Racial Disparities in Incidence and Survival of Young Women Diagnosed with Breast Cancer: A Surveillance, Epidemiology, and End Results Analysis

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Abstract

Purpose: Disparities in breast cancer mortality between Black and white women have been well documented. Few studies, however, have examined the interaction of race and clinical characteristics among young breast cancer survivors. This study aimed to enhance the understanding of racial disparities in survival probabilities specific to the young breast cancer population.

Methods: We extracted Surveillance, Epidemiology and End Results (SEER) Research Data for 2000 to 2017 for breast cancer, females, and age 20 to 44 years. We applied Kaplan-Meier curves, Cox proportional hazard regression, and marginal effects analysis after Cox regression.

Results: We analyzed data from 93,491 young breast cancer cases. Notably, compared to non-Hispanic Whites (NHW), non-Hispanic Blacks (NHB) showed significantly higher predicted hazard ratio (HR) values regardless of cancer subtype or stage. NHB with triple-negative subtype had an HR of 11.238 (p=.026) compared to NHW counterparts; NHB with Her2-/HR+ subtype had an HR of 16.599 (p<.001). NHB showed significantly worse cancer-specific survival probabilities than NHW across all stages, with the largest difference in stage IV, with an HR of 95.890 (p=0.001) for NHB compared to NHW.

Conclusions: Our findings revealed that young NHB breast cancer survivors had significantly lower cancer-specific survival probabilities than NHW survivors, even given the same tumor biology and stage, with the lowest survival probabilities among NHB with Her2-/HR+ subtype and higher cancer stage. These findings document significant disparities in survival among young breast cancer survivors and point to avenues for clinical interventions to improve outcomes for all young survivors.

Introduction

In 2019, 49,020 or 18% of new invasive breast cancer cases in the U.S. were females under 49 years old [1, 2]. Although this age group constitutes a small proportion of all breast cancer cases, it demonstrates several distinctive characteristics. This group shows considerable heterogeneity in pathology compared to other age groups with invasive tumors and aggressive breast cancer subtypes among the leading causes of mortality in this population [3, 4]. This group also shows significant disparities in survival outcomes by race. From 2013 to 2017, death rates for Blacks under age 50 years were 1.9 to 2.6 times higher than those for comparably aged Whites [5]. Population-based cancer registries have proven beneficial in providing information on characteristics of and meaningful differences among breast cancer survivors. Analysis of data specifically for young breast cancer survivors can provide insights into their clinical characteristics, disparities in mortality, incidence and survival patterns. Prior epidemiologic studies have characterized young breast cancer survivors, but to the best of our knowledge none have provided detailed descriptive data for a large population of such survivors. In 2020, Kong et al (2020) published a comprehensive and detailed analysis of variation in cancer subtype incidence and distribution by race for the general breast cancer population [6]. However, few studies have examined

interaction effects between demographic (e.g. race, ethnicity) and clinical (e.g. cancer stage or subtype) characteristics with respect to cancer-specific survival among young women.

To enhance our understanding of racial disparities specific to this population, we used the Surveillance, Epidemiology and End Results (SEER) database of the National Cancer Institute (NCI) to investigate clinical characteristics and survival probabilities in this age group. SEER is broadly representative of the US population [7] and now contains detailed clinical and race/ethnicity data for breast cancer subtypes. Using SEER data collected from 2000 to 2015, Thomas, et al, report increased incidence in age groups 20–29, 30–39, and 40–49, with the greatest increase observed among survivors aged 20 to 29 years [8]. Updated SEER data for 2000 to 2017, representing more than one-quarter of the US population based on the 2010 census, includes expanded race and ethnic categories [9, 10]. Using this expanded dataset, we incorporated race and ethnic categories into an analysis of the characteristics of breast cancer survivors 20–44 years old. We also generated estimates of breast cancer-specific survival probabilities in this population according to their demographic and clinical characteristics. Finally, we developed survival models based on an analysis of the interaction effects between demographic and clinical characteristics.

Methods

Data source and study population

In this retrospective cohort study, we conducted analyses of data for 2000 to 2017 extracted from the “SEER Research Data, 18 Registries” of the NCI [11]. The SEER database covers 18 geographic areas and accounts for approximately 27.8% of the US population.

To identify records for young breast cancer survivors, data for breast cancer, as defined by International Classification of Diseases for Oncology (third edition), for the years 2000 to 2017 were extracted from the SEER database. Specifically, under our eligibility criteria, we extracted data for breast cancer, the 20- to 44-year age group, and females. Corresponding with the SEER age groups, we also employed a cutoff age of 44 years to define ‘young breast cancer’ based on the definition from the Centers for Disease Control and Prevention [12]. We initially considered data for 120,585 cases divided into five SEER age subgroups: 20 to 24, 25 to 29, 30 to 34, 35 to 39, and 40 to 44 years. We excluded stage 0 cases captured under c50 ICD codes presumed to represent ductal carcinoma in situ, histologic grade IV cases, and cases with unknown data codes (i.e., not determined, not stated, or not applicable). A total of 93,491 breast cancer survivors in the SEER cohort who met our eligibility criteria were included in this study.

Variable description

We used definitions and interpretations of the study variables from both the *Dictionary of SEER*Stat Variable* released in April 2020 and the *SEER Research Description*. We also reviewed the SEER website to obtain exact explanations of the dataset, and we contacted the SEER team to verify the exact meaning of each numerical code employed. In analyzing the dataset, both demographic and clinical variables were included as described below.

Race and ethnicity were categorized according to the RaceandoriginrecodeNHWNHB variable and included Non-Hispanic White (NHW), Non-Hispanic Black (NHW), Non-Hispanic American Indian/Alaska Native, Non-Hispanic Asian or Pacific Islander, Hispanic (all races), and Non-Hispanic Unknown Race. Cancer stage was characterized as 1 through 4, and histologic grade was identified as grade 1 (well differentiated) through grade 3 (poorly differentiated). Breast cancer subtype was categorized according to the SEER BreastSubtype2010 variable and included Her2+/HR+, Her2+/HR-, Her2-/HR+, and Triple Negative; because this variable was included in the SEER database only after 2009, we analyzed the breast cancer subtype distribution using 2010-2017 data. In addition, T category and N category were categorized according to the SEER BreastAdjustedAJCC6th variable, but these data were included in the SEER database only through 2015; for these data, we collapsed the T and N subcategories (e.g., T1a, T1b, and T1c were collapsed to T1) based on SEER website guidance. Finally, year of diagnosis was used for analysis of annual incidence, and both the survival months and the SEER cause-specific death classification variables were extracted for identification of survival probability patterns and cancer-specific death for a given cohort of breast cancer survivors.

Statistical analysis

We compared incidence of breast cancer in female patients in the 20- to 44-year age group by age subgroups according to race/ethnicity, stage of disease, T and N categories, breast cancer subtype, histologic grade, and year of diagnosis. Pearson's Chi-square analysis was used to test the statistical significance of the difference in incidence for each of these characteristics.

To estimate cancer-specific survival probability for young breast cancer females, Kaplan-Meier curves were generated by age, race/ethnicity, breast cancer subtype, histologic grade, and stage, and a log-rank test was performed to compare survival curves. Cox Proportional Hazard regression analysis was used to predict cancer-specific survival in young breast cancer survivors according to race/ethnicity, stage, breast cancer subtype, and histologic grade. To determine whether the hazard proportionality assumption was violated for this model, a test of proportionality was applied. To predict survival probability by subgroups (interaction effects among variables), marginal effects analysis as post analysis of Cox regression was applied. In Cox regression, we excluded non-Hispanic Asian group (0.64%) and non-Hispanic unknown group (0.40%) because of small sample size.

In the SEER database, cancer-related death was reported as 0 (alive) and 1 (attributable to the cancer disease); we used the cancer-related death code of 1 as a failure variable in the survival analysis. Data designated as unknown, not reported, or not applicable were considered to be missing values. All statistical analyses were performed using STATA IC 16. A p-value less than 0.05 was considered significant, and all statistical tests were two-sided.

Results

Demographic and clinical characteristics

A total of 93,491 breast cancer survivors in the SEER cohort who met the eligibility criteria were included in this analysis. Table 1 details the number and proportion of young breast cancer survivors by demographic (age, race/ethnicity, year of diagnosis) and clinical factors (stage at diagnosis, histologic grade, breast cancer subtype, T category, and N category).

Table 1

Characteristics of cases in SEER registries diagnosed with breast cancer from 2000 to 2017

Cohort	20-24 years	25-29 years	30-34 years	35-39 years	40-44 years	Total	*P* value
	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)		
Total	570 (0.61)	3,386 (3.62)	10,975 (11.74)	25,331 (27.09)	53,229 (56.93)	93,491 (100)	
Race and origin							< 0.001
Non-Hispanic White	277 (0.51)	1,691 (3.11)	5,829 (10.73)	14,297 (26.32)	32,233 (59.33)	54,327 (100)	
Non-Hispanic Black	120 (0.94)	616 (4.81)	1,777 (13.88)	3,573 (27.91)	6,714 (52.45)	12,800 (100)	
Non-Hispanic American Indian/Alaska Native	3 (0.50)	29 (4.82)	71(11.79)	179 (29.73)	320 (53.16)	602 (100)	
Non-Hispanic Asian or Pacific Islander	51 (0.51)	337 (3.34)	1,189 (11.79)	2,803 (27.79)	5,707 (56.58)	10,087 (100)	
Hispanic (All races)	117 (0.76)	698 (4.56)	2,062 (13.47)	4,378 (28.61)	8,050 (52.60)	15,305 (100)	
Non-Hispanic Unknown Race	2 (0.54)	15 (4.05)	47 (12.70)	101 (27.30)	205 (55.41)	370 (100)	
Stage							< 0.001
Stage 1	147 (0.46)	758 (2.38)	2,755 (8.64)	7,480 (23.45)	20,751 (65.07)	31,891 (100)	
Stage 2	257 (0.63)	1,649 (4.02)	5,237 (12.78)	11,662 (28.46)	22,176 (54.11)	40,981 (100)	
Stage 3	113 (0.67)	766 (4.57)	2,346 (13.99)	5,012 (29.89)	8,350 (50.87)	16,767 (100)	
Stage 4	53 (1.38)	213 (5.53)	637 (16.54)	1,177 (30.56)	1,772 (46.00)	3,852 (100)	
T stage							< 0.001
1	209 (0.46)	1,186 (2.63)	4,247 (9.41)	11,105 (24.62)	28,364 (62.88)	45,111 (100)	
2	218 (0.64)	1,414 (4.17)	4,544 (13.39)	9,851 (29.02)	17,918 (52.79)	33,945 (100)	

3	64 (0.86)	405 (5.45)	1,069 (14.37)	2,226 (29.93)	3,674 (49.39)	7,438 (100)	
4	25 (0.88)	151 (5.34)	444 (15.71)	872 (30.85)	1,335 (47.22)	2,827 (100)	
N stage							< 0.001
0	280 (0.56)	1,604 (3.18)	5,263 (10.45)	12,754 (25.31)	30,486 (60.50)	50,387 (100)	
1	190 (0.66)	1,163 (4.01)	3,730 (12.88)	8,317 (28.71)	15,569 (53.74)	28,969 (100)	
2	48 (0.58)	334 (4.02)	1,136 (13.67)	2,458 (29.59)	4,332 (52.14)	8,308 (100)	
3	48 (0.89)	271 (5.05)	772 (14.39)	1,664 (31.02)	2,609 (48.64)	5,364 (100)	
Breast Subtype (2010+)							< 0.001
Her2+/HR+	56 (1.02)	311 (5.64)	811 (14.70)	1,611 (29.21)	2,727 (49.44)	5,516 (100)	
Her2+/HR-	28 (1.36)	96 (4.65)	325 (15.74)	636 (30.80)	980 (47.46)	2,065 (100)	
Her2-/HR+	108 (0.52)	693 (3.31)	2,216 (10.58)	5,148 (24.57)	12,786 (61.03)	20,951 (100)	
Triple Negative	37 (0.65)	347 (6.11)	918 (16.17)	1,657 (29.18)	2,719 (47.89)	5,678 (100)	
Histologic Grade							< 0.001
Well differentiated	36 (0.32)	184 (1.65)	688 (6.19)	2,274 (20.45)	7,939 (71.39)	11,121 (100)	
Moderate differentiated	166 (0.48)	968 (2.78)	3,403 (9.78)	8,884 (25.52)	25,385 (61.44)	34,806 (100)	
Poorly differentiated	368 (0.77)	2,234 (4.70)	6,884 (14.47)	14,173 (29.80)	23,905 (50.26)	47,564 (100)	
Year of diagnosis							< 0.001
2000-2008 (9 years)	289 (0.56)	1,655 (3.20)	5,854 (11.32)	14,260 (27.57)	29,666 (57.35)	51,724 (100)	
2009-2017 (9 years)	281 (0.67)	1,731 (4.14)	5,121 (12.26)	11,071 (26.51)	23,563 (56.42)	41,767 (100)	

Compared to data from 2000 to 2008 (9 years), data from 2009 to 2017 (9 years) showed a greater percentage of patients aged 20 to 34 years (15.08% vs 17.07%). In addition, from 2000 to 2017, the incidence of breast cancer differed significantly according to race/ethnicity (p<.0001). To be specific, among the five racial/ethnic subgroups, NHB accounted for the highest proportion of breast cancer patients under 40 years old (e.g., NHB=48% vs NHW=41%) (see Figure 1). Breast cancer subtype also differed significantly by race/ethnicity, and the NHB subgroup showed the highest percentage of the triple-negative subtype (e.g., 25% in NHB vs 15% in NHW) (see Figure 2). Across all racial/ethnic categories, the highest percentages of patients showed stage 2 (n=40,981, 43.83%), T1 stage (n=45,111, 50.50%), and N0 stage (n=50,387, 54.16%). Survival month values for the cancer-related death group (n=15,131) showed that the oldest age group had the most survival months (e.g., 40-44 years=55 months vs 20-24 years=50 months).

Survival curves

Kaplan-Meier survival curves corresponding to the period of 2000–2017 for five characteristics are shown in Figure 3. The oldest breast cancer subgroup in our cohort (aged 40-44 years) had the longest survival probabilities, while the youngest subgroup (aged 20-24 years) showed the shortest probabilities.

NHB had the lowest survival probabilities for all years. In addition, triple-negative subtype was associated with the lowest survival probabilities. Those who had the highest cancer stage and highest histologic grade also had the lowest survival probabilities. All log-rank comparisons of Kaplan-Meier survival curves for all five variables were significant (p<0.0001).

Cox proportional hazard models

Table 2 presents the results of Cox multivariate regression analysis for cancer-specific survival in young breast cancer survivors.

Table 2

Cox regression analysis of cancer-specific survival among young breast cancer females

Variables	HR	95% CI		*P* value
Age, yr (reference: 20-24 yr)				
25-29	0.919	0.652	1.294	0.627
30-34	0.887	0.640	1.228	0.469
35-39	0.883	0.641	1.217	0.448
40-44	0.802	0.583	1.103	0.175
Race and Ethnicity (reference: Non-Hispanic White)				
Non-Hispanic Black	1.565	1.436	1.705	<0.001
Non-Hispanic Asian or Pacific Islander	0.920	0.811	1.044	0.198
Hispanic	1.294	1.183	1.416	<0.001
Breast cancer subtype (reference: Her2+/HR+)				
Her2+/HR-	1.576	1.338	1.856	<0.001
Her2-/HR+	1.932	1.718	2.173	<0.001
Triple-negative	4.438	3.923	5.022	<0.001
Cancer stage (reference: stage 1)				
Stage 2	2.555	2.211	2.952	<0.001
Stage 3	8.602	7.453	9.929	<0.001
Stage 4	40.764	35.127	47.305	<0.001
Histologic grade (reference: Well differentiated)				
Moderate differentiated	1.799	1.457	2.221	<0.001
Poorly differentiated	2.939	2.385	3.620	<0.001

In the Cox multivariate proportional hazard models, race/ethnicity, breast cancer subtype, stage, and histologic grade were significant predictors of cancer-specific survival (LR chi2 (15) = 5418.78, p<0.001). The highest risk of death was found in the cancer stage 4 subgroup (HR = 40.764, 95% CI = 35.127 to 47.305), tumor subtype of triple-negative (HR = 4.438, 95% CI = 3.923 to 5.022), and race/ethnicity NHB (HR = 1.565, 95% CI = 1.436 to 1.705). To determine the violation of proportionality assumption in Cox regression model, the proportionality test was applied. The proportionality test for cancer-specific survival was significant (chi2 (15) =307.51, p<.001). Among the predictors, breast cancer subtype, cancer stage, and tumor grade significantly violated the proportionality assumption.

Interaction effects in Cox proportional hazard models

We tested the pre-specified interaction effects between variables in Cox proportional hazard models. We used predictive margins and marginal effects analysis in Cox regression as shown in Table 3. This table also shows predicted HR and p values according to race/ethnicity and breast cancer subtype as well as according to race/ethnicity and cancer stage. With respect to breast cancer subtype, an interaction effect was found with race/ethnicity. NHB showed significantly higher predicted HR values for breast cancer-specific survival compared to NHW, regardless of breast cancer subtype, and all values were significant. The highest predicted HR was seen in NHB with Her2-/HR+ subtype (HR = 16.599, p<.001) compared to NHW with Her2-/HR+ (reference group). NHB had significantly higher HR for all other subtypes compared to NHW with the same subtype (reference group): HER2+/HR+ (HR = 11.910, p=.002), HER2+/HR- (HR: =11.725, p=.013), and triple-negative (HR = 11.238, p=.026). With regard to cancer stage, interaction effects with race/ethnicity showed significantly higher predicted HR values among NHB compared to NHW with the same stage, and all values were significant. The higher the stage, the higher the predicted HR (Stage 1 HR = 5.130, p=0.005 vs Stage 4 HR = 95.890, p=0.001).

Table 3

Marginal effects of race/ethnic groups and breast cancer subtype/cancer stage on survival probability (Interaction effects)

Breast cancer subtype	Race/ethnic group (Reference: NHW)	Predicted HR	SE	z	95% CI		*P* value
Her2+/HR+	NHB	11.910	3.752	3.17	4.556	19.264	0.002
	NHAPI	-2.135	1.807	-1.18	-5.676	1.405	0.237
	Hispanic	3.991	2.184	1.83	-.290	8.271	0.068
Her2+/HR-	NHB	11.725	4.768	2.46	2.379	21.071	0.014
	NHAPI	6.695	4.647	1.44	-2.414	15.804	0.150
	Hispanic	5.203	3.556	1.46	-1.766	12.172	0.143
Her2-/HR+	NHB	16.599	4.213	3.94	8.342	24.856	<0.001
	NHAPI	-2.986	1.811	-1.65	-6.536	.564	0.099
	Hispanic	6.477	2.193	2.95	2.178	10.776	0.003
Triple-negative	NHB	11.238	5.064	2.22	1.313	21.163	0.026
	NHAPI	-0.811	6.331	-0.13	-13.220	11.599	0.898
	Hispanic	12.780	5.623	2.27	1.760	23.800	0.023
Cancer Stage							
Stage 1	NHB	5.130	1.840	2.79	1.523	8.737	0.005
	NHAPI	-.599	.869	-0.69	-2.303	1.105	0.491
	Hispanic	.722	.953	0.76	-1.146	2.589	0.449
Stage 2	NHB	6.183	1.829	3.38	2.598	9.769	0.001
	NHAPI	-1.669	1.227	-1.36	-4.074	.736	0.174
	Hispanic	1.945	1.168	1.67	-.344	4.235	0.096
Stage 3	NHB	20.333	5.805	3.50	8.956	31.710	<0.001
	NHAPI	-7.785	4.012	-1.94	-15.647	.078	0.052
	Hispanic	15.375	4.933	3.12	5.706	25.044	0.002
Stage 4	NHB	95.890	29.710	3.23	37.660	154.120	0.001
	NHAPI	40.315	26.355	1.53	-11.338	91.969	0.126

	Hispanic	57.636	22.877	2.52	12.797	102.474	0.012

NHW = Non-Hispanic White; NHB = Non-Hispanic Black; NHAPI = Non-Hispanic Asian or Pacific Islander

Discussion

Drawing upon one of the largest cancer datasets in the United States, this study provides revealing information on the distinctive characteristics of young female breast cancer survivors with an analysis of differences by race and ethnicity. Our analysis reveals racial disparities in both incidence and cancer-specific survival probabilities. It is notable that NHB showed the highest breast cancer incidence in the age groups under 40 years old. Notable findings in the interaction effects between race and tumor subtypes include significantly worse cancer-specific survival probabilities (higher predicted HR) among NHB compared to NHW with the same tumor biology, with the highest predicted HR in the Her2-/HR + subtype. NHB also showed significantly worse cancer-specific survival probabilities than NHW across all stages, with the highest predicted HR at stage 4.

Our results for the period 2000 to 2017 show that NHB had the highest proportion of triple-negative phenotype in breast cancer survivors under 45 years of age (n = 1,711, 24.93%) compared to all other racial/ethnic categories. Our Kaplan-Meier graph showed that younger, NHB, triple-negative subtype, higher tumor stage, and higher cancer stage were all negatively associated with breast cancer-specific survival probabilities in female patients under 45 years of age. In our Cox proportional hazards model, triple-negative subtype was associated with a 338% increased risk of cancer-specific mortality overall and NHB was associated with a 56% greater cancer-specific mortality.

High rates of mortality among young NHB survivors is frequently attributed to high rates of triple negative disease in this population [13, 14]. Indeed, we found survival probability was lowest for patients with triple negative disease, regardless of race. However, in the interaction of tumor type and race for survival, the greatest disparity was seen in patients with Her2-/HR + tumors. Survival probability in this group was 16.5 times higher among NHW compared to NHB patients, compared to 11.2 for triple negative breast cancers. A similar pattern was identified by Walsh, et al. (2019) in a smaller retrospective study of 1332 breast cancer patients treated at a single institution [16] and Albain, et al (2020) in a post-hoc analysis of the 9719 patients in the NCI-sponsored Trial Assigning Individualized Options for Treatment [17]. In an analysis of survival probabilities for a cohort of women age 18–64 years with hormone positive disease in the National Cancer Data Base, Jemal, et al. (2019) showed an HR of 2.05 for Black versus white women [18]. Our analysis points to disparities that are at least ten times greater between Black and white women < 45 years with hormone positive breast cancer, however, Jemal shows a reduction in racial disparities when matched by demographics, comorbidities, insurance, tumor characteristics, and treatment. Further analysis is needed to determine whether these factors show a proportionate reduction in disparities among young women.

Our analysis of the interaction effects between race/ethnicity and cancer stage indicated significant disparities in survival between Black and white patients at every stage. These disparities are often

explained in terms of tumor characteristics and stage at diagnosis; young Black women are more frequently diagnosed at stages 3 and 4, and with higher rates of triple negative disease compared to young white women who are more often diagnosed at stages 1 and 2, and with lower rates of triple negative disease. While this explanation is consistent with our data on survival across all races, our data specific to the interaction between age, race, and stage suggest a more complex problem. Recent research suggests that these disparities may be attributed to differences in clinicopathological characteristics between young survivors and older survivors. A comparison of survival probabilities for stage IV documented significant differences between younger and older survivors, with significantly longer survival in the cohort of < 40 years compared to the cohort of 40–59 years [18]. An analysis of survival trends in survivors < 40 years from 1975–2015 showed improved survival trends in stages I-III through 2005, when the trend plateaued, compared to survival trends among those with stage IV disease, which continued to improve through 2015 [19]. Studies also suggest that these disparities may be attributed to differences in clinical characteristics between NHB and NHW [17, 20]. Tao el at (2016) analysis of California Cancer Registry data found significant differences in breast cancer mortality by stage between NHW and NHB at stages 2 and 3 for specific tumor types [21]. They found higher rates of cancer specific mortality among NHB survivors compared to NHW survivors for stages 2 and 3 Her2-/HR + cancer and stage III triple negative cancer in NHB survivors. In contrast to our findings, they found no significant difference in cancer specific mortality between NHB and NHW for stage 1 and 4. Our results showing a considerable difference in cancer-specific survival by race for stage 4 suggests that NHB may not be experiencing the improved survival in younger patients, or that other factors may be contributing to excess mortality among NHB < 40 years at stage IV.

Our study of young breast cancer survivors identified two key factors that contribute to persistent disparities in mortality between Black and white women diagnosed under the age of 45 years. Young NHB bear a disproportionate burden of mortality across all subtypes and all stages, however this burden is greater for NHB diagnosed with Her2-/HR + tumor subtype and for NHB diagnosed with stage IV disease. Our findings show that young Black women have not benefited from improved treatment options for hormone-receptor positive and late stage disease that have extended survival for young white women with the same clinical characteristics (e.g., tumor type and stage). Our analysis points to the need for more detailed investigation of structural barriers to timely, high quality, and effective care for all young women diagnosed with breast cancer and the need for clinical interventions tailored to address barriers to care for young Black women with a breast cancer diagnosis.

We acknowledge several limitations of this study. Although the SEER dataset had the advantages of being representative of the U.S. population and focusing on clinical variables, it does not include socioeconomic data such as income, education, or healthcare accessibility information. The SEER database is also limited in its treatment-specific information such as chemotherapy type. Thus, sources of more comprehensive and detailed information on sociodemographic and treatment factors need to be explored to help reduce breast cancer disparities. In addition, because ours was a descriptive study employing secondary data analysis, and because some variables of the SEER dataset had a limited

duration of data collection, further research is necessary to examine causal relationships among predictors of survival rates and interactions among variables.

Conclusion

This study took advantage of 18 years of SEER data providing expanded racial and ethnic categories to generate meaningful information on young breast cancer survivors, and we identified multiple racial disparities distinctive to this population. Our analysis points to significant disparities in areas where improvements in breast cancer treatment have extended survival among young white women. Clinical and community interventions focused addressing social determinants of health and inequities in survivorship care may be effective to reduce breast cancer mortality for young Black women.

Declarations

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Author contributions:

Conceptualization: MK, AD, VK, TH; methodology, data curation, and formal analysis: MK, CP; funding acquisition and project administration: AD, TH; writing original draft: MK, TH; review and editing of manuscript: MK, AD, SH, CP, VG, TH

Ethics approval and consent to participate:

This project does not meet the definition of human subjects research. There was no process for consent to participate as this was de-identified data from a publicly available resource.

Availability of data and material:

The data that support the findings of this study are openly available in Surveillance, Epidemiology and End Results (SEER) database of the National Cancer Institute (NCI) at https://seer.cancer.gov/registries/terms.html

Consent for publication:

Not applicable

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Figures

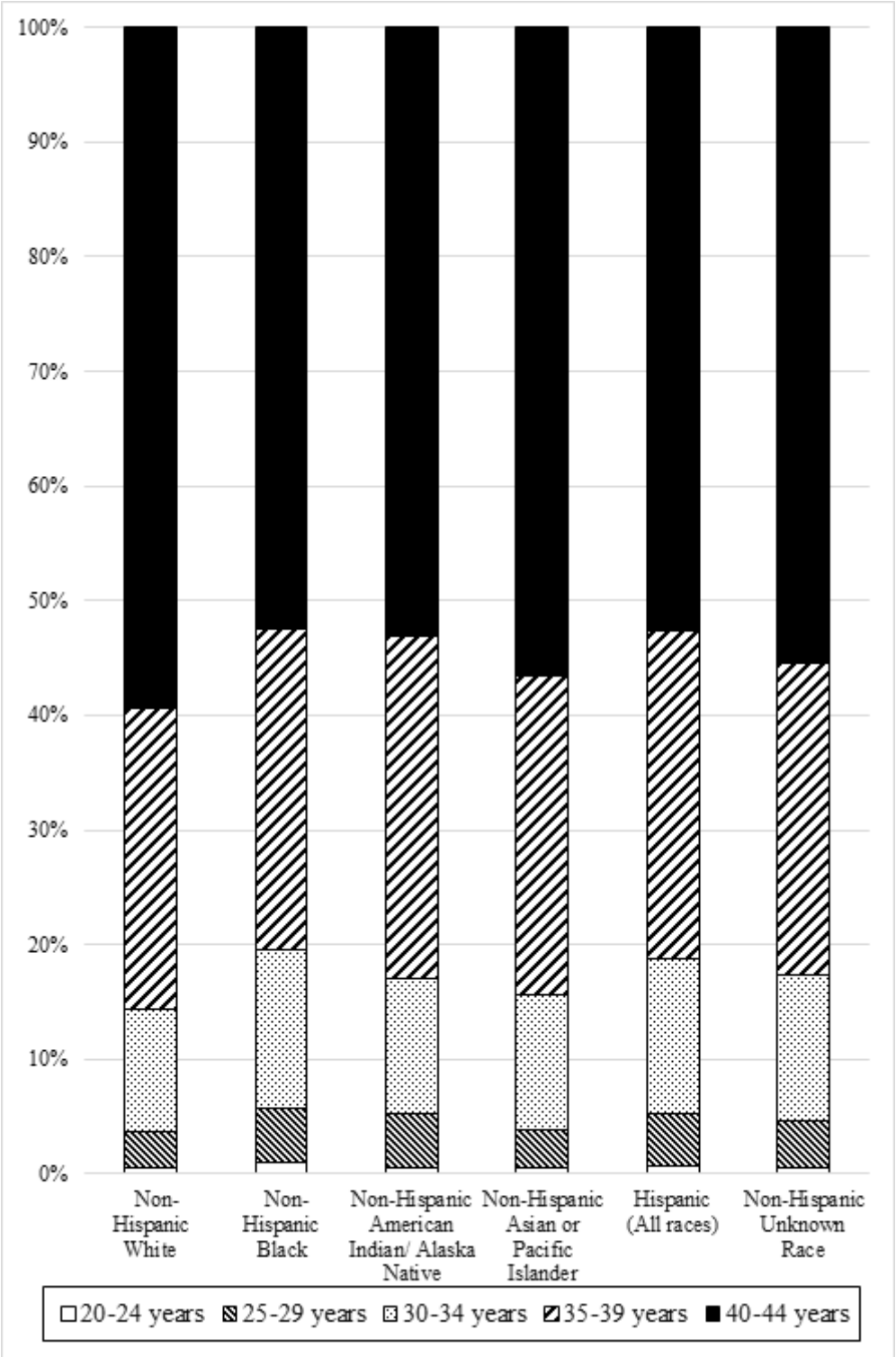

Figure 1

Breast Cancer Incidence by Race and Ethnicity

Note. Pearson Chi2(20) = 490.55 p<0.001

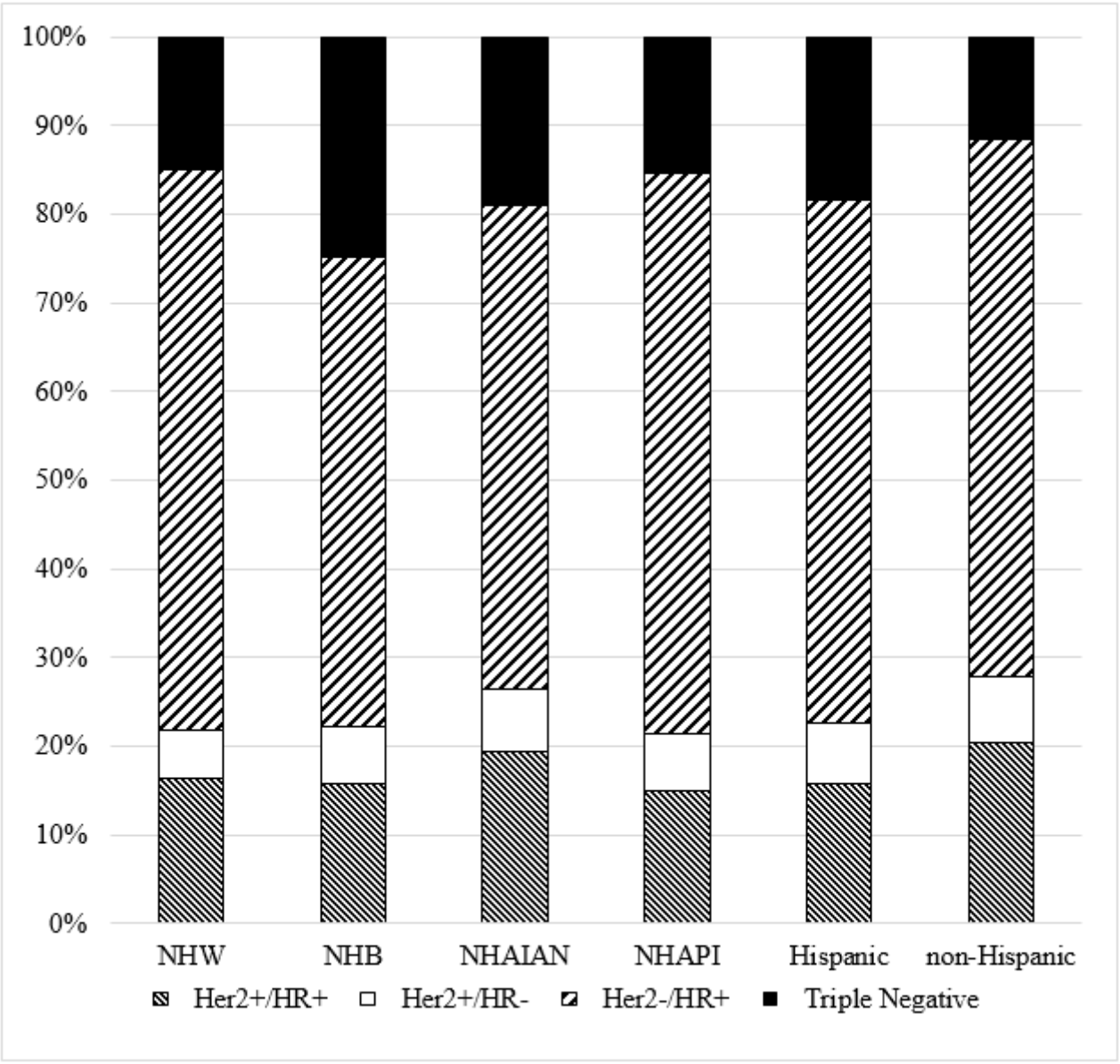

Figure 2

Breast Cancer Subtype by Race and Ethnicity

Note. Pearson Chi2(15) = 402.73 p<0.001

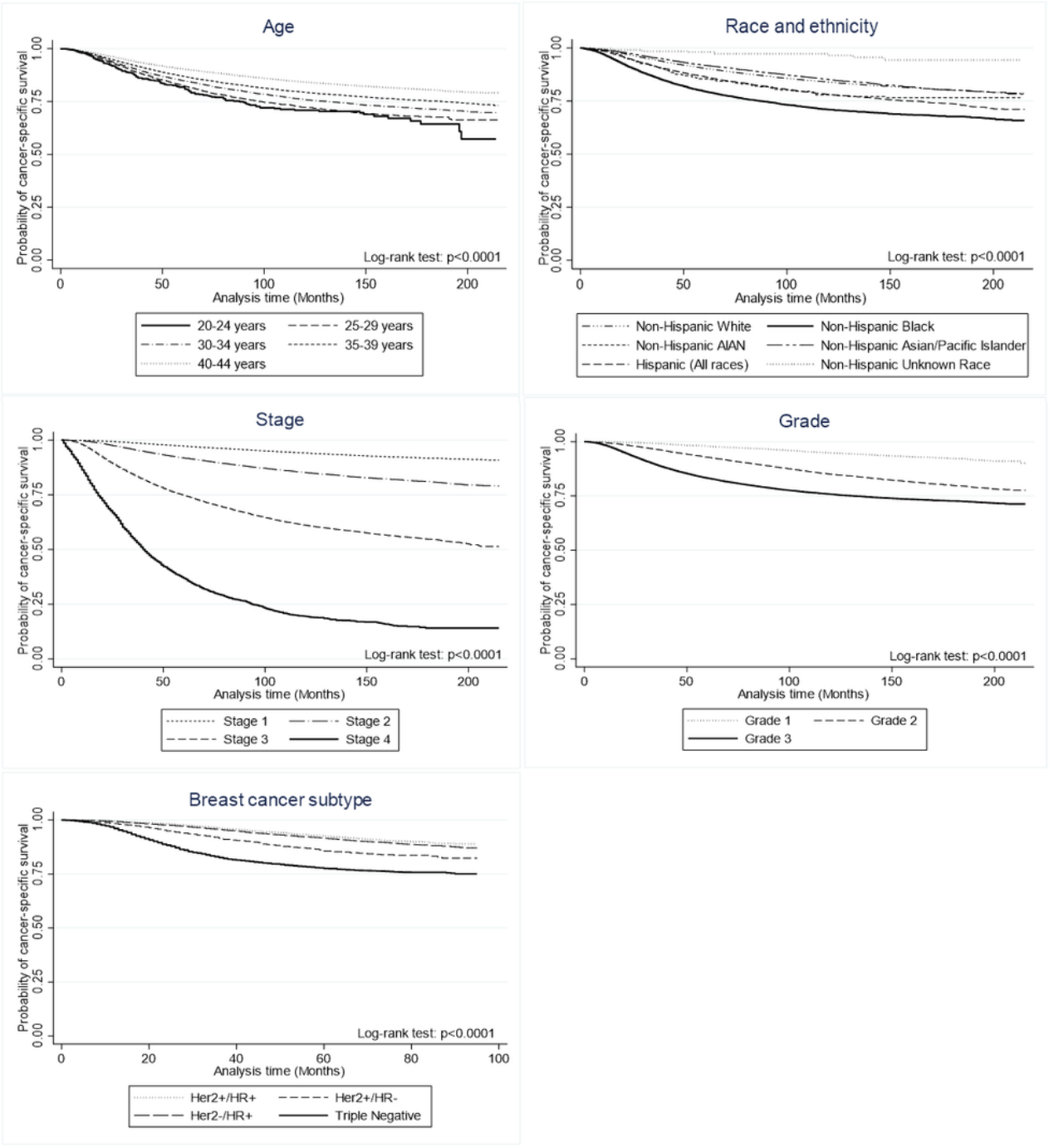

Figure 3

Kaplan-Meier estimates of cancer-specific survival