Med.* 2018;379:111-121.
77. Albain KS, Gray RJ, Makower DF, et al. Race, ethnicity, and clinical outcomes in hormone receptor-positive, HER2-negative, node-negative breast cancer in the randomized TAILORx trial. *J Natl Cancer Inst.* 2021;113:390-399.
78. Murphy BL, Day CN, Hoskin TL, Habermann EB, Boughey JC. Neoadjuvant chemotherapy use in breast cancer is greatest in excellent responders: triple-negative and HER2+ subtypes. *Ann Surg Oncol.* 2018;25:2241-2248.
79. Korde LA, Somerfield MR, Carey LA, et al. Neoadjuvant chemotherapy, endocrine therapy, and targeted therapy for breast cancer: ASCO guideline. *J Clin Oncol.* 2021;39:1485-1505.
80. Masuda N, Lee SJ, Ohtani S, et al. Adjuvant capecitabine for breast cancer after preoperative chemotherapy. *N Engl J Med.* 2017;376:2147-2159.
81. von Minckwitz G, Huang CS, Mano MS, et al. Trastuzumab emtansine for residual invasive HER2-positive breast cancer. *N Engl J Med.* 2019;380:617-628.
82. Waks AG, Winer EP. Breast cancer treatment: a review. *JAMA.* 2019;321:288-300.
83. Schmid P, Cortes J, Pusztai L, et al. Pembrolizumab for early triple-negative breast cancer. *N Engl J Med.* 2020;382:810-821.
84. Schmid P, Cortes J, Dent R, et al. Event-free survival with pembrolizumab in early triple-negative breast cancer. *N Engl J Med.* 2022;386:556-567.
85. Hall PE, Schmid P. Emerging drugs for the treatment of triple-negative breast cancer: a focus on phase II immunotherapy trials. *Expert Opin Emerg Drugs.* 2021;26:131-147.
86. Hall PE, Schmid P. Emerging strategies for TNBC with early clinical data: new chemoimmunotherapy strategies. *Breast Cancer Res Treat.* 2022;193:21-35.
87. Khan SA, Zhao F, Goldstein LJ, et al. Early local therapy for the primary site in de novo stage IV breast cancer: results of a randomized clinical trial (E2108). *J Clin Oncol.* 2022;40:978-987.
88. Miles D, Ciruelos E, Schneeweiss A, et al. Final results from the PERUSE study of first-line pertuzumab plus trastuzumab plus a taxane for HER2-positive locally recurrent or metastatic breast cancer, with a multivariable approach to guide prognostication. *Ann Oncol.* 2021;32:1245-1255.
89. Cortes J, Kim SB, Chung WP, et al. Trastuzumab deruxtecan versus trastuzumab emtansine for breast cancer. *N Engl J Med.* 2022;386:1143-1154.
90. Burstein HJ. Systemic therapy for estrogen receptor-positive, HER2-negative breast cancer. *N Engl J Med.* 2020;383:2557-2570.
91. Modi S, Jacot W, Yamashita T, et al. Trastuzumab deruxtecan in previously treated HER2-low advanced breast cancer. *N Engl J Med.* 2022;387:9-20.
92. Giordano SH, Franzoi MAB, Temin S, et al. Systemic therapy for advanced human epidermal growth factor receptor 2-positive breast cancer: ASCO guideline update. *J Clin Oncol.* 2022;40:2612-2635.
93. Pinheiro PS, Morris CR, Liu L, Bungum TJ, Altekruse SF. The impact of follow-up type and missed deaths on population-based cancer survival studies for Hispanics and Asians. *J Natl Cancer Inst Monogr.* 2014;2014:210-217.
94. Barreto-Coelho P, Cerbon D, Schlumbrecht M, Parra CM, Hurley J, George SHL. Differences in breast cancer outcomes amongst Black US-born and Caribbean-born immigrants. *Breast Cancer Res Treat.* 2019;178:433-440.
95. Plevritis SK, Munoz D, Kurian AW, et al. Association of screening and treatment with breast cancer mortality by molecular subtype in US women, 2000–2012. *JAMA.* 2018;319:154-164.
96. Costa RLB, Gradishar WJ. Triple-negative breast cancer: current practice and future directions. *J Oncol Pract.* 2017;13:301-303.
97. Kim G, Pastoriza JM, Qin J, et al. Racial disparity in distant recurrence-free survival in patients with localized breast cancer: a pooled analysis of National Surgical Adjuvant Breast and Bowel Project trials. *Cancer.* 2022;128:2728-2735.
98. Iqbal J, Ginsburg O, Rochon PA, Sun P, Narod SA. Differences in breast cancer stage at diagnosis and cancer-specific survival by race and ethnicity in the United States. *JAMA.* 2015;313:165-173.
99. Warner ET, Tamimi RM, Hughes ME, et al. Racial and ethnic differences in breast cancer survival: mediating effect of tumor characteristics and sociodemographic and treatment factors. *J Clin Oncol.* 2015;33:2254-2261.
100. Tao L, Gomez SL, Keegan TH, Kurian AW, Clarke CA. Breast cancer mortality in African-American and non-Hispanic White women by molecular subtype and stage at diagnosis: a population-based study. *Cancer Epidemiol Biomarkers Prev.* 2015;24:1039-1045.
101. Moubadder L, Collin LJ, Nash R, et al. Drivers of racial, regional, and socioeconomic disparities in late-stage breast cancer mortality. *Cancer*. Published online July 22, 2022. doi:10.1002/cncr.34391
102. Jemal A, Robbins AS, Lin CC, et al. Factors that contributed to Black-White disparities in survival among nonelderly women with breast cancer between 2004 and 2013. *J Clin Oncol.* 2018;36:14-24.
103. Malinowski C, Lei X, Zhao H, Giordano SH, Chavez-MacGregor M. Association of Medicaid expansion with mortality disparity by race and ethnicity among patients with de novo stage IV breast cancer. *JAMA Oncol.* 2022;8:863-870.
104. Cho B, Han Y, Lian M, et al. Evaluation of racial/ethnic differences in treatment and mortality among women with triple-negative breast cancer. *JAMA Oncol.* 2021;7:1016-1023.
105. Freedman RA, Virgo KS, He Y, et al. The association of race/ethnicity, insurance status, and socioeconomic factors with breast cancer care. *Cancer.* 2011;117:180-189.
106. Chavez-MacGregor M, Clarke CA, Lichtensztajn DY, Giordano SH. Delayed initiation of adjuvant chemotherapy among patients with breast cancer. *JAMA Oncol.* 2016;2:322-329.
107. Eaglehouse YL, Georg MW, Shriver CD, Zhu K. Racial differences in time to

breast cancer surgery and overall survival in the US military health system. *JAMA Surg.* 2019;154:e185113.

108. Sadigh G, Gray RJ, Sparano JA, et al. Breast cancer patients' insurance status and residence zip code correlate with early discontinuation of endocrine therapy: an analysis of the ECOG-ACRIN TAILORx trial. *Cancer.* 2021;127:2545-2552.

109. American Cancer Society. *Cancer Facts & Figures 2022*. American Cancer Society; 2022. Accessed July 1, 2022. cancer.org/research/cancer-facts-statistics/all-cancer-facts-figures/cancer-facts-figures-2022.html

110. Palarino JV. The immigrant health advantage: an examination of African-origin Black immigrants in the United States. *Pop Res Policy Rev.* 2021;40:895-929.

111. Singh GK, Hiatt RA. Trends and disparities in socioeconomic and behavioural characteristics, life expectancy, and cause-specific mortality of native-born and foreign-born populations in the United States, 1979–2003. *Int J Epidemiol.* 2006;35:903-919.

112. Siegel RL, Miller KD, Jemal A. Cancer statistics, 2018. *CA Cancer J Clin.* 2018;68:7-30.

113. Oeffinger KC, Fontham ET, Etzioni R, et al. Breast cancer screening for women at average risk: 2015 guideline update from the American Cancer Society. *JAMA.* 2015;314:1599-1614.

114. American Cancer Society. Table 6B. Up-to-Date Mammography Prevalence (%) by State, US, 2020. *Cancer Prevention & Early Detection Facts & Figures Tables and Figures 2022*. American Cancer Society; 2022:32. Accessed July 1, 2022. cancer.org/content/dam/cancer-org/research/cancer-facts-and-statistics/cancer-prevention-and-early-detection-facts-and-figures/cped-2022-tables-and-figures.pdf

115. Siu AL. Screening for breast cancer: U.S. Preventive Services Task Force recommendation statement. *Ann Intern Med.* 2016;164:279-296.