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Disparities in Breast Cancer Characteristics and Outcomes by Race/Ethnicity

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Abstract

Purpose—Disparities in breast cancer stage and mortality by race/ethnicity in the United States are persistent and well known. However, few studies have assessed differences across racial/ethnic subgroups of women broadly defined as Hispanic, Asian, or Pacific Islander, particularly using more recent data.

Methods—Using data from 17 population-based cancer registries in the Surveillance, Epidemiology, and End Results (SEER) Program, we evaluated the relationships between race/ethnicity and breast cancer stage, hormone receptor status, treatment, and mortality. The cohort consisted of 229,594 women 40-79 years of age diagnosed with invasive breast carcinoma between January 2000 and December 2006, including 176,094 non-Hispanic whites, 20,486 blacks, 15,835 Hispanic whites, 14,951 Asians, 1,224 Pacific Islanders and 1,004 American Indians/Alaska Natives.

Results—With respect to statistically significant findings, American Indian/Alaska Native, Asian Indian/Pakistani, black, Filipino, Hawaiian, Mexican, Puerto Rican, and Samoan women had 1.3 to 7.1-fold higher odds of presenting with stage IV breast cancer compared to non-Hispanic white women. Almost all groups were more likely to be diagnosed with estrogen receptor-negative/progesterone receptor-negative (ER-/PR-) disease with black and Puerto Rican women having the highest odds ratios (2.4 and 1.9-fold increases, respectively) compared to non-Hispanic whites. Lastly, black, Hawaiian, Puerto Rican, and Samoan patients had 1.5 to 1.8-fold elevated risks of breast cancer specific mortality.

Conclusions—Breast cancer disparities persist by race/ethnicity, though there is substantial variation within subgroups of women broadly defined as Hispanic or Asian. Targeted, multi-pronged interventions that are culturally appropriate may be important means of reducing the magnitudes of these disparities.

Keywords

Breast cancer; disparities; race; ethnicity; stage; estrogen receptor; progesterone receptor; mortality

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INTRODUCTION

It is well established that compared to non-Hispanic whites, several racial/ethnic groups, including blacks, Hispanic whites, and American Indians, are more likely to be diagnosed with advanced stage breast cancer and have poorer disease specific survival rates [10]. These same groups of women are also more likely to be diagnosed with hormone receptor negative tumors [14], which are more aggressive than hormone receptor positive tumors and have a poorer prognosis regardless of factors such as stage of disease [6]. There is clear evidence that over the past two decades the proportion of breast cancers diagnosed at an advanced stage has fallen and survival rates have increased across women of all racial/ethnic groups [10,23]. However, the relative disparities with respect to stage and mortality have held essentially constant by race/ethnicity [10,17].

Few studies have assessed breast cancer disparities related to stage or mortality across subgroups of broadly defined racial/ethnic groups, such as Asians, Hispanic whites, and Pacific Islanders. Here we assess these disparities among six distinct Asian populations, four distinct Hispanic populations, and two distinct Pacific Islander populations. We have previously reported on some of these differences based on Surveillance, Epidemiology and End Results (SEER) Program data from 1992-1998, which was the first to document differences in these disparities across many of these subgroups [3,15]. An update of this report to both confirm the disparities and to evaluate how they have changed is warranted, particularly since the SEER Program was substantially expanded in 2000 and now includes 26% of the United States population. Identification of the types of disparities experienced by each racial/ethnic subgroup can help identify needs specific to different communities and facilitate the development of culturally appropriate strategies to reduce these disparities.

METHODS

Women 40-79 years of age without a prior history of any type of cancer who were diagnosed with invasive breast cancer between January 2000 and December 2006 were identified through 17 population-based cancer registries in the United States that participate in the National Cancer Institute's SEER Program. Women less than 40 years of age and 80 years of age and older were excluded. This is because one of the primary outcomes of interest was cancer stage, and stage is influenced by mammographic screening and routine screening is not recommended for women <40 and is less common among women ≥80 years of age. 2000 was chosen as the starting point for this analysis because this was the year when several registries were added to the SEER program. The SEER registries that were included serve the states of California (through the participation of four distinct SEER registries), Connecticut, Hawaii, Iowa, Kentucky, Louisiana, New Jersey, New Mexico, and Utah, the areas surrounding Atlanta, Georgia; Detroit, Michigan, and Seattle, Washington; a rural area of Georgia; and the population of Alaskan Natives living in Alaska. It is estimated that more than 95% of all incident cases in the populations under surveillance are ascertained. The primary source of data used by SEER is patient medical records, and further operational details regarding the methodology employed by the SEER Program are provided elsewhere [28].

A total of 242,056 women were potentially eligible for this study. To make our race/ethnicity categories mutually exclusive, 195 black women, 27 American Indian/Alaska Native women, 60 Asian women, and 25 Pacific Islanders who were also categorized as being Hispanic were excluded, as were the 1,610 with an unknown race/ethnicity. Of the remaining 240,139 cases, 10,545 with an unknown AJCC were excluded leaving a total of 229,594 cases.

Our primary exposure of interest was race/ethnicity. Based on SEER data, race/ethnicity was categorized into six broad groups: non-Hispanic white, black, Hispanic white, Asian, Pacific Islander, and American Indian/Alaska Native. SEER also collects more detailed data on Hispanic, Asian, and Pacific Islander subgroups. Analyses were conducted on the following subgroups: Hispanics – Mexican, South/Central American, Puerto Rican, and Cuban women; Asians – Filipino, Chinese, Japanese, Asian Indian/Pakistani, Korean, and Vietnamese women; and Pacific Islanders – Hawaiian and Samoan women.

Our primary outcomes of interest were AJCC stage, joint estrogen receptor (ER)/ progesterone receptor (PR) status, receipt of appropriate treatment, and breast cancer specific mortality. Data on AJCC stage and ER/PR status are directly available in the SEER data. The 14,444 women with missing stage data and the additional 40,182 women missing ER/PR status were excluded leaving a final total of 229,594 women included in our analyses. We were also interested in assessing whether or not the primary surgical and radiation treatments given to women of different races/ethnicities with stage I and II breast carcinomas less than 2.0 cm in size met current standards of care outlined by National Comprehensive Cancer Network using methodology consistent with previous reports [2,20]. Women were categorized as having received an appropriate first course of treatment if they either received a total mastectomy or had breast conserving surgery (BCS) with axillary node dissection and radiation. Women who had BCS but did not receive axillary node dissection and/or radiation were categorized as having received inappropriate treatment. This analysis was limited to women with tumors <2.0 cm because of the potential benefit those with larger tumors experience with neoadjuvant chemotherapy. Our final outcome of interest was breast cancer specific mortality. Information on vital status and survival time is obtained annually by each registry through a variety of data sources. SEER calculates survival time in months beginning with the month and year of diagnosis, and in this study the outcome of interest was death due to breast cancer. So women were followed until whichever of the following occurred first: 1) date of death due to breast cancer, 2) date of death due to a cause other than breast cancer (censored) 3) date last known to be alive, or 4) December 31, 2006, the follow-up cutoff date used in this analysis.

Associations between race/ethnicity and AJCC stage, ER/PR status, and treatment were estimated using polytomous logistic regression. Risks of mortality by race/ethnicity were calculated using the Cox proportional hazards model. In all analyses non-Hispanic white women served as the reference race/ethnicity, and risk estimates were adjusted for age at diagnosis, year of diagnosis, SEER registry, and county level measures of poverty and education according to how they are categorized in Table 1. Analyses of ER/PR status and treatment were additionally adjusted for AJCC stage. For risk of mortality we conducted analyses additionally adjusted for AJCC stage, surgical and radiation treatments, and ER/PR status. All analyses were conducted using Stata/SE 10.1 for Windows (Stata Corp, College Station, TX) statistical software.

RESULTS

Non-Hispanic white women were somewhat older at diagnosis compared to women in each of the other racial/ethnic groups (Table 1). The proportions of patients that were non-Hispanic white generally decreased from 2000-2006, while they increased somewhat among blacks, Hispanic whites, Asians, and American Indians/Alaska Natives. Non-Hispanic white women most frequently came from the Greater California and New Jersey registries; black women from Atlanta, Detroit, Los Angeles, Louisiana and New Jersey; Hispanic whites from Greater California and Los Angeles, Asians from Greater California, Hawaii, Los Angeles and San Francisco-Oakland; Pacific Islanders from Hawaii and Greater California; and American Indians/Alaska Natives from the Alaska Natives, Greater California, New

Mexico and Seattle-Puget Sound registries. Higher proportions of blacks, Hispanic whites, Asians, and American Indians/Alaska Natives lived in counties where higher proportions of the population were living below 200% of the federal poverty level based on 2000 census data. Higher proportions of Hispanic whites, blacks and Asians lived in counties where higher proportions of the population had less than a high school education.

With respect to statistically significant findings ($p<0.05$), compared with non-Hispanic white women, black, Hispanic white, Pacific Islander and American Indian/Alaska Native women had 1.5 to 2.5-fold higher odds of presenting with stage IV tumors (Table 2). Among Hispanic whites, Mexican and Puerto Rican women had the highest odds of presenting with stage IV disease (OR=1.8, 95% CI: 1.6-2.1 and OR=1.5, 95% CI: 1.1-2.1, respectively). Among Asians, both Chinese and Japanese women were 30% less likely while Filipino and Asian Indian/Pakistani women were 30% and 50%, respectively, more likely to be diagnosed with stage IV disease. Samoan women had the highest odds of having stage IV breast cancer of any of the women studied (OR=7.1, 95% CI: 3.6-14.0), though both Hawaiian and other Pacific Islander women were also more likely to present with stage IV disease.

Compared with non-Hispanic white women, black, Hispanic white, Asian and American Indian/Alaska Native women had 1.2 to 2.4-fold higher odds of being diagnosed with ER-/PR- breast cancer (Table 3). Among Hispanic whites, Mexican, South or Central American and Puerto Rican women had higher likelihood of being diagnosed with ER-/PR- breast cancer (OR=1.5, 95% CI: 1.4-1.6, OR=1.4, 95% CI: 1.2-1.5 and OR=1.9, 95% CI: 1.6-2.3, respectively). Among Asians, Japanese women had a 20% lower odds of having ER-/PR- breast cancer, while Korean women had the highest OR (1.5, 95% CI: 1.3-1.7). Black women had the highest odds of being diagnosed with ER-/PR- breast cancer of any of the racial/ethnic groups studied (OR=2.4, 95% CI: 2.3-2.5).

Among women with stage I or II breast carcinomas less than 2.0 cm in size, compared with non-Hispanic white women, black and Hispanic white women had increased odds of receiving inappropriate primary surgical and radiation breast cancer treatment (OR=1.5, 95% CI: 1.3-1.6 and OR=1.2, 95% CI: 1.1-1.3, respectively) (Table 4). Among Hispanic whites, Mexican and South or Central American women had the highest likelihood of receiving inappropriate treatment (OR=1.2, 95% CI: 1.0-1.5 and OR=1.3, 95% CI: 1.0-1.7, respectively). Samoan women had the highest OR of receiving inappropriate treatment of any of the racial/ethnic subgroups studied (OR=5.1, 95% CI: 2.0-13.0).

Compared with non-Hispanic white women, black, Hispanic white, Pacific Islander and American Indian/Alaska Native women had 1.4 to 2.4-fold greater risks of breast cancer specific mortality, adjusting for diagnosis age, year, and SEER registry (Table 5). Elevations in risk of mortality were still observed, though attenuated, in black, Hispanic white and Pacific Islander women, after additionally adjusting for stage, ER/PR status, surgical and radiation treatments, and county level measures of poverty and education. Among Hispanic whites, Puerto Rican women had the highest risk of breast cancer specific mortality in our multivariate adjusted model (OR=1.7, 95% CI: 1.3-2.1). Among Asians, Japanese women had 20% lower breast cancer specific mortality risks, after multivariate adjustment (OR=0.8, 95% CI: 0.6-1.0). Among Pacific Islanders, both Hawaiian and Samoan women had increased risk of mortality (multivariate adjusted OR=1.5, 95% CI: 1.1-2.0 and OR=1.8, 95% CI: 1.1-3.0, respectively).

DISCUSSION

The results of our study (summarized in Table 6) are consistent with multiple prior studies that have evaluated various aspects of breast cancer disparities by race/ethnicity. Specifically, it is consistent with the literature demonstrating that compared to non-Hispanic white women, black [3,15,18,22], Hispanic white [13,15,16,18,22], Hawaiian [4,7,15], and American Indian [15,26,27] women present with more advanced stages of breast cancer and have greater risks of mortality after a breast cancer diagnosis. It has also been previously reported that Japanese women have better breast cancer survival rates compared to non-Hispanic white women [4,19]; that black and Hispanic white women are more likely to receive inappropriate treatments [3,15]; and that black, Hispanic white and American Indian women are more likely to present with tumors that were ER- or PR- [11,14,16,21]. Beyond confirming that all of these disparities persist in the United States through 2006, a unique contribution is the characterization of breast cancer disparities impacting Pacific Islander women. These women, and in particular Samoan women, were among those experiencing disparities with the highest magnitudes. Specifically, Samoan women had substantially higher odds of presenting with Stage IV disease (OR=7.1) and receiving inappropriate treatment for early stage breast cancer (OR=5.1), and the highest risk of any group of breast cancer mortality (HR=1.8) despite being one of the only groups to have a similar risk of ER-/PR- disease compared to non-Hispanic whites. This suggests that the disparities these women experience are primarily related to issues of access to care with respect to both screening and follow-up after a breast cancer diagnosis rather than differences in tumor biology. These disparities have not been previously well characterized as most prior studies have combined Pacific Islander women with Asian women in their analyses despite the fact that they are a racially diverse group of people with respect to genetics, socioeconomic status (SES), and culture.

Black breast cancer patients continue to fare quite poorly as they had elevated likelihood of having all four adverse breast outcomes assessed here. This suggests that disparities are impacting black women across the breast cancer spectrum with respect to access and utilization of screening and preventive services, clinical care subsequent to breast cancer diagnosis, and long term follow-up care and clinical management for black breast cancer survivors. These results support continued multi-pronged efforts to address these disparities in black communities throughout the U.S.

We observed distinct differences with respect to breast cancer stage, treatment and mortality risks within the broadly defined racial/ethnic group of Hispanic whites, Asians and Pacific Islanders. With respect to Hispanic white women of the four subgroups assessed, Mexican women had the highest likelihood of presenting with stage III and IV breast cancer, Puerto Rican women were the most frequently diagnosed with ER-/PR- disease, only Mexican and South/Central American women had higher likelihood of receiving inappropriate treatment, and only Puerto Rican women had an increased risk of mortality in the multivariate adjusted model. As each outcome measured is an indicator of different types of disparities, this information could be potentially useful in designing public health strategies. For example, the high likelihood of advanced stage cancer among Mexican women suggests that efforts to promote breast cancer screening and/or timely access to care after an abnormal mammogram may be of particular importance in this population, while the high risk of mortality among Puerto Rican women indicates that efforts to ensure that Puerto Rican breast cancer survivors get adequate treatment and follow-up care may be needed.

Even greater heterogeneity was observed among Asian subgroups. Japanese women consistently had better outcomes than non-Hispanic white women in several respects including lower odds of having stage IV breast cancer, ER-/PR- disease, and lower mortality risk. The picture was more mixed for other Asian subgroups as Chinese women also had lower likelihood of presenting with stage IV disease but more likely to have ER-/PR- disease and Asian Indian/Pakistani women had odds of having stage III and IV breast cancer but had a lower risk of mortality. With the exception of higher odds of ER-/PR- disease, Korean and Vietnamese women were similar to non-Hispanic whites in other respects. Lastly, of all the Asian subgroups, Filipino women in general had the poorest outcomes compared to the other Asian subgroups in that they were more likely to present with advanced stage and with ER-/PR- breast cancer. Again, consideration of the nature of the disparities each subgroup experienced could be useful in developing strategies to address them.

We also found that Alaska Native/American Indian women are more likely to be diagnosed with advanced stage and ER-/PR- breast cancer. Our results agree with previous studies that show that American Indian/Alaska Native women are more likely to be diagnosed with late stage breast cancer. Prior studies also suggest that these women are more likely to die of breast cancer [27], even after adjustment for definitive therapy [26]; however, results of our study did not show differences in mortality. While it is possible that relative mortality rates for these women have improved, there is also considerable heterogeneity across American Indian/Alaska Native populations, which could contribute to this difference.

While many of the relative disparities persist, including with respect to receipt of appropriate treatment for early stage breast cancer, one encouraging difference we found is in the higher proportions of women with early stage disease who do receive appropriate treatment across all races/ethnicities. While our study that included data from 1992-1998 found that the percentage of women receiving appropriate therapy ranged from 77.1-86.3% across races/ethnicities, the more recent 2000-2006 data shown here indicate that with the exception of Samoan women, 91.6-95.4% of women across races/ethnicities received appropriate treatment.

One potential limitation of our study was that race/ethnicity was determined via medical record reviews only, and is also subjected to misclassification of race/ethnicity, which has been shown to vary by race/ethnicity [8]. Consequently, a sizable proportion of Asian, Pacific Islander and Hispanic white women were classified as “other” or “not-otherwise-specified” (NOS) (14.5%, 19.5% and 51.5%, respectively). Precisely how our point estimates would have changed if these women, and particularly the large number of Hispanic whites, NOS, could have been correctly classified into a subgroup is unknown. In general though, the point estimates for the “other” groups were consistent with those for the broader classifications. Another potential limitation is misclassification of our various outcomes. For example, ER/PR data also came from medical record data and so variation in the methods used to evaluate and interpret ER and PR status across hospitals and geographic regions could contribute to this misclassification. Lastly, a lack of data on individual level socioeconomic variables as well as other factors such as family history of breast cancer, lifestyle factors, anthropometric characteristics, and treatment with hormonal therapy and chemotherapy precludes us from evaluating these exposures as potential confounders or effect modifiers of the relationships observed.

The disparities identified here are multifactorial and due to a combination of several factors including those related to socioeconomic status, access to health care, lifestyle and cultural differences, and cancer biology. These factors all have the potential to influence disparities at several points along the spectrum of breast cancer clinical care from prevention and screening services, to diagnosis and treatment, and to long-term follow-up and survivorship. We demonstrate here that many breast cancer disparities persist after adjusting for various aspects of these disparities. Other studies with more detailed individual level data have shown that some disparities are attenuated or disappear after adjusting for certain factors, while other show that they persist [5,9,12,24,25]. For example, one study compared breast cancer outcomes among underinsured black and non-Hispanic white patients treated in an equal healthcare access setting over a ten year period (1997-2006) [12]. It found that black patients had a poorer breast cancer-specific survival rate compared to non-Hispanic white patients, but that after adjustment for clinical and sociodemographic factors this difference was no longer statistically significant. Similar attenuation was seen in another study that evaluated breast cancer outcomes in a population with low SES and similar access to health care [5]. 60% of the patients in the two hospitals studied were blacks and over two-thirds of patients had either Medicaid coverage or no insurance, and here 5-year overall survival rates for black and Caucasian patients were similar. In contrast, a study of breast cancer incidence observed that even after adjusting for factors associated with SES, a disparity in breast cancer incidence persisted among blacks [24]. The authors utilized several studies (published between 1990 and 2007) that addressed disparities in breast cancer incidence across racial and socioeconomic strata to calculate incidence rate ratios (IRRs) comparing the highest to the lowest strata of SES for white, black, Hispanic and Asian/Pacific Islander populations. They found that the magnitude of the disparity in breast cancer incidence between races decreased as SES increased. However, when adjusted for factors closely associated with SES, disparities in breast cancer incidence between white, Hispanic, and Asian/Pacific-Islander were no longer seen, but did persist in the comparison between white and black women. With respect to disparities in breast cancer diagnosis and treatment delay by race/ethnicity, in a study of 49,865 female Medicare recipients 65 years and older diagnosed with breast cancer during a seven-year period (1992-1999), black women most frequently experienced delays in both initial diagnosis and initiation of breast cancer treatment relative to women of other races/ethnicities in a multivariate adjusted model that included access to healthcare [9,25]. Diagnostic and therapeutic delays were also found to contribute to breast and cervical cancer disparity in a population-based sampling and cross sectional design study, which showed that Hispanic whites are more likely to report diagnostic delays while blacks are more likely to report therapeutic delays [1]. However, breast cancer disparities by race/ethnicity seem to be less affected by mammography usage during our study time period. Mammography usage based on Behavioral Risk Factor Surveillance System (BRFSS) data indicate that from 1993 to 2003 mammography utilization has been similar among Black and non-Hispanic women [23].

While many other studies have also addressed these issues, the studies described above are illustrative of the complexity and multifactorial nature of racial/ethnic disparities in breast cancer. Our study shows that despite ongoing efforts, breast cancer disparities by race and ethnicity persist in the United States and in particular quantitates disparities present in smaller racial/ethnic subgroups that have not been previously well studied. Importantly, our study identifies the types of disparities faced by distinct racial/ethnic subgroups and can potentially help inform further development and implementation of specific strategies to address them.

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Table 1

Characteristics of the 229,594 breast cancer cases by race/ethnicity

	Non-Hispanic whites (n=176,094)		Blacks (n=20,486)		Hispanic whites (n=15,835)		Asians (n=14,951)		Pacific Islanders (n=1,224)		American Indians/ Alaska Natives (n=1,004)	
	n	%	n	%	n	%	n	%	n	%	n	%
Age at diagnosis, years												
40-49	37,015	21.0	5,816	28.4	5,157	32.6	4,503	30.1	323	26.4	307	30.6
50-59	52,288	29.7	6,457	31.5	4,783	30.2	4,826	32.3	412	33.7	331	33.0
60-69	46,260	26.3	4,805	23.5	3,525	22.3	3,318	22.2	315	25.7	225	22.4
70-79	40,531	23.0	3,408	16.6	2,370	15.0	2,304	15.4	174	14.2	141	14.0
Mean±standard deviation	59.7±10.8		57.3±10.6		56.4±10.6		56.7±10.5		57.2±10.1		56.5±10.2	
Year of diagnosis												
2000	26,581	15.1	2,833	13.8	1,904	12.0	1,879	12.6	138	11.3	131	13.0
2001	26,916	15.3	2,850	13.9	2,020	12.8	1,993	13.3	190	15.5	132	13.1
2002	26,354	15.0	2,986	14.6	2,257	14.3	2,210	14.8	176	14.4	125	12.5
2003	24,549	13.9	2,983	14.6	2,249	14.2	2,061	13.8	193	15.8	162	16.1
2004	24,064	13.7	3,006	14.7	2,341	14.8	2,197	14.7	178	14.5	147	14.6
2005	23,651	13.4	2,740	13.4	2,563	16.2	2,281	15.3	186	15.2	157	15.6
2006	23,979	13.6	3,088	15.1	2,501	15.8	2,330	15.6	163	13.3	150	14.9
SEER Registry												
Alaska Natives	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	282	28.1
Atlanta	5,479	3.1	2,522	12.3	146	0.9	200	1.3	3	0.2	5	0.5
Connecticut	11,164	6.3	766	3.7	454	2.9	135	0.9	6	0.5	10	1.0
Detroit	10,131	5.8	2,870	14.0	110	0.7	136	0.9	1	0.1	8	0.8
Greater California	43,538	24.7	2,038	9.9	5,726	36.2	3,354	22.4	131	10.7	201	20.0
Hawaii	1,135	0.6	20	0.1	62	0.4	2,138	14.3	828	67.6	18	1.8
Iowa	9,372	5.3	117	0.6	58	0.4	27	0.2	2	0.2	17	1.7
Kentucky	12,176	6.9	834	4.1	41	0.3	43	0.3	4	0.3	1	0.1
Los Angeles	14,546	8.3	2,787	13.6	4,746	30.0	3,484	23.3	66	5.4	30	3.0
Louisiana	9,058	5.1	3,591	17.5	94	0.6	73	0.5	3	0.2	9	0.9
New Jersey	23,073	13.1	3,039	14.8	1,485	9.4	1,047	7.0	29	2.4	13	1.3

	Non-Hispanic whites (n=176,094)		Blacks (n=20,486)		Hispanic whites (n=15,835)		Asians (n=14,951)		Pacific Islanders (n=1,224)		American Indians/ Alaska Natives (n=1,004)	
	n	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
New Mexico	3,665	2.1	54	0.3	1,021	6.4	44	0.3	0	0.0	184	18.3
Rural Georgia	258	0.1	124	0.6	1	0.0	0	0.0	0	0.0	0	0.0
San Francisco-Oakland	9,547	5.4	1,194	5.8	895	5.7	2,330	15.6	73	6.0	22	2.2
San Jose-Monterey	5,002	2.8	124	0.6	678	4.3	1,070	7.2	19	1.6	12	1.2
Seattle-Puget Sound	13,183	7.5	386	1.9	170	1.1	798	5.3	39	3.2	174	17.3
Utah	4,767	2.7	20	0.1	148	0.9	72	0.5	20	1.6	18	1.8
% of population in county living below 200% of the federal poverty level in the year 2000, quartiles												
≥36.74%	38,927	22.1	6,193	30.2	7,800	49.3	4,215	28.2	97	7.9	282	28.1
28.36-36.73%	42,292	24.0	7,222	35.3	3,662	23.1	2,040	13.6	218	17.8	179	17.8
19.74-28.35%	45,222	25.7	4,221	20.6	2,497	15.8	5,315	35.5	807	65.9	413	41.1
≤19.73%	49,653	28.2	2,850	13.9	1,876	11.8	3,381	22.6	102	8.3	130	12.9
% of population in county with less than a high school education in the year 2000, quartiles												
≥25.06%	36,970	21.0	6,163	30.1	8,151	51.5	4,378	29.3	108	8.8	155	15.4
17.64-25.05%	45,606	25.9	7,671	37.4	3,324	21.0	3,231	21.6	80	6.5	161	16.0
14.73-17.63%	41,906	23.8	4,160	20.3	2,996	18.9	4,908	32.8	909	74.3	170	16.9
≤14.72%	51,612	29.3	2,492	12.2	1,364	8.6	2,434	16.3	127	10.4	518	51.6

Table 2

Risk of advanced stage breast cancer by race/ethnicity

	Stage I		Stage II				Stage III				Stage IV			
Race/ethnicity	**n**	**%**	**n**	**%**	**OR**	**95% CI**	**n**	**%**	**OR**	**95% CI**	**n**	**%**	**OR**	**95% CI**
Non-Hispanic white	88,505	50.3	65,922	37.4	1.0	ref	14,228	8.1	1.0	ref	7,439	4.2	1.0	ref
Black	7,257	35.4	8,836	43.1	1.5	1.5-1.6*	2,726	13.3	2.1	2.0-2.2*	1,667	8.1	2.5	2.4-2.7*
Hispanic white	6,060	38.3	6,914	43.7	1.4	1.3-1.5*	2,114	13.4	1.8	1.7-1.9*	747	4.7	1.5	1.3-1.6*
Asian	7,096	47.5	6,001	40.1	1.1	1.1-1.2*	1,326	8.9	1.1	1.1-1.2*	528	3.5	1.0	0.9-1.1
Pacific Islander	508	41.5	511	41.7	1.6	1.4-1.8*	132	10.8	2.0	1.6-2.5*	73	6.0	2.4	1.8-3.1*
American Indian/Alaska Native	448	44.6	403	40.1	1.2	1.0-1.4*	89	8.9	1.3	1.0-1.8*	64	6.4	2.3	1.7-3.0*
Hispanic Subgroups														
Mexican	1,569	33.8	2,090	45.0	1.6	1.5-1.7*	751	16.2	2.4	2.2-2.7*	232	5.0	1.8	1.6-2.1*
South or Central American	902	41.2	925	42.3	1.2	1.1-1.4*	271	12.4	1.6	1.4-1.8*	89	4.1	1.1	0.9-1.4
Puerto Rican	250	38.3	280	42.9	1.5	1.2-1..7*	86	13.2	2.1	1.6-2.7*	37	5.7	1.5	1.1-2.1*
Cuban	159	43.2	144	39.1	1.2	1.0-1.5	42	11.4	1.6	1.1-2.3*	23	6.3	1.4	0.9-2.2
Other Hispanics	3,324	39.8	3,627	43.4	1.4	1.3-1.4*	1,011	12.1	1.6	1.5-1.7*	386	4.6	1.4	1.2-1.5*
Asian Subgroups														
Filipino	1,892	43.6	1,812	41.7	1.2	1.2-1.3*	451	10.4	1.4	1.3-1.6*	189	4.4	1.3	1.1-1.5*
Chinese	1,451	50.2	1,134	39.2	1.0	0.9-1.1	225	7.8	0.9	0.8-1.0	83	2.9	0.7	0.6-0.9*
Japanese	1,503	56.5	919	34.6	0.9	0.8-1.0*	165	6.2	0.8	0.7-1.0*	71	2.7	0.7	0.5-0.9*
Asian Indian/Pakastani	436	41.3	447	42.3	1.3	1.2-1.5*	118	11.2	1.5	1.2-1.8*	55	5.2	1.5	1.1-1.9*
Korean	444	43.8	442	43.6	1.2	1.1-1.4*	97	9.6	1.2	0.9-1.5	31	3.1	0.9	0.6-1.2
Vietnamese	397	45.5	351	40.3	1.1	0.9-1.3	93	10.7	1.3	1.0-1.6*	31	3.6	1.0	0.7-1.5
Other Asians	1,002	46.1	921	42.4	1.2	1.1-1.3*	182	8.4	1.0	0.9-1.2	69	3.2	0.9	0.7-1.1
Pacific Islander Subgroups														
Hawaiian	390	44.1	368	41.6	1.5	1.2-1.7*	83	9.4	1.7	1.3-2.2*	44	5.0	1.8	1.3-2.6*
Samoan	26	21.7	59	49.2	3.1	1.9-4.9*	22	18.3	5.5	3.1-9.8*	13	10.8	7.1	3.6-14.0*

	Stage I		Stage II				Stage III				Stage IV			
Race/ethnicity	n	%	n	%	OR	95% CI	n	%	OR	95% CI	n	%	OR	95% CI
Other Pacific Islanders	106	43.4	91	37.3	1.1	0.9-1.5	31	12.7	1.7	1.1-2.6*	16	6.6	2.9	2.0-4.4*

*p<0.05.

Note: Non-Hispanic white women served as the reference race/ethnicity and all odds ratios (OR) are adjusted for age at diagnosis, year of diagnosis, SEER registry, and county level measures of poverty and education.

Table 3

Risk of breast cancer by estrogen and progesterone status by race/ethnicity

	ER+/PR+		ER+/PR−				ER−/PR−			
Race/ethnicity	**n**	**%**	**n**	**%**	**OR**	**95% CI**	**n**	**%**	**OR**	**95% CI**
Non-Hispanic white	102,537	68.4	19,528	13.0	1.0	ref	27,824	18.6	1.0	ref
Black	8,214	49.4	2,175	13.1	1.3	1.3-1.4*	6,230	37.5	2.4	2.3-2.5*
Hispanic white	7,868	61.4	1,634	12.8	1.1	1.0-1.2*	3,310	25.8	1.4	1.3-1.5*
Asian	8,417	66.2	1,606	12.6	1.1	1.0-1.2*	2,682	21.1	1.2	1.2-1.3*
Pacific Islander	783	70.9	114	10.3	0.9	0.7-1.1	208	18.8	1.1	0.9-1.2
American Indian/Alaska Native	571	65.3	96	11.0	0.8	0.6-1.1	208	23.8	1.3	1.1-1.6*
Hispanic Subgroups										
Mexican	2,239	60.1	440	11.8	1.0	0.9-1.2	1,048	28.1	1.5	1.4-1.6*
South or Central American	1,089	61.8	233	13.2	1.1	1.0-1.3	441	25.0	1.4	1.2-1.5*
Puerto Rican	290	54.9	73	13.8	1.2	0.9-1.6	165	31.3	1.9	1.6-2.3*
Cuban	203	70.7	34	11.8	0.8	0.5-1.1	50	17.4	0.9	0.7-1.2
Other Hispanics	4,237	62.2	892	13.1	1.1	1.0-1.2*	1,686	24.7	1.3	1.3-1.4*
Asian Subgroups										
Filipino	2,343	64.0	484	13.2	1.1	1.0-1.3*	834	22.8	1.3	1.2-1.4*
Chinese	1,633	66.6	317	12.9	1.1	1.0-1.3*	501	20.4	1.2	1.0-1.2*
Japanese	1,699	73.5	280	12.1	1.0	0.8-1.1	332	14.4	0.8	0.7-0.9*
Asian Indian/Pakastani	558	62.3	108	12.1	1.0	0.8-1.3	229	25.6	1.4	1.2-1.6*
Korean	544	62.5	100	11.5	1.1	0.9-1.3	227	26.1	1.5	1.3-1.7*
Vietnamese	448	62.9	82	11.5	1.1	0.8-1.4	182	25.6	1.4	1.2-1.7*
Other Asians	1,228	66.3	240	13.0	1.1	1.0-1.3	385	20.8	1.2	1.0-1.3*
Pacific Islander Subgroups										
Hawaiian	582	72.5	85	10.6	0.9	0.7-1.2	136	16.9	0.9	0.7-1.1
Samoan	75	70.1	9	8.4	0.7	0.3-1.3	23	21.5	0.9	0.6-1.5

	ER+/PR+		ER+/PR−				ER−/PR−			
Race/ethnicity	**n**	**%**	**n**	**%**	**OR**	**95% CI**	**n**	**%**	**OR**	**95% CI**
Other Pacific Islanders	143	65.6	23	10.6	0.9	0.6-1.4	52	23.9	1.3	0.9-1.8

*p<0.05.

Note: Non-Hispanic white women served as the reference race/ethnicity and all odds ratios (OR) are adjusted for age at diagnosis, year of diagnosis, AJCC stage, SEER registry, and county level measures of poverty and education.

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Table 4

Risk of inappropriate treatment for early stage breast cancer by race/ethnicity

	Standard Treatment		Inappropriate Treatment			
Race/ethnicity	**n**	**%**	**n**	**%**	**OR**	**95% CI**
Non-Hispanic white	94,779	94.2	5,876	5.8	1.0	ref
Black	7,716	92.0	672	8.0	1.5	1.3-1.6*
Hispanic white	6,549	93.6	451	6.4	1.2	1.1-1.3*
Asian	7,564	94.6	431	5.4	1.0	0.9-1.2
Pacific Islander	539	92.9	41	7.1	1.4	1.0-1.9
American Indian/Alaska Native	476	93.9	31	6.1	1.3	0.8-2.0
Hispanic Subgroups						
Mexican	1,743	94.3	106	5.7	1.2	1.0-1.5*
South or Central American	961	92.8	75	7.2	1.3	1.0-1.7*
Puerto Rican	273	91.6	25	8.4	1.2	0.8-1.8
Cuban	159	92.4	13	7.6	1.0	0.6-1.8
Other Hispanics	3,573	93.5	247	6.5	1.2	1.1-1.4*
Asian Subgroups						
Filipino	1,991	94.7	112	5.3	1.0	0.9-1.3
Chinese	1,572	94.6	90	5.4	1.0	0.8-1.3
Japanese	1,585	94.0	102	6.0	0.9	0.7-1.1
Asian Indian/Pakastani	461	95.4	22	4.6	0.9	0.6-1.3
Korean	485	94.2	30	5.8	1.3	0.9-1.8
Vietnamese	412	95.2	21	4.8	1.1	0.7-1.8
Other Asians	1,093	95.0	57	5.0	1.1	0.9-1.5
Pacific Islander Subgroups						
Hawaiian	418	93.3	30	6.7	1.2	0.8-1.8
Samoan	21	77.8	6	22.2	5.1	2.0-13.0*
Other Pacific Islanders	113	95.0	6	5.0	1.1	0.5-2.4

* p<0.05.

Note: Non-Hispanic white women served as the reference race/ethnicity and all odds ratios (OR) are adjusted for age at diagnosis, year of diagnosis, AJCC stage, SEER registry, and county level measures of poverty and education.

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Table 5

Risk of breast cancer specific mortality by race/ethnicity

			Adjusted for age and registry		Multivariate adjusted	
	Alive	**Dead**	**HR**	**95% CI**	**HR**	**95% CI**
Non-Hispanic white	165,271	10,823	1.0	ref	1.0	ref
Black	17,678	2,808	2.4	2.3-2.5*	1.5	1.4-1.6*
Hispanic white	14,647	1,188	1.4	1.3-1.5*	1.1	1.0-1.2*
Asian	1,407	744	1.0	0.9-1.1	0.9	0.8-1.0
Pacific Islander	1,125	99	1.8	1.5-2.3*	1.5	1.2-1.9-
American Indian/Alaska Native	925	79	1.6	1.3-2.1*	1.1	0.8-1.4
Hispanic Subgroups						
Mexican	4,259	383	1.7	1.5-1.8*	1.1	0.9-1.2
South or Central American	2,052	135	1.1	1.0-1.4	1.0	0.8-1.2
Puerto Rican	570	83	2.2	1.8-2.8*	1.7	1.3-2.1*
Cuban	328	40	1.8	1.3-2.5*	1.4	0.9-2.1
Other Hispanics	7,770	578	1.3	1.2-1.4*	1.1	0.9-1.2
Asian Subgroups						
Filipino	4,063	281	1.2	1.1-1.4*	1.1	0.9-1.2
Chinese	2,761	132	0.9	0.7-1.0	1.0	0.8-1.2
Japanese	2,553	105	0.7	0.6-0.9*	0.8	0.6-1.0*
Asian Indian/Pakastani	1,002	54	1.0	0.8-1.3	0.7	0.5-1.0*
Korean	958	53	1.1	0.9-1.5	1.0	0.8-1.4
Vietnamese	827	45	1.1	0.8-1.4	1.0	0.7-1.4
Other Asians	2,100	74	0.7	0.6-0.9*	0.6	0.5-0.8*
Pacific Islander Subgroups						
Hawaiian	817	68	1.6	1.2-2.0*	1.5	1.1-2.0*
Samoan	101	19	3.7	2.4-5.9*	1.8	1.1-3.0*

			Adjusted for age and registry		Multivariate adjusted	
	Alive	**Dead**	**HR**	**95% CI**	**HR**	**95% CI**
Other Pacific Islanders	228	16	1.5	0.9-2.4	1.2	0.7-2.0

*p<0.05.

Note: Non-Hispanic white women served as the reference race/ethnicity and all odds ratios (OR) are adjusted for age at diagnosis, year of diagnosis, SEER registry, AJCC stage, ER/PR status, surgical and radiation treatments, and county level measures of poverty and education.

Table 6

Summary of Breast Cancer Disparities by Race/Ethnicity

Race/ethnicity	Stage IV	ER−/PR−	Inappropriate treatment	Multivariate adjusted risk of breast cancer specific mortality
Non-Hispanic white	ref	ref	ref	ref
Black	↑↑	↑↑	↑	↑
Hispanic	↑	↑	↑	↑
Asian	–	↑	–	–
Pacific Islander	↑↑	–	–	↑
American Indian/Alaska Native	↑↑	↑	–	–
Hispanic Subgroups				
Mexican	↑	↑	↑	–
South or Central American	–	↑	↑	–
Puerto Rican	↑	↑	–	↑
Cuban	–	–	–	–
Asian Subgroups				
Filipino	↑	↑	–	–
Chinese	↓	↑	–	–
Japanese	↓	↓	–	↓
Asian Indian/Pakistani	↑	↑	–	↓
Korean	–	↑	–	–
Vietnamese	–	↑	–	–
Pacific Islander Subgroups				
Hawaiian	↑	–	–	↑
Samoan	↑↑	–	↑↑	↑

↑ denotes a statistically significant increase ≤2.0 in magnitude

↑↑ denotes a statistically significant increase >2.0 in magnitude

↓ denotes a statistically significant decrease

– denotes not statistically different from non-Hispanic whites