Original Article

Age Distributions of Breast Cancer Diagnosis and Mortality by Race and Ethnicity in US Women

R. Edward Hendrick, PhD [1]; Debra L. Monticciolo, MD[2]; Kelly W. Biggs, MD[3]; and Sharp F. Malak, MD, MPH[4]

BACKGROUND: Surveillance, Epidemiology, and End Results (SEER) data from 1973-2010 have been used to show that minority women have disproportionately higher percentages of breast cancers diagnosed at younger ages in comparison with White women. **METHODS:** The authors analyzed SEER 21 invasive breast cancer incidence data for 2014-2017 and National Center for Health Statistics mortality data for 2014-2018 and compared invasive incidence and mortality by age in non-Hispanic Black (NH-Black), Asian American/Pacific Islander (AAPI), Native American, and Hispanic women with those in non-Hispanic White (NH-White) women. They evaluated incidence rates and percentages of invasive breast cancer cases and breast cancer deaths occurring before the age of 50 years along with advanced-stage incidence rates and percentages in minority women versus NH-White women. **RESULTS:** Recent SEER data showed that invasive breast cancers were diagnosed at significantly younger ages in minority women versus NH-White women. Among women diagnosed with invasive breast cancer, compared with NH-White women, minority women were 72% more likely to be diagnosed under the age of 50 years (relative risk [RR], 1.72; 95% confidence interval [CI], 1.70-1.75), 58% more likely to be diagnosed with advanced-stage breast cancer under the age of 50 years (RR, 1.58; 95% CI, 1.55-1.61), and 24% more likely to be diagnosed with advanced-stage (regional or distant) breast cancer at all ages (RR, 1.24; 95% CI, 1.23-1.25). Among women dying of breast cancer, minority women were 127% more likely to die under the age of 50 years than NH-White women. **CONCLUSIONS:** NH-Black, AAPI, Native American, and Hispanic women have higher proportions of invasive breast cancers at younger ages and at advanced stages and breast cancer deaths at younger ages than NH-White women. ***Cancer* 2021;127:4384-4392**. *© 2021 American Cancer Society.*

LAY SUMMARY:

- This study analyzes the most recently available data on invasive breast cancers and breast cancer deaths in US women by age and race/ethnicity.
- Its findings show that non-Hispanic Black, Asian American/Pacific Islander, Native American, and Hispanic women have a higher percentage of invasive breast cancers at younger ages and at more advanced stages and a higher percentage of breast cancer deaths at younger ages than non-Hispanic White women.

KEYWORDS: breast cancer, early detection of cancer, female, incidence, minority groups, mortality, screening mammography.

INTRODUCTION

In 2009, the US Preventive Services Task Force (USPSTF) revised its guidelines for screening mammography in women at average risk for breast cancer.[1] Before 2009, the USPSTF and other institutions recommended that average-risk women begin annual screening mammography at the age of 40 years. Although organizations such as the American College of Radiology (ACR), the National Comprehensive Cancer Network, and the American Society of Breast Surgeons continue to recommend this screening regimen, USPSTF recommends women begin screening at the age of 50 years and have biennial mammograms through the age of 74 years. Debate continues over these guidelines, with other organizations providing evidence that USPSTF guidelines will likely result in significantly more breast cancers deaths in comparison with their own guidelines on the basis of age alone.[2]

In a June 2018 research letter, Stapleton et al[3] wrote that the diagnosis of invasive breast cancer cases peaked for Black, Asian, and Hispanic women in their 40s but peaked for White women in their mid-60s. They noted that USPSTF breast screening guidelines may adversely affect minorities by not accounting for these differences.

Other studies have corroborated differences in the epidemiology of breast cancer between minority women and White women. Summarizing findings based on the National Cancer Institute's Surveillance, Epidemiology, and End

Corresponding Author: R. Edward Hendrick, PhD, Department of Radiology, University of Colorado School of Medicine, Anschutz Medical Campus, 12700 E 19th Ave, Mail Stop C278, Aurora, CO 80045 (edward.hendrick@gmail.com).

[1]Department of Radiology, University of Colorado School of Medicine, Aurora, Colorado; [2]Department of Radiology, Baylor Scott & White Healthcare–Central Texas, Temple, Texas; [3]Department of Radiology, Tyrone Regional Health Network, Tyrone, Pennsylvania; [4]Associated Radiologists, Ltd, St. Bernards Healthcare, Jonesboro, Arkansas

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Results (SEER) data up to 2011, Daly and Olopade[4] noted that, compared with White women, Black women were more likely to be diagnosed with breast cancer under the age of 50 years, were more likely to be diagnosed with regional or distant cancer, and were more likely to die of breast cancer. They asserted that the reasons for these differences were multifactorial, and they cited tumor biology, genomics, comorbidities, and patterns of care as key factors. DeSantis et al[5] focused on 2017 SEER data and found similar disparities; for example, the median age at breast cancer death for Black women was 62 years, whereas it was 70 years for White women. DeSantis et al confirmed trends identified by Daly and Olopade and also highlighted regional differences, with Black women more seriously affected by breast cancer than White women, particularly in the southern United States.

Nahleh et al[6] showed similar trends in tumor biology and in the advanced presentation of disease among Hispanic and non-Hispanic Black (NH-Black) women in comparison with non-Hispanic White (NH-White) women. Revised ACR guidelines for women at higher than average risk for breast cancer, released in 2018, highlight Black women and women of Ashkenazi Jewish descent as having special risks for aggressive breast cancers.[7] Although the ACR does not advise unique screening regimens based on race alone, it does cite these disparities to emphasize that all women should be assessed for their degree of risk for breast cancer by the age of 30 years.

Using SEER 9 data from 1973-1999 combined with SEER 18 data from 2000-2010, Stapleton et al[3] based their analysis on invasive breast cancer case distributions, expressed as a percentage at each age in females aged 40 to 75 years, by age and race/ethnicity. The SEER 9 registries have provided incidence data since 1973 on approximately 9% of the US population, but they include only cancer case numbers, not population or incidence rates, by race and ethnic (Hispanic/non-Hispanic) background.[8,9] SEER 18 expanded to 18 cancer incidence registries in 2000 and included approximately 27.8% of the US population in 2010.[10] Given the importance of their findings and their implications concerning racial disparities, we thought it worthwhile to revisit breast cancer incidence trends using more recent data with broader representation of the US population. We also include recent data on distributions of breast cancer deaths by race and ethnicity.

MATERIALS AND METHODS

All data used in this work were anonymized, publicly available data from SEER and from the National Center for Health Statistics (NCHS) and, therefore, did not require institutional review board approval. We analyzed age-adjusted, delay-adjusted invasive breast cancer incidence rates in females for the years 2014-2017 by using data from SEER 21, which includes 21 registries representing 36.7% of the total US population.[8,11] Using SEER*Stat software (versions 8.3.6 and 8.3.8; National Cancer Institute), we examined invasive breast cancer incidence rates and mortality rates by the following race and ethnicity cohorts: NH-White women, NH-Black women, Asian American/Pacific Islander (AAPI) women, American Indian/Alaska Native (Native American) women, and Spanish-Hispanic-Latina women (called Hispanic here for brevity) as well as minority women collectively.

As in Stapleton et al,[3] we included only invasive breast cancers and determined the percentage of invasive breast cancer cases at each age from 40 to 75 years in each cohort. We also evaluated population distributions by age, along with breast cancer incidence rates by age at diagnosis, as percentages of the total from the ages of 40 to 75 years for each race or ethnicity cohort.

We used SEER 21 data from 2014-2017 for females aged 40 to 75 years to determine the median age, interquartile range, and mode (ie, peak count) age of invasive breast cancer incidence in each race and ethnicity cohort. We used 2014-2017 SEER 21 data for women of all ages to determine the percentage of invasive breast cancer cases diagnosed under the age of 50 years, the percentage of invasive breast cancers diagnosed at advanced (regional or distant) stages, and the percentage of advanced breast cancers diagnosed under 50 years of age for each race/ethnicity cohort. We used NCHS breast cancer mortality data from 2014-2018 for women of all ages to determine the percentage of breast cancer deaths occurring under the age of 50 years for each race/ethnicity cohort.[12]

Two-tailed z tests with an α value of .05 were used to test the significance of differences between NH-White women and each minority cohort and minority women collectively in the proportion of women under the age of 50 years who were diagnosed with invasive breast cancer, the proportion of women under the age of 50 years and of all ages who presented with advanced-stage (regional or distant) breast cancer rather than localized invasive disease, and the proportion of women who died of breast cancer under 50 years of age.

To remove population distribution effects, we compared invasive breast cancer incidence rates, advanced-stage breast cancer incidence rates, and breast cancer mortality rates for women under the age of 50 years in each race/ethnicity group. We further compared ratios

of advanced breast cancer rates to invasive breast cancers rates for women under the age of 50 years and of breast cancer mortality rates to invasive breast cancer rates for women under the age of 50 years. The same 2014-2017 SEER 21 incidence data and the same 2014-2018 NCHS mortality data used in the aforementioned analyses were used for these analyses. We determined relative risks (RRs), 95% confidence intervals (CIs), and *P* values for RRs for each minority group in comparison with NH-White women, again by using 2-tailed *z* tests with an α value of .05.

The supporting information details methods used to quantify invasive breast cancer distribution differences between minority cohorts and NH-White women and to quantify the relative contributions of population distribution differences and invasive breast cancer rate (or breast cancer mortality rate) distribution differences to case distribution differences.

For women of all ages, RRs and 95% CIs for 1) the percentage of women with invasive breast cancer diagnosed under the age of 50 years, 2) the percentage of women under the age of 50 years with invasive breast cancer who were diagnosed with advanced-stage (regional or distant) disease, 3) the percentage of women of all ages with invasive breast cancer who were diagnosed with advanced-stage disease, and 4) the percentage of women dying of breast cancer who died under the age of 50 years were computed by standard statistical methods for each minority cohort and for all minorities collectively in comparison with NH-White women.[13]

RESULTS

Our analysis of the SEER 21 database for the years 2014-2017 included 362,503 invasive breast cancers in women of all ages, including 278,871 invasive breast cancers in women aged 40 to 75 years. An analysis of the SEER 9 and SEER 18 databases for 1973-2010 included 725,554 invasive breast cancers in women aged 40 to 75 years. An analysis of NCHS mortality data for 2014-2018 included 208,329 female breast cancer deaths.

The distribution of invasive breast cancers by age at diagnosis as a percentage of the total for the ages of 40 to 75 years, based on 2014-2017 SEER 21 data (Fig. 1), shows that incidence tends to occur at younger ages in each minority cohort in comparison with NH-White women. Table 1 shows the population composition, median age at diagnosis, interquartile range, and mode age at diagnosis for each race/ethnicity cohort for women 40 to 75 years old. Compared with SEER data spanning the

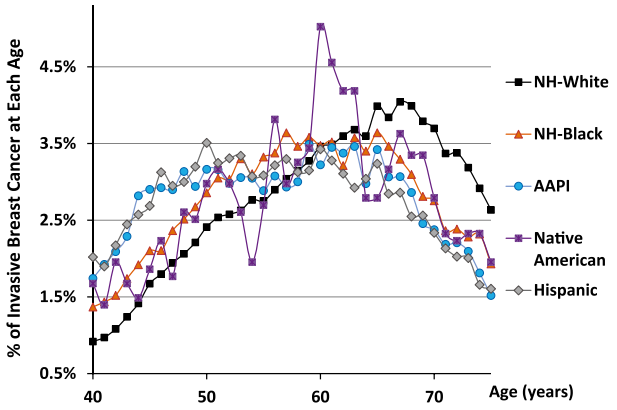

Figure 1. Distribution of invasive breast cancer cases, expressed as percentages of the total for the ages of 40 to 75 years, by the age at diagnosis for each race/ethnicity cohort according to 2014-2017 SEER 21 data. AAPI indicates Asian American/Pacific Islander; NH-Black, non-Hispanic Black; NH-White, non-Hispanic White; SEER, Surveillance, Epidemiology, and End Results.

years 1973-2010,[3] recent SEER incidence data show an increase in the median age at diagnosis of 1 to 2 years for each race/ethnicity cohort. The mode age also has shifted upward for each cohort: by 2 years from 65 to 67 years for NH-White women and by more dramatic shifts for each minority cohort, including 15 years from 50 to 65 years for NH-Black women, 10 years from 49 to 59 years for AAPI women, 8 years from 51 to 59 years for Native American women, and 10 years from 48 to 58 years for Hispanic women.

For women of all ages, Table 2 shows the numbers and percentages of invasive cancers diagnosed before the age of 50 years for each race/ethnicity cohort along with RRs and 95% CIs for diagnosis before the age of 50 years for each minority cohort in comparison with NH-White women. Among women diagnosed with invasive breast cancer, each minority cohort had a significantly higher RR of having an invasive breast cancer diagnosed before the age of 50 years than NH-White women ($P < .0001$ for each), with Hispanic women having the highest risk (RR, 1.93; 95% CI, 1.90-1.96). Among women with invasive breast cancer, minority women collectively had a 72% higher risk of having an invasive breast cancer diagnosed before the age of 50 years than NH-White women (RR, 1.72; 95% CI, 1.70-1.75).

Each minority cohort also had a significantly higher risk of being diagnosed with an advanced-stage breast cancer in comparison with NH-White women; this was true both for women of all ages and for women under the age

TABLE 1. Population Composition, Median Ages at Diagnosis (and IQRs), Mean Ages at Diagnosis (and SDs), and Mode Ages (Ages at Peak Diagnosis) for Invasive Breast Cancers by Cohort According to 2014-2017 SEER 21 Data for Females Aged 40 to 75 Years

Female Cohort	Population in Woman-y	% of Female Population	Median Age at Diagnosis, y	IQR, y	Mean Age at Diagnosis ± SD, y	Mode Age at Diagnosis, y
NH-White	60,919,444	60.8	61	53-67	60.4 ± 9.2	67
NH-Black	11,709,837	11.7	58	51-66	58.5 ± 9.3	65
AAPI	10,602,460	10.6	57	49-65	57.3 ± 9.6	59
Native American	652,849	0.7	59	51,66	58.8 ± 9.3	60
Hispanic	16,379,469	16.3	56	49-64	57.0 ± 9.5	50
All Women Aged 40-75 y	100,264,059	100	60	52-67	58.6 ± 9.4	65

Abbreviations: AAPI, Asian American/Pacific Islander; IQR, interquartile range; NH-Black, non-Hispanic Black; NH-White, non-Hispanic White; SD, standard deviation; SEER, Surveillance, Epidemiology, and End Results.

TABLE 2. Numbers of Invasive Breast Cancers and Numbers and Percentages of Women Diagnosed With Invasive Breast Cancer Under the Age of 50 Years in Each Race/Ethnicity Cohort According to 2014-2017 SEER 21 Data for Females of All Ages

	Invasive Breast Cancer Diagnosed Under Age of 50 y				
	No. of Invasive Breast Cancers	No. Under Age of 50 y	% Under Age of 50 y	RR of Invasive Cancer at <50 y	95% CI
NH-White	246,943	37,685	15.3	1	—
NH-Black	39,761	8782	22.1	1.45	1.42-1.48
AAPI	29,037	8099	27.9	1.83	1.79-1.87
Native American	1336	297	22.2	1.46	1.32-1.61
Hispanic	40,609	11,938	29.4	1.93	1.89-1.96
All Minorities	110,743	29,116	26.3	1.72	1.70-1.75

Abbreviations: AAPI, Asian American/Pacific Islander; CI, confidence interval; NH-Black, non-Hispanic Black; NH-White, non-Hispanic White; RR, relative risk; SEER, Surveillance, Epidemiology, and End Results.
Among women diagnosed with invasive breast cancer, the RRs and 95% CIs compare a given minority woman diagnosed under the age of 50 years with a NH-White woman.

of 50 years (Table 3). Minority women collectively had a 24% higher risk than NH-White women of an advanced breast cancer at diagnosis (RR, 1.24; 95% CI, 1.23-1.25), whereas for women under the age of 50 years, minority women collectively had a 58% higher risk of an advanced breast cancer at diagnosis (RR, 1.58; 95% CI, 1.55-1.61; $P < .0001$ for each).

The distribution of breast cancer deaths by age as a percentage of the total for all ages based on 2014-2018 NCHS data (Fig. 2) shows that each minority cohort had a higher proportion of breast cancer deaths at younger ages than NH-White women. Among women of all ages dying of breast cancer, each minority cohort had a significantly higher risk of dying before the age of 50 years than NH-White women ($P < .0001$ for each; Table 4); NH-Black women had a 111% higher risk, AAPI women had a 129% higher risk, and Hispanic women had a 164% higher risk of dying before the age of 50 years in comparison with NH-White women. Among women dying of breast cancer, minority women collectively had a 127% higher risk of dying before the age of 50 years than NH-White women (RR, 2.27; 95% CI, 2.21-2.33).

Minority women have population distributions skewed to younger ages in comparison with NH-White women (Fig. 3), and this contributes to higher percentages of invasive breast cancers and breast cancer deaths at younger ages. Distributions of invasive breast cancer rates by the age at diagnosis for women aged 40 to 75 years from SEER 21 are shown in Figure 4. Lower incidence rates at older ages for minority women (compared with NH-White women) also contribute to higher relative percentages at younger ages when they are plotted as a percentage of the total number of cancers for each cohort.

Table 5 reports invasive breast cancer incidence rates, advanced-stage breast cancer incidence rates, and breast cancer mortality rates for women under 50 years of age along with RRs, 95% CIs, and *P* values for each minority cohort in comparison with NH-White women. This analysis removes population distribution differences by comparing incidence and mortality rates for women under the age of 50 years rather than comparing percentages of invasive breast cancers or breast cancer deaths occurring under the age of 50 years. Table 5 shows that rates of invasive breast cancer, advanced breast cancers, and

TABLE 3. Numbers of Invasive BCs of Known Stages and Numbers and Percentages of Women Diagnosed With Advanced-Stage (Regional or Distant) BC for Each Race/Ethnicity Cohort and Numbers and Percentages of Advanced BCs Occurring Under the Age of 50 Years According to 2014-2017 SEER 21 Data for Females of All Ages

		Advanced-Stage (Regional or Distant) Breast Cancer (BC)				Advanced-Stage BC Under Age of 50 y			
	No. of Invasive BCs[a]	No. of Advanced BCs	% Advanced BCs	RR of Advanced BCs	95% CI	No. of Advanced BCs at <50 y	% Advanced BCs at <50 y	RR of Advanced BCs at <50 y	95% CI
NH-White	244,681	75,193	30.7	1	–	15,038	20.0	1	
NH-Black	39,444	16,319	41.4	1.35	1.33-1.36	4284	26.3	1.31	1.27-1.35
AAPI	29,432	9756	33.1	1.08	1.06-1.10	3280	33.6	1.68	1.63-1.73
Native American	1413	525	37.2	1.21	1.13-1.29	152	29.0	1.45	1.27-1.66
Hispanic	40,181	15,546	38.7	1.26	1.24-1.28	5614	36.1	1.81	1.76-1.85
All Minorities	110,470	42,146	38.2	1.24	1.23-1.25	13,330	31.6	1.58	1.55-1.61

Abbreviations: AAPI, Asian American/Pacific Islander; BC, breast cancer; CI, confidence interval; NH-Black, non-Hispanic Black; NH-White, non-Hispanic White; RR, relative risk; SEER, Surveillance, Epidemiology, and End Results.
The RRs and 95% CIs compare a woman in each minority cohort diagnosed with advanced-stage breast cancer (left half) or diagnosed with an advanced-stage breast cancer under the age of 50 years (right half) with a NH-White woman.
[a]Includes only invasive BCs of known stages.

Figure 2. Distribution of female breast cancer deaths by age at death, expressed as percentages of the total from the ages of 20 to 85+ years, for each race/ethnicity cohort according to 2014-2018 NCHS mortality data. Data points represent 5-year age groups; the data points for the ages of 20 to 24 years are plotted at 22 years and so forth. The last (farthest right) data points represent the percentages of breast cancer deaths for women aged 85 years or older. AAPI indicates Asian American/Pacific Islander; NCHS, National Center for Health Statistics; NH-Black, non-Hispanic Black; NH-White, non-Hispanic White.

breast cancer deaths are lower for AAPI, Native American, and Hispanic women than NH-White women. For NH-Black women, on the other hand, although invasive breast cancer rates are slightly lower than those of NH-White women, rates of advanced breast cancers are significantly higher (by 18%) and rates of breast cancer deaths are significantly higher (by 88%) than those of NH-White women.

Table 6 shows ratios of advanced-stage breast cancer rates to invasive breast cancer rates in women under the age of 50 years for each race/ethnicity cohort along with RRs, 95% CIs, and *P* values of these ratios for each minority cohort in comparison with NH-White women. Significantly higher ratios of advanced breast cancer rates to invasive breast cancer rates exist for NH-Black, Native American, and Hispanic women under the age of 50 years in comparison with NH-White women under the age of 50 years.

Table 6 also shows ratios of breast cancer mortality rates to invasive breast cancer rates in women under the age of 50 years for each race/ethnicity cohort along with RRs, 95% CIs, and *P* values of these ratios for each minority cohort in comparison with NH-White women. Similarly, significantly higher breast cancer mortality to incidence rate ratios exist for NH-Black, Native American, and Hispanic women under the age of 50 years in comparison with NH-White women under the age of 50 years. Significantly lower mortality to incidence rates

TABLE 4. Numbers of Breast Cancer Deaths and Numbers and Percentages of Breast Cancer Deaths Under the Age of 50 Years in Each Race/Ethnicity Cohort According to 2014-2018 NCHS Data for Females of All Ages

	Breast Cancer Deaths Under Age of 50 y				
	No. of Total Breast Cancer Deaths	No. Under Age of 50 y	% Under Age of 50 y	RR of Cancer Death at <50 y	95% CI
NH-White	154,916	11,817	7.6	1	—
NH-Black	31,418	5066	16.1	2.11	2.05-2.18
AAPI	6386	1115	17.5	2.29	2.16-2.42
Native American	1041	129	12.4	1.62	1.38-1.91
Hispanic	14,568	2935	20.1	2.64	2.55-2.74
All Minorities	53,413	9245	17.3	2.27	2.21-2.33

Abbreviations: AAPI, Asian American/Pacific Islander; CI, confidence interval; NCHS, National Center for Health Statistics; NH-Black, non-Hispanic Black; NH-White, non-Hispanic White; RR, relative risk.
Among women dying of breast cancer, the RRs and 95% CIs compare a given minority woman dying before the age of 50 years with a NH-White woman.

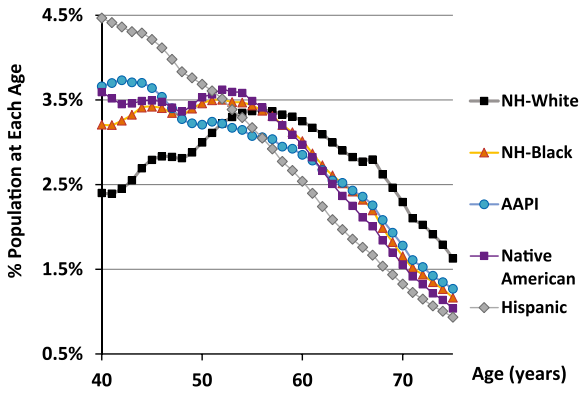

Figure 3. Population distributions as percentages of the total for women aged 40 to 75 years by race/ethnicity according to 2014-2017 SEER 21 data. Note that distributions are larger for each minority cohort at younger ages. AAPI indicates Asian American/Pacific Islander; NH-Black, non-Hispanic Black; NH-White, non-Hispanic White; SEER, Surveillance, Epidemiology, and End Results.

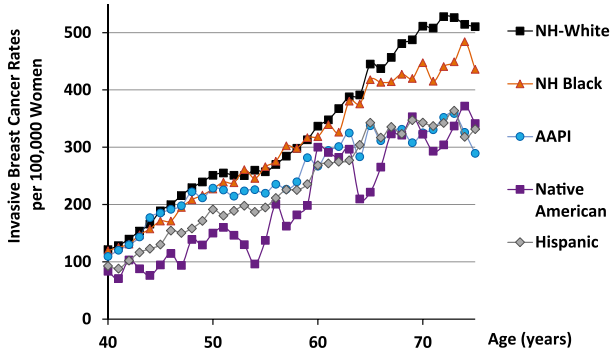

Figure 4. Distribution of invasive breast cancer rates (per 100,000 women) by the age at diagnosis for women aged 40 to 75 years according to 2014-2017 SEER 21 data. AAPI indicates Asian American/Pacific Islander; NH-Black, non-Hispanic Black; NH-White, non-Hispanic White; SEER, Surveillance, Epidemiology, and End Results.

exist for AAPI women versus NH-White women under the age of 50 years.

DISCUSSION

Our analysis of the most recent SEER incidence data shows that in terms of case distribution, invasive breast cancers occur at younger ages in NH-Black, AAPI, Native American, and Hispanic women versus NH-White women. Among women diagnosed with invasive breast cancer, minority women collectively have a significant 72% higher risk of being diagnosed under the age of 50 years than NH-White women, with Hispanic women having a 93% higher risk and AAPI women having an 83% higher risk than NH-White women.

Our analysis also shows that minority women present with more advanced-stage breast cancers than NH-White women; this is true both for women of all ages and for women under the age of 50 years. Collectively, minority women have a significant 24% higher risk of being diagnosed with regional- or distant-stage breast cancer than NH-White women, with NH-Black women having a 35% higher risk and Hispanic women having a 26% higher risk than NH-White women. When we consider women under the age of 50 years, minority women collectively have a significant 58% higher risk of being diagnosed with an advanced-stage breast cancer than NH-White women, with individual minority cohort RRs ranging from 31% higher for NH-Black women to 81% higher for Hispanic women in comparison with NH-White women under the age of 50 years. The higher

TABLE 5. For Women Younger Than 50 Years of Age, Invasive Breast Cancer Incidence Rates, Advanced-Stage (Regional Plus Distant) Breast Cancer Incidence Rates, and Breast Cancer Mortality Rates Per 100,000 Women for Each Race/Ethnicity Cohort and RRs of Each Minority Cohort in Comparison With NH-White Women (Along With 95% CIs and *P* Values for the Significance of Each RR Being Distinct From 1)

	Invasive Breast Cancer Incidence				Advanced-Stage Breast Cancer Incidence[a]				Breast Cancer Mortality			
Race/Ethnicity	Incidence Rate	RR	95% CI	*P*	Incidence Rate	RR	95% CI	*P*	Mortality Rate	RR	95% CI	*P*
NH-White	49.2	1			19.6	1			4.0	1		
NH-Black	47.9	0.97	0.95-1.00	.03	23.1	1.18	1.14-1.22	<.0001	7.5	1.88	1.82-1.94	<.0001
AAPI	45.5	0.92	0.90-0.95	<.0001	17.7	0.91	0.87-0.94	<.0001	3.0	0.74	0.69-0.79	<.0001
Native American	28.6	0.58	0.52-0.65	<.0001	13.4	0.68	0.58-0.80	<.0001	3.0	0.76	0.64-0.90	.002
Hispanic	36.8	0.75	0.73-0.76	<.0001	16.9	0.87	0.84-0.89	<.0001	3.2	0.81	0.78-0.84	<.0001

Abbreviations: AAPI, Asian American/Pacific Islander; CI, confidence interval; NH-Black, non-Hispanic Black; NH-White, non-Hispanic White; RR, relative risk.
Incidence and mortality rates are presented per 100,000 women.
[a]Advanced-stage (regional and distant) breast cancers.

proportion of later-stage breast cancer diagnoses means that more aggressive treatment is needed among minority women with breast cancer, and this causes a greater societal burden.

Among women dying of breast cancer, minority women collectively have a 127% higher risk of dying under the age of 50 years than NH-White women, with Hispanic women having a 164% higher risk, AAPI women having a 129% higher risk, and NH-Black women having a 111% higher risk than NH-White women. The fact that disparities in breast cancer mortality between minority women and NH-White women exceed disparities in breast cancer incidence amplifies the significant negative societal impact experienced by minority women.

Differences in population distributions between minority cohorts and NH-White women are responsible for most of the differences seen in invasive breast cancer distributions in women 40 to 75 years old: more than three-quarters of the difference for NH-Black women, more than half the difference for AAPI women, and almost all the difference for Native American and Hispanic women (see the supporting information). Similarly, in comparison with NH-White women, population differences account for approximately half of the mortality distribution differences for NH-Black and AAPI women, approximately three-quarters of the difference for Hispanic women, and all the difference for Native American women.

When population distribution differences are removed by comparisons of invasive breast cancer incidence rates, advanced-stage breast cancer rates, and mortality rates for women under the age of 50 years, a different picture emerges. The RR of invasive breast cancers for women under the age of 50 years is marginally lower for NH-Black women and is significantly lower for other minority cohorts in comparison with NH-White women. RRs of advanced-stage breast cancers and breast cancer deaths are significantly higher for NH-Black women than NH-White women under the age of 50 years (by 18% and 88%, respectively), whereas both metrics are significantly lower for other minority cohorts in comparison with NH-White women under the age of 50 years.

In women under the age of 50 years, ratios of advanced-stage breast cancer incidence rates to invasive breast cancer incidence rates were significantly higher for NH-Black, Native American, and Hispanic women in comparison with NH-White women; they ranged from 15% higher for Hispanic women to 21% higher for NH-Black women. Similarly, ratios of breast cancer mortality rates to invasive breast cancer incidence rates for women

TABLE 6. For Women Younger Than 50 Years, Ratios of ABC Incidence Rates to Invasive BC Incidence Rates and Ratios of Breast Cancer Mortality Rates to Invasive Breast Cancer Incidence Rates for Each Race Ethnicity Cohort (Along With RRs, 95% CIs, and *P* Values for the Significance of Each RR Distinct From 1)

	Advanced BC Incidence to Invasive Incidence				BC Mortality to Invasive Incidence			
Race/Ethnicity	ABC/Incidence	RR	95% CI	*P*	Mortality/Incidence	RR	95% CI	*P*
NH-White	0.40	1			0.08	1		
NH-Black	0.48	1.21	1.18-1.24	<.0001	0.16	1.93	1.88-1.97	<.0001
AAPI	0.39	0.98	0.95-1.01	.11	0.06	0.80	0.77-0.86	<.0001
Native American	0.47	1.18	1.05-1.32	.006	0.11	1.31	1.15-1.50	<.0001
Hispanic	0.46	1.15	1.13-1.18	<.0001	0.09	1.08	1.05-1.12	<.0001

Abbreviations: AAPI, Asian American/Pacific Islander; ABC, advanced-stage breast cancer; BC, breast cancer; CI, confidence interval; NH-Black, non-Hispanic Black; NH-White, non-Hispanic White; RR, relative risk.

under the age of 50 years were significantly higher for NH-Black, Native American, and Hispanic women in comparison with NH-White women; they ranged from 8% higher for Hispanic women to 93% higher for NH-Black women. In women under the age of 50 years, the ratio of breast cancer mortality rates to invasive breast cancer rates was significantly lower for AAPI women than NH-White women.

Previous authors have studied the importance of age and stage at breast cancer diagnosis in minority women.[6,14-18] Using SEER 18 data, Hung et al[14] examined age and racial/ethnic disparities in younger women (15-44 years old) and older women (45-64 years old). They found that a significantly greater proportion of younger women (48.1%) were diagnosed at late stages (regional and distant) in comparison with older women (38.7%; $P < .0001$). Significantly, 54.5% of younger NH-Black women and 52.9% of younger Hispanic women were diagnosed with late-stage disease, whereas 46.0% of younger NH-White women were ($P < .0001$ for both). In comparison with younger NH-White women, a greater proportion of younger NH-Black women also had a lower life expectancy, more years of life lost, a higher probability of being diagnosed at an early age, and a greater burden of age-adjusted incidence and mortality rates.[14] In their analysis, younger Hispanic women had a higher proportion of years of life lost, but they were less likely to die of their disease than NH-White women. Nahleh et al[6] noted that both Hispanic and African American women were diagnosed at younger ages, had a higher prevalence of aggressive triple-negative breast cancer (TNBC), and were diagnosed at more advanced stages than NH-White women. The evaluation of Hispanic women is challenging because of the heterogeneous ancestry in the Hispanic population.[6,15]

Kurian et al[16] found that White women had a higher proportion of tumors diagnosed at a local stage than Black women (64.5% vs 54.5%) and also more tumors diagnosed at a size of 2 cm or less (61.7% vs 48.6%); both conferred treatment advantages to White women. More recently, Iqbal et al[17] used SEER 18 data to look at early-stage disease and biological aggressiveness of tumors in women of different races and ethnicities. Black women were less likely to be diagnosed with stage I breast cancer than NH-White women (37.0% vs 50.8%; odds ratio, 0.65), and they were nearly twice as likely to die with small tumors of 2 cm or less (hazard ratio [HR], 1.96). Even with small tumors, Black women were more likely to have nodal metastases, more distant metastases, and more TNBC than NH-White women with tumors of similar size. After the exclusion of women with TNBC, the age-adjusted HR for death remained significantly higher for Black women in comparison with their NH-White counterparts (4.6% vs 2.4%; HR, 1.73; $P < .001$).[17] Others have noted that although TNBC is overrepresented in Black women, especially premenopausal Black women,[18] and contributes to disparities, the greatest disparities still occur with good-prognosis, hormone receptor–positive subtypes.[19,20]

A limitation of our study is that although SEER provides a large data set from which to analyze trends, SEER has limited information on several variables that may affect results and permit analyses of possible causes. Differences in the distribution of invasive breast cancers between different racial and ethnic groups and their effects on morbidity and mortality involve factors beyond just population distributions. Breast cancer is a complex disease; incidence and mortality may be affected by personal factors such as family history, prior cancer history, parity, exogenous hormone exposure, body mass index, and genetic susceptibility as well as external factors such as access to health care and socioeconomic status.[4-6,15,21] All data needed to explore such factors are not directly available through SEER. Linking SEER data with other data sources could benefit future research. Interestingly,

Santorelli et al[22] found that the addition of Medicare comorbidity data to SEER data did not explain breast cancer–specific survival differences between NH-Black and NH-White women. Because of the importance of understanding the trends that we have outlined, further research is clearly needed.

Although the disparities in incidence and mortality demonstrated here between minority women and NH-White women exist, it is important to note that this is an association and does not constitute causation. There may exist unknown factors causing an association of incidence or mortality disparities that are correlated with race rather than being caused by race or ethnicity.

Our work adds to the body of literature addressing health care disparities between minority women and NH-White women. Like others, we find that a large subset of minority women, especially African American and Hispanic women, are disadvantaged in breast cancer diagnosis and treatment: they have higher proportions of invasive cancers at younger ages and at advanced stages, as well as breast cancer deaths at younger ages. The earlier onset of disease and death in minority women needs to be directly communicated to women and their medical providers and better addressed and understood by the medical community.

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AUTHOR CONTRIBUTIONS

R. Edward Hendrick: Conceptualization, data curation, formal analysis, methodology, investigation, project administration, resources, software, validation, writing–original draft, and writing–review and editing. **Debra L. Monticciolo:** Methodology, investigation, project administration, resources, supervision, and writing–review and editing. **Kelly W. Biggs:** Methodology, investigation, project administration, resources, writing–original draft, and writing–review and editing. **Sharp F. Malak:** Methodology, investigation, resources, and writing–review and editing.

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