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Racial and Ethnic Differences in Adjuvant Hormonal Therapy Use

Jennifer C. Livaudais, Ph.D.,[1] Christopher Li, Ph.D., M.D.,[2,3] Esther M. John, Ph.D.,[4] Mary Beth Terry, Ph.D.,[5] Mary Daly, M.D., Ph.D.,[6] Saundra S. Buys, M.D.,[7] Laurel Habel, Ph.D.,[8] Beti Thompson, Ph.D.,[2,3] N. David Yanez, Ph.D.,[3] and Gloria D. Coronado, Ph.D.[9]

Abstract

Background: In the United States, 5-year breast cancer survival is highest among Asian American women, followed by non-Hispanic white, Hispanic, and African American women. Breast cancer treatment disparities may play a role. We examined racial/ethnic differences in adjuvant hormonal therapy use among women aged 18–64 years, diagnosed with hormone receptor-positive breast cancer, using data collected by the Northern California Breast Cancer Family Registry (NC-BCFR), and explored changes in use over time.
Methods: Odds ratios (OR) comparing self-reported ever-use by race/ethnicity (African American, Hispanic, non-Hispanic white vs. Asian American) were estimated using multivariable adjusted logistic regression. Analyses were stratified by recruitment phase (phase I, diagnosed January 1995–September 1998, phase II, diagnosed October 1998–April 2003) and genetic susceptibility, as cases with increased genetic susceptibility were oversampled.
Results: Among 1385 women (731 phase I, 654 phase II), no significant racial/ethnic differences in use were observed among phase I or phase II cases. However, among phase I cases with no susceptibility indicators, African American and non-Hispanic white women were less likely than Asian American women to use hormonal therapy (OR 0.20, 95% confidence interval [CI]0.06–0.60; OR 0.40, CI 0.17–0.94, respectively). No racial/ethnic differences in use were observed among women with 1+ susceptibility indicators from either recruitment phase.
Conclusions: Racial/ethnic differences in adjuvant hormonal therapy use were limited to earlier diagnosis years (phase I) and were attenuated over time. Findings should be confirmed in other populations but indicate that in this population, treatment disparities between African American and Asian American women narrowed over time as adjuvant hormonal treatments became more commonly prescribed.

Introduction

Five-year age-adjusted breast cancer survival rates in the United States are highest among Asian/Pacific Islander women (89.4%), followed by non-Hispanic white (87.5%), Hispanic (83.0%), and African American women (75.0%).[1] Survival disparities can be attributed to racial/ethnic differences in stage at diagnosis, tumor biology (including hormone receptor status), socioeconomic status (SES), and breast cancer treatment.[2–4] After adjustment for these factors, breast cancer survival is similar between Asian American and non-Hispanic white women, but African American and Hispanic women remain at increased risk for breast cancer death (hazard ratio [HR] 1.5 and HR 1.1, respectively).[3,4]

[1]Mount Sinai School of Medicine, New York, New York.
[2]Fred Hutchinson Cancer Research Center, Seattle, Washington.
[3]University of Washington School of Public Health, Seattle, Washington.
[4]Cancer Prevention Institute of California, Fremont, California, and Stanford University School of Medicine and Stanford Cancer Center, Stanford, California.
[5]Columbia University, New York, New York.
[6]Fox Chase Cancer Center, Philadelphia, Pennsylvania.
[7]Huntsman Cancer Institute, Salt Lake City, Utah.
[8]Kaiser Division of Research, Oakland, California.
[9]The Center for Health Research, Kaiser Permanente Northwest, Portland, Oregon.

Differences in use of other breast cancer treatments not captured by population-based cancer registries, including adjuvant chemotherapy and adjuvant hormonal therapy, may contribute to the remaining disparities.[4–6]

Adjuvant hormonal therapies improve disease-free and overall survival among women with hormone receptor-positive breast cancer, irrespective of patient age, menopausal status, lymph node status, or chemotherapy use.[7,8] A small number of studies to date have documented racial/ethnic differences in the use of adjuvant hormonal therapy, indicating that compared to non-Hispanic white women, African American,[5,9–11] Hispanic,[9] and Chinese[10] women are significantly less likely to use adjuvant hormonal therapy. However, none of these studies have explored how patterns of use by racial/ethnic groups have changed over time. Nationally, adjuvant hormonal therapy use has increased over time as treatments have become more widely available and more commonly prescribed.[11]

To build on findings from prior studies, we conducted a secondary analysis of data collected from a racially and ethnically diverse sample of women diagnosed with breast cancer over a broad range of years to examine racial/ethnic differences in use of adjuvant hormonal therapy for hormone receptor-positive breast cancer and to explore how any identified differences in use changed over time.

Materials and Methods

Design and recruitment procedures of parent study

Our analysis was performed as a secondary analysis of data collected as part of the Northern California Breast Cancer Family Registry (NC-BCFR).[12,13] The NC-BCFR is one of six sites of the National Cancer Institute's (NCI) Breast Cancer Family Registry (BCFR), which contains information and biospecimens contributed by more than 15,300 families across the spectrum of risk for breast cancer and from population-based or relative controls. The resources collected by the BCFR are open to the scientific and medical community for collaborative research projects.

At the NC-BCFR site, incident breast cancer patients aged 18–64 years were identified through the Greater Bay Area Cancer Registry, which ascertains all incident cases diagnosed at different sites across the region as part of the Surveillance, Epidemiology and End Results (SEER) program and the California Cancer Registry. After soliciting physician consent, patients were contacted by telephone interview to determine eligibility. All patients with indicators of increased genetic susceptibility (diagnosis before age 35 years, a personal history of ovarian or childhood cancer, bilateral breast cancer with a first diagnosis before age 50 years, or a family history of breast or ovarian cancer in first-degree female relatives) were eligible to enroll in the NC-BCFR. Patients not meeting these criteria were randomly sampled (2.5% of non-Hispanic white and 32% of racial/ethnic minorities) to include a proportion of women with sporadic breast cancer in the final sample. Women from all racial/ethnic groups were recruited during phase I of the study, diagnosed between January 1995 and September 1998. Because of funding considerations, only Chinese, Japanese, Filipina, Hispanic, and African American women were recruited during phase II, diagnosed between October 1998 and April 2003.

Family history, epidemiologic and dietary data, blood samples, clinical and treatment data, tumor blocks, and pathology reports were collected for all study participants. All participants completed a detailed structured questionnaire on cancer family history, breast cancer risk factors, and treatment as part of the original NC-BCFR study, which was administered to participants by study staff through in-person interviews.[12] Working groups across the six original BCFR sites collaborated to develop all instruments for data collection.

The Institutional Review Board (IRB) at the Cancer Prevention Institute of California approved the NC-BCFR, and informed written consent was obtained from all participants. The IRB at the Fred Hutchinson Cancer Research Center approved the secondary data analysis.

Inclusion/exclusion criteria for secondary analysis

Our analysis included a subset of the original NC-BCRF population. Specifically, we included female breast cancer patients who were diagnosed between January 1995 and September 1998 (phase I) or between October 1998 and April 2003 (phase II). We identified a total of 1671 patients with a first primary hormone receptor-positive (estrogen receptor-positive or progesterone receptor-positive or both) breast cancer from the original NC-BCFR sample. Information on hormone receptor positivity was available from the SEER database, which has been documented to reliably capture pathologically confirmed receptor status.[14] We restricted our inclusion criteria to women with SEER localized or regional stage tumors ($n = 1496$) and to those who self-identified as Chinese, Japanese, Filipina, Hispanic, African American, or non-Hispanic white ($n = 1445$). Racial/ethnic categories were mutually exclusive. Further, only women with complete information on use of adjuvant hormonal therapy were included ($n = 1385$), given our research question of interest. The final sample of 1385 women meeting our inclusion criteria included 731 women who had been recruited during phase I (131 Asian Americans, including 69 Chinese, 20 Japanese, 42 Filipinas; 96 Hispanics; 79 African Americans; 425 non-Hispanic whites) and 654 women who had been recruited during phase II (280 Asian Americans, including 146 Chinese, 34 Japanese, 100 Filipinas; 198 Hispanics; 176 African Americans).

Data measures

Use of adjuvant hormonal breast cancer treatment. Information was collected on use of adjuvant hormonal therapy (yes or no) by self-report and, if applicable, type of therapy used. For our analysis, women who had reported use of tamoxifen, toremifene, aromatase inhibitors (anastrazole, letrozole, or exemestane), or goserelin (an alternative hormonal treatment that is a gonadotropin-releasing hormonal agonist) and those who used adjuvant hormonal therapy without specifying the type used were coded as users. Women who indicated no use of adjuvant hormonal therapies were coded as nonusers.

Covariates. Covariates of interest measured during the detailed interviews included age at diagnosis, calendar year of diagnosis, marital status (single/widowed/divorced vs. married/living with partner), and highest level of education completed (college or beyond, high school, less than high school) (Table 1). Body mass index (BMI) was calculated as

Table 1. Northern California Breast Cancer Family Registry: Characteristics of Women Diagnosed with Hormone Receptor-Positive Breast Cancer, January 1995–September 1998 (Phase I) ($n=731$)

	Asian American *131 (17.9)* n *(%)*[a]	*Hispanic* *96 (13.1)* n *(%)*[a]	*African American* *79 (10.8)* n *(%)*[a]	*Non-Hispanic white* *425 (58.1)* n *(%)*[a]	p *value*	*Nonuse of adjuvant hormonal therapy* *253 (34.6)* n *(%)*[a]	*Use of adjuvant hormonal therapy* *478 (65.4)* n *(%)*[a]	p *value*
Background characteristics								
Age at diagnosis (mean ± SD)	47.6 ± 9.6	49.4 ± 9.5	49.4 ± 10.4	50.1 ± 10.2	0.102	46.6 ± 10.4	51.0 ± 9.5	< 0.001
Year of diagnosis								
1995	23 (17.6)	6 (6.3)	2 (2.5)	54 (12.7)	< 0.001	39 (15.4)	46 (9.6)	0.129
1996	34 (25.9)	20 (20.8)	16 (20.3)	212 (49.9)		96 (37.9)	186 (38.9)	
1997	49 (37.4)	45 (46.9)	39 (49.4)	142 (33.4)		88 (34.8)	187 (39.1)	
1998	25 (19.1)	25 (26.0)	22 (27.8)	17 (4.0)		30 (11.9)	59 (12.4)	
Marital status								
Single, widowed, separated, or divorced	33 (25.2)	36 (37.5)	39 (49.4)	144 (33.9)	0.004	87 (34.4)	165 (34.5)	0.972
Married or living with partner	98 (74.8)	60 (62.5)	40 (50.6)	281 (66.1)		166 (65.6)	313 (65.5)	
Education level								
College or higher	71 (54.2)	21 (21.9)	20 (25.3)	195 (45.9)	< 0.001	99 (39.1)	208 (43.5)	0.279
High school diploma or equivalent	53 (40.5)	36 (37.5)	53 (67.1)	216 (50.8)		134 (53.0)	224 (46.9)	
Less than high school	7 (5.3)	39 (40.6)	6 (7.6)	14 (3.3)		20 (7.9)	46 (9.6)	
Health-related indicators and tumor characteristics								
BMI, kg/m^2 (mean ± SD)[b]	23.2 ± 4.2	27.0 ± 5.4	28.9 ± 6.0	25.0 ± 5.3	< 0.001	24.7 ± 5.2	25.8 ± 5.6	0.010
Obese (BMI ≥ 30 kg/m^2)	7 (5.4)	25 (26.0)	28 (35.9)	73 (17.4)	< 0.001	36 (14.5)	97 (20.5)	0.048
≥ 1 indicator of increased genetic susceptibility	61 (46.6)	52 (54.2)	45 (57.0)	342 (80.5)	< 0.001	179 (70.8)	321 (67.2)	0.320
Positive for *BRCA1* or *BRCA2* mutation[c]	7 (6.1)	5 (5.3)	4 (5.5)	22 (5.4)	0.993	10 (4.2)	28 (6.2)	0.270
SEER summary stage								
Localized	84 (64.1)	62 (64.6)	45 (57.0)	286 (67.3)	0.064	189 (74.7)	288 (60.2)	< 0.001
Regional, direct extension or LN only	42 (32.1)	28 (29.2)	26 (32.9)	128 (30.1)		54 (21.3)	170 (35.6)	
Regional, direct extension + LN	5 (3.8)	6 (6.2)	8 (10.1)	11 (2.6)		10 (4.0)	20 (4.2)	
Histologic type[d]								
Ductal	107 (81.7)	77 (80.2)	57 (75.0)	331 (79.2)	0.28	196 (78.7)	376 (79.7)	0.001
Lobular/mixed lobular	17 (13.0)	14 (14.6)	8 (10.5)	57 (13.6)		24 (9.6)	72 (15.2)	
Other specified histology	7 (5.3)	5 (5.2)	11 (14.5)	30 (7.2)		29 (11.7)	24 (5.1)	
Treatment for breast cancer								
Surgery and radiation[e]								
Mastectomy ± radiation	73 (57.0)	44 (46.3)	32 (41.6)	204 (48.6)	0.132	102 (41.3)	251 (53.1)	< 0.001
Lumpectomy + radiation	50 (39.1)	49 (51.6)	44 (57.1)	210 (50.0)		133 (53.8)	220 (46.5)	
Lumpectomy, no radiation	5 (3.9)	2 (2.1)	1 (1.3)	6 (1.4)		12 (4.9)	2 (0.4)	
Chemotherapy	87 (66.4)	61 (63.5)	48 (60.8)	219 (51.5)	0.007	133 (52.6)	282 (59.0)	0.095

[a]Percents based on nonmissing values.
[b]1.0% missing.
[c]5.5% missing.
[d]1.4% missing.
[e]1.5% missing.
BMI, body mass index; LN, lymph node; SD, standard deviation; SEER, Surveillance, Epidemiology and End Results program.

self-reported weight (in kilograms)/self-reported height (in meters^2) during the year prior to diagnosis. Women meeting ≥1 of the inclusion criteria were considered to have indicators of increased genetic susceptibility (diagnosis before age 35 years, personal history of ovarian or childhood cancer, bilateral breast cancer with a first diagnosis before age 50 years, family history of breast or ovarian cancer in one or more first-degree relatives). Women with ≥1 genetic susceptibility indicators were considered to be nonsporadic breast cancer cases; women with no genetic susceptibility indicators were considered to be sporadic breast cancer cases. Women were also tested for the presence of *BRCA1* and *BRCA2* mutations, and we classified participants as being positive for either *BRCA1* or *BRCA2* or negative for both *BRCA1* and *BRCA2*.[15] Women who were not tested for *BRCA1* and *BRCA2* mutations ($n = 172$) were considered to have missing information on this variable.

Tumor stage was classified according to the SEER summary stage classification system: localized or regional with (a) direct extension or positive lymph nodes or (b) direct extension including positive lymph nodes. Tumor histology type was available from pathology reports and grouped into three categories, including ductal (ICD-O code 8500), lobular/mixed lobular (ICD-O codes 8520, 8522, 8524), and mixed or other specified histology (all other ICD-O codes). Information on the use of other breast cancer treatments was available from SEER and included type of surgery performed for breast cancer (lumpectomy or mastectomy) and whether or not any radiation and chemotherapy were received.

Statistical analysis

Summary statistics for cases are presented according to race/ethnicity and according to use of adjuvant hormonal therapy by comparing women with respect to age at diagnosis, year of diagnosis, marital status, education level, BMI during the year before diagnosis, indicators of increased genetic susceptibility, *BRCA1 or BCRA2* mutation status, SEER summary stage, histology type, type of surgical treatment for breast cancer, and use of radiation and chemotherapy treatments. The descriptive statistics presented are based on nonmissing values, and percentages of cases with missing data are reported in table footnotes. Chi-square tests were used to assess significant differences between groups with respect to categorical variables, and *t* tests were used to assess differences with respect to continuous variables (two-tailed significant level $p < 0.05$).

To examine the association of race/ethnicity with use of adjuvant hormonal therapy, we used logistic regression with robust variance adjustment in Stata/SE version 11.0. Asian American women served as the referent exposure category. The group of non-Hispanic white women could not be used for this purpose across both phases because none were recruited during phase II of the original study. Covariates adjusted for included factors that were associated in bivariate analysis with race/ethnicity and with use of adjuvant hormonal therapy among the referent group (Asian American women); age at diagnosis (continuous years), year of diagnosis, education level, BMI (phase I cases only), SEER stage, tumor histology, surgical and radiation treatment, and chemotherapy treatment.

We proposed *a priori* to explore whether the relationship between race/ethnicity and use of adjuvant therapy varied significantly according to (1) recruitment phase (phase I vs. phase II),[8] (2) age at diagnosis (<55 years vs. ≥55 years), (3) education level (college education vs. less than college education), or (4) indicators of increased genetic susceptibility (none vs. ≥1). Interactions for each of these variables were explored using the Wald test (significance level $p < 0.05$). Interaction by recruitment phase was statistically significant (p value for interaction = 0.04, African American), and results were stratified according to phase. Although no other statistically significant interactions were observed, we further stratified our results according to markers of increased genetic susceptibility to allow separate discussion of findings for women with sporadic (i.e., no susceptibility indicators) and nonsporadic breast cancer (i.e., ≥1 susceptibility indicators). Phase I: p value for interaction 0.72 (Hispanic), 0.19 (African American), 0.84 (non-Hispanic White); phase II: p value for interaction = 0.35 (Hispanic), 0.91 (African American).

Results

Participant characteristics

Phase I. A total of 731 women from the NC-BCFR who met eligibility criteria were diagnosed with hormone receptor-positive localized or regional stage breast cancer between January 1995 and September 1998 (Table 1). Non-Hispanic white women made up the majority of the sample (58%), followed by Asian American (18%), Hispanic (13%), and African American women (11%). Mean age at diagnosis was 49 years (standard deviation [SD] 10). Being married or living with a partner was most common among Asian American women (75%), as was completion of a college education or beyond (54%). Completion of less than a high school education was most common among Hispanic women (41%). Average BMI was highest among African American and Hispanic women (29 kg/m^2 and 27 kg/m^2, respectively), and having ≥1 indicators of increased genetic susceptibility was most common among non-Hispanic white women (81%) (due to the original study recruitment protocol). African American women were diagnosed at the most advanced (regional) stages (43%), and use of chemotherapy was least common among non-Hispanic white women (52%).

Among phase I women, 478 (65%) reported use of adjuvant hormonal therapy for breast cancer. Users were significantly older on average than nonusers (51 years vs. 47 years, $p < 0.001$), had significantly higher BMI (26 kg/m^2 vs. 25 kg/m^2, $p = 0.010$), and were diagnosed with more advanced (regional) stages of disease (40% vs. 25%, $p < 0.001$). Compared to nonusers, a greater percentage of users had undergone mastectomy (52% vs. 41%, $p < 0.001$). Characteristics of this sample are further described in Table 1.

Phase II. A total of 654 women were diagnosed with hormone receptor-positive localized or regional stage breast cancer between October 1998 and April 2003 (Table 2). Asian American women made up the majority of this sample (43%), followed by Hispanic (30%) and African American women (27%). Mean age at diagnosis was 50 years (SD 9). Being married or living with a partner was most common among Asian American women (77%) and least common among African American women (36%). Asian American women

Table 2. Northern California Breast Cancer Family Registry: Characteristics of Women Diagnosed with Hormone Receptor-Positive Breast Cancer, October 1998–April 2003 (Phase II) ($n = 654$)

	Asian American *280 (42.8)* n *(%)*[a]	*Hispanic* *198 (30.3)* n *(%)*[a]	*African American* *176 (26.9)* n *(%)*[a]	p *value*	*Nonuse of adjuvant hormonal therapy* *144 (22.0)* n *(%)*[a]	*Use of adjuvant hormonal therapy* *510 (78.0)* n *(%)*[a]	p *value*
Background characteristics							
Age at diagnosis (mean ± SD)	49.6 ± 8.9	49.7 ± 9.3	51.6 ± 9.4	0.055	50.9 ± 9.6	50.0 ± 9.1	0.296
Year of diagnosis							
1998	6 (2.1)	4 (2.0)	5 (2.8)	0.511	1 (0.7)	14 (2.7)	0.182
1999	27 (9.6)	28 (14.1)	27 (15.3)		19 (13.2)	63 (12.3)	
2000	58 (20.7)	38 (19.2)	33 (18.8)		25 (17.4)	104 (20.4)	
2001	66 (23.6)	30 (15.2)	33 (18.8)		22 (15.3)	107 (21.0)	
2002	86 (30.7)	70 (35.4)	56 (31.8)		52 (36.1)	160 (31.4)	
2003	37 (13.2)	28 (14.1)	22 (12.5)		25 (17.4)	62 (12.2)	
Marital status							
Single, widowed, separated, or divorced	65 (23.2)	79 (39.9)	112 (63.6)	< 0.001	49 (34.0)	207 (40.6)	0.154
Married or living with partner	215 (76.8)	119 (60.1)	64 (36.4)		95 (66.0)	303 (59.4)	
Education level[b]							
College or higher	170 (60.9)	29 (14.7)	53 (30.1)	< 0.001	59 (41.0)	193 (37.9)	0.641
High school diploma or equivalent	90 (32.3)	102 (51.5)	108 (61.4)		66 (45.8)	234 (46.0)	
Less than high school	19 (6.8)	67 (33.8)	15 (8.5)		19 (13.2)	82 (16.1)	
Health-related indicators and tumor characteristics							
BMI, kg/m^2 (mean ± SD)[b]	23.9 ± 4.2	28.2 ± 5.9	29.4 ± 7.5	< 0.001	26.2 ± 5.9	26.8 ± 6.4	0.313
Obese (BMI ≥ 30 kg/m^2)	23 (8.3)	68 (34.3)	63 (35.8)	< 0.001	27 (19.0)	127 (25.0)	0.141
≥1 marker of increased genetic susceptibility	106 (37.9)	89 (45.0)	69 (39.2)	0.278	52 (36.1)	212 (41.6)	0.239
Positive for *BRCA1* or *BRCA2* mutation[c]	3 (1.6)	7 (3.9)	3 (1.9)	0.311	3 (2.8)	10 (2.4)	0.801
SEER summary stage							
Localized	166 (59.3)	116 (58.6)	108 (61.4)	0.335	109 (75.7)	281 (55.1)	< 0.001
Regional, direct extension or LN only	109 (38.9)	72 (36.4)	63 (35.8)		32 (22.2)	212 (41.6)	
Regional, direct extension + LN	5 (1.8)	10 (5.0)	5 (2.8)		3 (2.1)	17 (3.3)	
Histologic type[b]							
Ductal	219 (78.5)	154 (78.2)	141 (81.0)	0.183	105 (73.9)	409 (80.5)	< 0.001
Lobular/mixed lobular	27 (9.7)	26 (13.2)	23 (13.2)		11 (7.8)	65 (12.8)	
Other specified histology	33 (11.8)	17 (8.6)	10 (5.8)		26 (18.3)	34 (6.7)	
Treatment for breast cancer							
Surgery and radiation[d]							
Mastectomy ± radiation	127 (46.2)	92 (46.7)	60 (34.3)	0.073	66 (48.2)	213 (41.8)	0.015
Lumpectomy + radiation	137 (49.8)	100 (50.8)	109 (62.3)		62 (45.2)	284 (55.7)	
Lumpectomy, no radiation	11 (4.0)	5 (2.5)	6 (3.4)		9 (6.6)	13 (2.5)	
Chemotherapy	179 (63.9)	135 (68.2)	104 (59.1)	0.188	59 (41.0)	359 (70.4)	< 0.001

[a] Percents based on nonmissing values.
[b] < 1.0% missing.
[c] 20.2% missing.
[d] 1.1% missing.
Ductal, histology code 8500; lobular/mixed lobular, histolology codes 8520, 8522, 8524; other histology, all other specified histology codes.

Table 3. Northern California Breast Cancer Family Registry: Logistic Regression: Use of Adjuvant Hormonal Therapy, by Recruitment Phase and Genetic Susceptibility Indicators, Among Women Diagnosed with Hormone Receptor-Positive Breast Cancer

	Phase I (1995–1998) n = *705*		*Phase II (1998–2003)* n = *642*	
	Use of adjuvant hormonal therapy n *(%)*	*aOR*[a,b] *(95% CI)*	*Use of adjuvant hormonal therapy* n *(%)*	*aOR*[a] *(95% CI)*
All women				
Race/ethnicity				
Asian American[c]	88 (68.8)	Referent	212 (77.7)	Referent
Hispanic	64 (67.4)	0.68 (0.34-1.34)	155 (79.1)	0.91 (0.54-1.53)
African American	47 (63.5)	0.53 (0.26-1.06)	140 (80.9)	1.15 (0.66-1.99)
Non-Hispanic white	266 (65.2)	0.73 (0.45-1.17)	N/A	N/A
No susceptibility indicators	(*n* = 226)		(*n* = 383)	
Race/ethnicity				
Asian American[c]	50 (72.5)	Referent	130 (76.9)	Referent
Hispanic	27 (62.8)	0.51 (0.18-1.42)	80 (73.4)	0.87 (0.46-1.64)
African American	20 (60.6)	0.20 (0.06-0.60)*	86 (81.9)	1.52 (0.77-3.00)
Non-Hispanic white	56 (69.1)	0.40 (0.17-0.94)**	N/A	N/A
One or more susceptibility indicators	(*n* = 479)		(*n* = 259)	
Race/ethnicity				
Asian American[c]	38 (64.4)	Referent	82 (78.9)	Referent
Hispanic	37 (71.2)	0.88 (0.34-2.32)	75 (86.2)	0.77 (0.28-2.12)
African American	27 (65.9)	0.88 (0.34-2.28)	54 (79.4)	0.65 (0.25-1.74)
Non-Hispanic white	210 (64.2)	0.88 (0.45-1.71)	N/A	N/A

[a]Adjusted for age at diagnosis (continuous years), year of diagnosis (continuous), education, SEER tumor stage, histology, surgical/radiation treatment, and chemotherapy treatment.
[b]Also adjusted for BMI (continuous).
[c]Includes Chinese, Japanese, and Filipino women.
*$p = 0.008$; **$p = 0.044$.
aOR, adjusted odds ratio; CI, confidence interval; N/A, not applicable.

completed the greatest number of years of education (61% completed college or beyond), and Hispanic women completed the fewest (15% completed college or beyond). BMI was lowest among Asian American women (24 kg/m^2), and mastectomy was least common among African American women (34%).

Among phase II patients, 510 (78%) reported use of adjuvant hormonal therapy for breast cancer. Users tended to be diagnosed at more advanced (regional) stages (45% vs. 24%, $p < 0.001$) and more often received lumpectomy compared to nonusers (58% vs. 52%, $p = 0.015$). Users were also significantly more likely to use chemotherapy than nonusers (70% vs. 41%, $p < 0.001$). Characteristics of the sample are further described in Table 2.

Multivariable logistic regression

Phase I. In multivariable adjusted logistic regression analysis among women recruited during phase I, no statistically significant differences in adjuvant hormonal therapy use were observed between Asian American women and Hispanic (OR 0.68, CI 0.34–1.34), African American (OR 0.53, CI 0.26–1.06) or non-Hispanic white women (OR 0.73, CI 0.45–1.17) (Table 3), although for each group, the direction of the OR indicated a trend toward a lower likelihood of use. Phase I analyses were adjusted for age at diagnosis, year of diagnosis, education level, BMI, SEER stage, tumor histology, surgical and radiation treatment, and chemotherapy treatment.

Phase II. Similarly, among women recruited during phase II, no statistically significant differences in use were observed between Asian American women and Hispanic (OR 0.91, CI 0.54–1.53) or African American (OR 1.15, CI 0.66–1.90) women (Table 3). Phase II analyses were adjusted for age at diagnosis, year of diagnosis, education level, SEER stage, tumor histology, surgical and radiation treatment, and chemotherapy treatment.

Multivariable logistic regression, stratified by genetic susceptibility indicators

Sporadic breast cancer (no indicators of increased genetic susceptibility). Only 32% of the subjects recruited during phase I ($n = 226$) had sporadic breast cancer compared to 60% of the subjects recruited during phase II ($n = 383$). Among phase I sporadic cases, African American and non-Hispanic white women were significantly less likely than Asian American women to use adjuvant hormonal therapy (OR 0.20, CI 0.06–0.60, $p = 0.008$, and OR 0.40, CI 0.17–0.94, $p = 0.044$). Although the direction of the OR indicated a trend toward lower likelihood of use, there was no significant difference in use between Hispanic and Asian American women (OR 0.51, CI 0.18–1.41, $p > 0.05$) (Table 3). In contrast, no

statistically significant differences in use by race/ethnicity were observed among phase II sporadic cases.

Nonsporadic breast cancer (one or more indicators of increased genetic susceptibility). Among women with ≥1 indicators of increased genetic susceptibility, no statistically significant differences in use by race/ethnicity were observed during either recruitment phase (Table 3).

Discussion

Within this population of women with hormone receptor-positive breast cancer, many who had ≥1 indicators of increased genetic susceptibility, use of adjuvant hormonal therapy as breast cancer treatment was common and increased over time, from 65% during phase I to 78% during phase II, consistent with national temporal trends in use.[11] Although the overall racial/ethnic differences were not statistically significant for either recruitment phase, we observed trends toward less frequent use among Hispanic, African American, and non-Hispanic white women compared to Asian American women diagnosed in earlier years (1995–1998). These trends were attenuated over time and were no longer apparent among women diagnosed between 1998 and 2003.

The NC-BCFR oversampled women with indicators of genetic susceptibility, yielding a greater proportion of high-risk cases than would be found in the general population. In light of this fact, we stratified our analysis according to indicators of increased genetic susceptibility. When we did so, the observed trends in adjuvant hormonal therapy use among patients diagnosed in earlier years (phase I) were apparent only among those women with no indicators of genetic susceptibility (sporadic breast cancer) and were statistically significant for African American and non-Hispanic white women. In contrast, among women with at least 1 susceptibility indicator, use of adjuvant hormonal therapy was similar across racial/ethnic groups during both recruitment phases. These are novel findings, as we are unaware of any prior studies that have presented results separately for women with sporadic vs. nonsporadic breast cancer. These stratified results should be interpreted cautiously, however, given nonsignificant p values for interaction by indicators of genetic susceptibility. Differential results according to indicators of genetic susceptibility among phase I patients may have been driven in part by the higher percentage of adjuvant hormonal therapy use among Asian American women (the referent group) with nonsporadic breast cancer relative to those with sporadic breast cancer (73% vs. 64%).

Because the NC-BCFR comprises a greater proportion of high-risk cases than would be found in the general population, we primarily consider the results among sporadic cases in comparing our findings to previous studies. As introduced earlier, a limited number of studies have explored racial/ethnic differences in the use of adjuvant hormonal therapies for the treatment of hormone receptor-positive breast cancer.[5,9,10,16,17] Unlike our analysis, prior studies have compared use of adjuvant hormonal therapy among racial/ethnic groups using non-Hispanic white women as the referent category, making direct comparisons with our study difficult. Similar to our study, however, three of the prior studies documented that African American women had the lowest frequency of adjuvant hormonal therapy use.[5,9,17] Specifically, two of these studies[5,17] reported that non-Hispanic white women were more likely to use adjuvant hormonal therapy than African American women (OR 4.59 and OR = 2.09, respectively), and the third study[9] reported a lower likelihood of adjuvant hormonal therapy use among both African American and Hispanic women compared to non-Hispanic white women (OR 0.91 and OR 0.95, respectively).

One explanation for low rates of adjuvant hormonal therapy use among African Americans may be limited access to care.[5,9] We were unable to control for this factor in our analysis, as the original study did not collect information on health insurance status. However, other research indicates that even after adjustment for insurance status and SES, African American women are less likely than non-Hispanic white women to use adjuvant hormonal therapy.[9] This suggests that factors unrelated to healthcare access also influence use of breast cancer treatment. As one example, comorbid conditions can influence physician's recommendations for adjuvant hormonal therapy,[16] and the presence of these conditions may be more common in African American women.[5] No information was available on comorbid conditions for the women in our sample.

Our phase I findings differ from findings of a previous study that reported a greater likelihood of adjuvant hormonal therapy nonuse for hormone receptor-positive disease among Chinese compared to non-Hispanic white women (OR 2.3).[10] We did not observe a significant difference in use between Asian American and non-Hispanic white women in our overall sample, and in the analysis restricted to sporadic cases, we observed a lower likelihood of use among non-Hispanic white women compared to Asian American women. However, in contrast to the earlier study that included women from a wide range of socioeconomic backgrounds in Northern California, including all women identified through the Greater Bay Area Cancer Registry (GBACR) diagnosed with localized breast cancer in 1994,[10] the sample of women who agreed to participate in NC-BCFR may not have been representative of all eligible cases. The potential difference in sample selection might explain the inconsistency between our study results and those from the earlier study.[10]

A somewhat unexpected finding was that among phase I subjects, adjuvant hormonal therapy users were older than nonusers. Certain tamoxifen side effects, such as thromboembolism, are of greater concern in older women, suggesting that our sample may not be representative. However, this finding was limited to phase I cases, who were diagnosed in earlier years when tamoxifen was most commonly prescribed for postmenopausal women.[8,11] We did not see the same age differential between users and nonusers among phase II subjects.

Our findings among women diagnosed in later years (phase II) indicate that the racial/ethnic differences in use of adjuvant hormonal therapy, specifically for sporadic breast cancer cases, were attenuated over time. This may be explained in part by better established and more comprehensive recommendations for adjuvant hormonal therapy use during this period.[7,8,18] It was not until 1998 that the Early Breast Cancer Trialists' Collaborative Group published findings confirming the efficacy of tamoxifen for both premenopausal and postmenopausal women exclusively for hormone receptor-positive tumors.[8] Over the last decade, aromatase inhibitors

have also been used increasingly as alternatives to tamoxifen among postmenopausal women.[19,20] Our findings must be confirmed in other populations but indicate that in this population, treatment disparities between African American and Asian American women narrowed over time as adjuvant hormonal treatments became more widely available and more commonly prescribed by physicians across the nation. The narrowing of racial/ethnic differences in use of these treatments may help to reduce future racial/ethnic disparities in breast cancer survival and mortality.

In addition to the potentially limited generalizability of our findings, several other limitations are important to consider. Our sample size was small, particularly for racial/ethnic minority groups, which may contribute to the lack of significant findings observed for subjects recruited during phase II. Further, we did not have information on duration of use or adherence to treatment, and research indicates that early discontinuation and nonadherence to adjuvant hormonal therapy are associated with increased mortality.[21] There may be differences in duration of use and adherence to treatment across racial/ethnic groups in our study, and these differences would be more directly linked to any differences in survival.

Further, we relied on self-reported use of adjuvant hormonal therapy as the outcome measure, which could have been inaccurately recalled and reported. We were not able to validate self-reported use against medical records in this sample, as no medical records were reviewed for the NC-BCFR site during the original study, and it was not feasible to do so as part of our secondary analysis. Previous studies,[22,23] however, including the Australian BCFR, which used the same treatment questions as the NC-BCFR,[24] have indicated good agreement between self-reported adjuvant hormonal treatment and information from medical records of breast cancer survivors.

Conclusions

We identified racial/ethnic differences in use of adjuvant hormonal therapy among women in the NC-BCFR recruited during earlier diagnosis years (phase I), particularly between African American and Asian American women, but these differences were significant only among women with no indicators of increased genetic susceptibility. Further, these differences were not observed for women recruited in later years (phase II). In summary, racial/ethnic differences in the use of adjuvant hormonal therapy were minimized among women diagnosed in later years and among women with ≥ 1 indicators of increased genetic susceptibility regardless of when they were diagnosed. The narrowing of racial/ethnic differences in use of these treatments may help to reduce future racial/ethnic disparities in breast cancer survival and mortality. Our findings should be confirmed in other populations, and efforts should be continued to ensure equality of treatment across racial/ethnic groups. Future research should also measure adherence to adjuvant hormonal therapy, which is more directly related to breast cancer survival.

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Disclosure Statement

The authors have no financial conflicts of interest to disclose.

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Address correspondence to:
Jennifer C Livaudais, Ph.D.
Department of Health Evidence and Policy
Mount Sinai School of Medicine
1425 Madison Avenue
New York, NY 10029

E-mail: jclivaudais@gmail.com