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Author manuscript

Cancer Causes Control. Author manuscript; available in PMC 2016 May 01.

Published in final edited form as:

Cancer Causes Control. 2015 May ; 26(5): 751–758. doi:10.1007/s10552-015-0548-x.

A comparative analysis of breast cancer stage between women enrolled in the National Breast and Cervical Cancer Early Detection Program and women not participating in the program

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Abstract

Purpose—To determine the proportional distribution of early- and late-stage breast cancers diagnosed in years 2004–2009 among women enrolled in the National Breast and Cervical Cancer Early Detection Program (NBCCEDP) and to compare this distribution to that of geographically comparable non-enrolled women diagnosed with breast cancer.

Methods—Using data from the National Program of Cancer Registries, we compared the demographic characteristics and cancer stage distribution of women enrollees and non-enrollees by use of conditional logistic regression using the odds ratio as a measure of association.

Results—NBCCEDP enrollees were slightly younger and more likely to identify as African-American, API and AIAN than were non-enrollees. The proportion of late-stage breast cancer (regional and distant) decreased slightly over the study period. NBCCEDP enrollees generally were diagnosed at a later stage of breast cancer than were those not enrolled in the NBCCEDP.

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Conclusions—The NBCCEDP has been effective in achieving its goal of enrolling racial and ethnic populations; however, enrollees had a poorer stage distribution of breast cancer than did non-enrollees underscoring the need to expand breast cancer control efforts among low-income, underserved populations.

Keywords

Breast cancer; Cancer screening; Cancer stage; Tumor stage; National Breast and Cervical Cancer Early Detection Program (NPCCEDP); Social economic status (SES)

Introduction

Each year more than forty thousand women die of breast cancer and 200,000 are newly diagnosed with the disease. Thus, breast cancer remains among the most common cancers diagnosed among women in the USA [1]. The American Cancer Society estimates that one in eight women in the USA will be diagnosed with the disease sometime in their lifetime [2]. The long-term survival of women with breast cancer is dependent on the stage at diagnosis and timely treatment after diagnosis. However, disparities in the stage at diagnosis and receipt of treatment among subpopulations have been reported in many studies [3–5]. The causes of these disparities are complex and are more likely attributable to a combination of many factors [3–8]. Among them, one of the most cited factors is socioeconomic status (SES) that includes both individual-and area-based SES [6–8]. From these studies, a higher prevalence of late stage of breast cancer among women of low SES has been observed.

In 1991, the Centers for Disease Control and Prevention (CDC) created the National Breast and Cervical Cancer Early Detection Program (NBCCEDP) for the purpose of increasing screening and hence reducing morbidity associated with a diagnosis of breast cancer among low-income women [9]. Currently implemented in all 50 states, the District of Columbia, 11 tribes/tribal organizations, and five territories, the NBCCEDP provides low-income women access to breast and cervical cancer screening and diagnostic and treatment services [9]. Women are eligible for the NBCCEDP if they are at or below 250 % of the federal poverty level, uninsured or underinsured (e.g., have coinsurance costs that are prohibitive), aged 40–64 years for breast cancer screening, and aged 21–64 years for cervical cancer screening. As of October 2013, the NBCCEDP has served more than 4.5 million women, provided more than 11 million breast and cervical cancer screening examinations, and has diagnosed more than 62,000 breast and over 3,400 cervical cancers [9].

Since the survival benefit of a cancer screening program is related to its ability to detect tumors at an earlier stage [10], we examined the proportion of early- and late-stage breast tumors diagnosed among NBCCEDP enrollees for diagnosis years 2004–2009 and compared these results to non-enrolled women diagnosed with breast cancer who resided in the same US census tract at the time of diagnosis. Results from this comparison may assist decision makers in determining the needs of NBCCEDP state-funded programs nationwide. To our knowledge, this is the first population-based study of a national sample comparing NBCCEDP enrollees diagnosed with breast cancer with women diagnosed with breast cancer who were not enrolled in the NBCCEDP.

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Materials and methods

Data source

NPCR is a population-based surveillance system that collects all newly diagnosed cancer cases annually through 48 Central Cancer Registries (CCR) in 45 states, the District of Columbia, Puerto Rico, and the U.S. Pacific Island Jurisdictions. The system covers 96 % of the total US population. To leverage surveillance resources and improve data quality, all NPCR programs are required to perform annual data linkages with the NBCCEDP in their states to enhance data quality and supplement information in each program's database. Patient enrollment status in the NBCCEDP and date of linkage are captured in the NPCR database. For this study, we used NPCR breast cancer data from the 2011 annual submission and included only those registries that met high data quality and completeness criteria used for publication in the USA—United States Cancer Statistics (USCS) [11].

We included women aged 40–64 years with breast as the primary site diagnosed in 2004–2009. We excluded data from states if: (1) the state-specific linkage rate changed ±10 % between sequential diagnostic years, (2) its NBCCEDP caseload accounted for <0.5 % of its breast cancer cases, or (3) for any of the diagnosis years, they had missing census tract for more than 10 % of their breast cancer cases. Cases identified solely on the basis of the death certificate were also excluded from the analysis. Case information was limited to data associated with the initial primary diagnosis. Patient's demographic information, stage at diagnosis, year at diagnosis, and census tract of residence were collected for all cases [12]. Because of complexities in cancer staging collection systems, we based our stage analysis on the derived surveillance epidemiology and end results (SEER) Summary Stage 2000 [13]. We also examined in situ and local stages together as early stage, while regional and distant stages were classified as late stage. The NBCCEDP enrollment status variable was used to identify NBCCEDP enrollees.

Women enrolled in NBCCEDP are by definition a very SES disadvantaged group, and detailed patient-level SES information was not readily available. Thus, we decided to match women enrolled in the NBCCEDP to non-NBCCEDP women in the same census tract of residence. We defined census tract strata as a census tract that included at least one breast cancer case diagnosed in the NBCCEDP. For these census tracts, we identified women who were diagnosed with breast cancer but not linked with the NBCCEDP as our comparison subjects. This method of selection excluded 214,306 women with breast cancer who resided in census tracts that did not have any NBCCEDP enrollees. We also excluded 336 NBCCEDP enrollees who resided in census tracts for which no comparison cases were available. The final analytic dataset contained 22,858 NBCCEDP enrolled women matched with 149,675 non-NBCCEDP women in 13,483 census tracts across 23 states.

For this study, race was classified as White, Black/African-American, American Indian and Alaska Native (AIAN), and Asian-Pacific Islander (API). Ethnicity was defined as Hispanic and non-Hispanic by the NAACCR Hispanic Identification Algorithm [14]. The category Hispanics contains Whites, Blacks, AIAN, and API, but about 80 % of Hispanics are classified as Whites. We classified study regions using census region definitions as follows:

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Northeast (NH, NJ, PA, and RI); Midwest (MO, OH, WI); South (AL, AR, DC, FL, GA, KY, LA, NC, OK, and SC); and West (AZ, CA, CO, ID, WA, and WY).

Statistical procedures

We compared women enrolled in the NBCCEDP with non-enrolled women using conditional logistic regression. We modeled stage as the outcome variable with NBCCEDP enrollment as a predictor variable. We used the odds ratio (OR) as the measure of association. We defined the referent category as either local or early-stage breast cancer. We evaluated the effect of age, race, and ethnicity on NBCCEDP participation one at a time in univariate logistic models as well as included all factors in a multivariable conditional logistic regression model to determine the independent contribution of each on NBCCEDP enrollment.

We also evaluated putative determinants of stage (age, race, ethnicity, year of diagnosis, and region) among the NBCCEDP non-enrollees to identify variables with a significant impact on stage at diagnosis. We restricted the analysis to non-enrollees because we wished to evaluate the impact of these determinants in the general population in the absence of the NBCCEDP effect. Since the NBCCEDP covers only about 1 % of the population, we believe that the non-enrollees more adequately represent the general population than do all study subjects. We fit logistic models conditional on census tracts with an indicator variable for late-stage (distant and regional) breast cancer versus early-stage (in situ and local) breast cancer as the outcome variable and included terms for age, race, ethnicity, and year of diagnosis. For the analysis pertaining to region of residence at diagnosis, we dropped the conditioning on census tracts and used unconditional logistic regression. We could not condition on census tracts to estimate the effect of region on stage since matching on census tract effectively matches on region.

All analyses were implemented using SAS V9.13 or Stata version 12.

Results

The distribution of breast cancer cases by NBCCEDP enrollment status according to various demographic factors is displayed in Table 1. NBCCEDP enrollees are younger than are non-enrollees (median age and interquartile range of 52 (48, 59) and 53 (48, 59), respectively. Compared with Whites in our study population, the odds ratio (OR) of being an enrollee for Blacks is 1.7, for AIAN the OR is 1.9, and for API the corresponding OR is 2.2. The odds of being enrolled in the NBCCEDP are about fourfold higher among Hispanics compared with non-Hispanics. Compared with the Northeast, the OR for residence in the Midwest (OR 1.4) and the West (OR 1.4) is increased. However, these ORs are impacted strongly by our restrictions in enrollment according to state and our matching on census tracts. The odds of inclusion in our study as a NBCCEDP enrollee increased over the study period from 2004 to 2009. The distribution of all of the factors in Table 1 is statistically significantly different for the two NBCCEDP comparative groups ($p < 0.0001$).

The potential determinants of breast cancer staging are displayed in Table 2. This analysis excludes women with missing or unknown races and, as mentioned in the method section, is

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restricted to non-enrollees in the NBCCEDP. The odds of late-stage breast cancer increased monotonically as age at diagnosis decreased. The odds of late-stage breast cancer among women aged 40–49 were 22 % higher ($p < 0.001$) than the odds of late-stage breast cancer among women aged 60–64. The odds of late-stage breast cancer were 29 % higher ($p < 0.001$) among Blacks compared with Whites and 11 % lower ($p < 0.001$) among API compared with Whites. The odds of late-stage breast cancer did not differ significantly for AIAN and Whites. Hispanics had later stage breast cancer than did non-Hispanics (OR 1.12; $p < 0.001$). The prevalence of late-stage breast cancer compared with early-stage breast cancer decreased between 2004 and 2009. The odds of late-stage breast cancer were 8 % less in 2009 than it was in 2004 ($p < 0.001$). The decreasing prevalence of late-stage breast cancer over time was seen in Whites and API, but not for Blacks (data not shown). Compared with Northeast, the odds of late-stage breast cancer are 6 % higher in the Midwest ($p = 0.01$) and 9 % higher in the South ($p < 0.001$). The odds of late-stage breast cancer were not statistically significantly different in Northeast and the West (Table 2).

The comparisons of breast cancer stage between NBCCEDP enrollees and non-enrollees according to racial and ethnic categories are displayed in Table 3. For all races combined, the odds of in situ breast cancer compared with local-stage breast cancer are significantly lower ($p < 0.001$) among NBCCEDP enrollees compared with non-enrollees. The odds of regional-stage and distant-stage breast cancer compared with local-stage breast cancer are significantly higher among enrollees compared with non-enrollees ($p < 0.001$ for both regional and distant). This pattern is similar for Whites and API. The differences between regional and local breast cancer among Blacks are less pronounced (OR 1.20) than among Whites (OR 1.32; p value for effect modification = 0.014). Among Blacks, there is a nonsignificant lower odds of distant breast cancer compared with local breast cancer. The findings for Hispanics are comparable to the overall findings for all racial–ethnic groups combined in that there is a lower odds of in situ compared with local stage. However, for Hispanics, there are only slightly higher odds of regional versus local stage, and there are significantly lower odds of distant-stage breast cancer compared with local-stage disease.

We repeated these analyses using the late-stage versus early-stage classification of breast cancer. For all races combined, the odds ratio for late-stage versus early-stage breast cancer for NBCCEDP enrollees compared with non-enrollees was 1.39 (1.35, 1.44). The corresponding OR (and 95 % CIs) for Whites was 1.43 (1.38, 1.48); for Blacks 1.26 (1.15, 1.37); for AIAN 1.69 (0.81, 3.53); and for API 1.38 (1.19, 1.59). The small difference between the ORs for Whites and Blacks was statistically significant ($p < 0.001$), whereas the differences in ORs for Whites and AIAN and for Whites and API were not significant ($p > 0.20$). For Hispanics, the odds ratio for late-stage versus early-stage breast cancer was 1.08 (0.99, 1.17) (data not shown).

Discussion

Among women diagnosed with breast cancer, we found that women enrolled in the NBCCEDP were slightly younger and more likely to identify as Black or African-American, API, or AIAN than the non-enrolled women. We also found that NBCCEDP enrollees were more likely to be diagnosed with later stage breast cancer than non-enrolled women. This

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result was consistent across most racial and ethnic groups except for non-enrolled women identified as African-American and Hispanic, who were more often diagnosed at distant stage. We believe these observations are generally reflective of NBCCEDP efforts in recruiting and serving the rarely or never screened, underserved racial and ethnic populations and women with symptoms or clinically worrisome findings. Studies have shown that these women generally present with later stage disease [3–5].

Among non-NBCCEDP breast cancer cases, we found that women's age at diagnosis, race, ethnicity, and year of diagnosis were all independent determinants of stage at diagnosis after controlling for census tract of residence. Region was also related to breast cancer stage in that the South had the least favorable stage distribution. However, this finding must be interpreted with caution since we excluded many states from the study population because of missing census tract information.

Despite recent increases in the incidence of early-stage breast cancer across racial and ethnic groups [15], our findings, in accord with previously published studies [16–21], indicate a higher burden of late-stage breast cancer among African-American and Hispanic women as compared to their White and non-Hispanic counterparts. Interestingly, we found that women identified as API are having the highest proportion of early-stage cancer among our study population. Future studies should examine correlates between early-stage breast cancer among these women and determine whether factors associated with these diagnoses may be modified to address the diagnosis of breast cancer among other racial and ethnic groups. Nonetheless, undetermined here is whether this increased incidence is an artifact of screening practices, improved health-seeking behaviors, or rather a true change in incidence among these groups of women. Regardless, the observation that mammogram utilization for women aged ≥40 years was highest among African-Americans in the past 10 years [22] is paradoxical since the favorable shift is not observed in this analysis. Some studies have suggested that tumor characteristics may also contribute to racial disparities in breast cancer stage [17, 23, 24] and may be a partial explanation as to why African-Americans have a less favorable stage than do Whites and API. Indeed, among all White and African-Americans non-NBCCEDP enrollees in our data, the higher odds of regional and distant breast cancer compared with local breast cancer for African-Americans compared with Whites is reduced by about 25 % after adjustment for tumor grade (data not shown). Nevertheless, the adjusted odds of regional and distant breast cancer for African-Americans remain (28 and 77 % for regional and distant breast cancer, respectively). Additionally, we observed an inverse association between the stage at diagnosis and women's age at diagnosis. This inverse association was apparent among the non-NBCCEDP enrollees in our study population. Less favorable stage among younger women may indicate more aggressive breast cancer among them or could be explainable by higher screening rates among older women.

To our knowledge, this investigation is the first population-based study of a national sample to compare breast cancer staging among women in the NBCCEDP to non-enrolled NBCCEDP women. There are several possible explanations for the findings we have presented. For instance, in the USA, about 9 % of women are eligible for breast cancer screening through the NBCCEDP and only about 12 % of the eligible population is actually served. Consequently, a large population of women may be unscreened or may experience a

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delay in enrollment into the NBCCEDP at which point they already are at a more advanced stage. For many disadvantaged women, those with symptoms of breast cancer may be referred to the NBCCEDP for further work-up and possible treatment, particularly younger women as NBCCEDP prioritizes routine screening for women of age 50 and older. If women with symptoms or abnormal screening results are preferentially referred to the NBCCEDP, they may present with more advanced disease than do women whose mammograms are true screening exams. In reducing the incidence of late-stage cancers in the NBCCEDP, there is a need for a broader, potentially more universal approach to more population-based strategies [25] that reach and educate women on the benefits of routine screening prior to symptom onset.

This study has several limitations. The selected areas in our study depended on the availability of census tract information from the states, and it may be true that the selected areas do not adequately reflect the distribution of stage among all breast cancer cases in the NBCCEDP. However, it is unclear how the selection would bias the findings in the direction of late-stage disease among NBCCEDP enrollees. We excluded many non-NBCCEDP women from our study since we matched our study subjects at the census tract level as an attempt to control for SES. Although it may limit generalizability, this exclusion was necessary to control indirectly for SES. The fact that the non-enrollees included in our study population generally were comparable on demographic factors to those excluded (data not shown) indicates little bias from this selection. Although residents of census tracts are believed to be relatively homogeneous with respect to economic status and living conditions, it may be true that the NBCCEDP enrollees within census tracts are of lower SES than are the non-enrollees, and this difference would explain some of the less favorable stage among enrollees compared with non-enrollees.

Our findings suggest that there remains a large unmet need for earlier diagnosis of breast cancer in the USA, particularly among the low-income and under- or uninsured women. The NBCCEDP remains an extremely critical program that helps care for millions of women with breast cancer, who otherwise do not have access to care. However, maintained attention is warranted as late-stage cancers continue to have a disproportionate impact on specific demographic groups in the USA. In addition, as more women gain access to cancer screening services through healthcare reform, the NBCCEDP may have the opportunity to follow a more population-based approach to extend its reach to areas where gaps persist.

References

1. Group Uw. United States Cancer Statistics: 1999–2010 Incidence and Mortality Web-based Report. U.S. Department of Health and Human Services, Centers for Disease Control and Prevention and National Cancer Institute; 2013. http://apps.nccd.cdc.gov/uscs/
2. DeSantis C, Ma J, Bryan L, Jemal A. Breast Cancer Statistics, 2013. CA Cancer J Clin. 2013; 64:52–62. [PubMed: 24114568]
3. Soerjomataram I, Louwman MW, Ribot JG, Roukema JA, Coebergh JW. An overview of prognostic factors for long-term survivors of breast cancer. Breast Cancer Res Treat. 2008; 107(3):309–330. [PubMed: 17377838]
4. Rosenberg J, Chia YL, Plevritis S. The effect of age, race, tumor size, tumor grade, and disease stage on invasive ductal breast cancer survival in the U.S. SEER database. Breast Cancer Res Treat. 2005; 89(1):47–54. [PubMed: 15666196]

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5. Li CI, Moe RE, Daling JR. Risk of mortality by histologic type of breast cancer among women aged 50 to 79 years. Arch Intern Med. 2003; 163(18):2149–2153. [PubMed: 14557212]
6. Sprague BL, Trentham-Dietz A, Gangnon RE, et al. Socioeconomic status and survival after an invasive breast cancer diagnosis. Cancer. 2011; 117:1542–1551. [PubMed: 21425155]
7. Halpern MT, Bian J, Ward EM, Schrag NM, Chen AY. Insurance status and stage of cancer at diagnosis among women with breast cancer. Cancer. 2007; 110:403–411. [PubMed: 17562557]
8. Harper S, Lynch J, Meersman SC, Breen N, Davis WW, Reichman MC. Trends in area-socioeconomic and race-ethnic disparities in breast cancer incidence, stage at diagnosis, screening, mortality, and survival among women ages 50 years and over (1987–2005). Cancer Epidemiol Biomark Prev. 2009; 18:121–131.
9. CDC. National Breast and Cervical Cancer Early Detection Program (NBCCEDP). 2013. About the program. http://www.cdc.gov/cancer/nbccedp/about.htm
10. Chatterjee NA, He Yulei, Keating NL. Racial differences in breast cancer stage at diagnosis in mammography era. Am J Public Health. 2013; 103:170–176. [PubMed: 22698058]
11. Group USCSW. USCS Publication Criteria. 2014. http://www.cdc.gov/cancer/npcr/uscs/technical_notes/criteria.htm
12. Registries TNAAoCC. Data standards and data dictionary. 2013. http://www.naaccr.org/StandardsandRegistryOperations/VolumeII.aspx
13. Institute NC. SEER Summary Staging Manual—2000. 2001. http://seer.cancer.gov/tools/ssm/
14. NAACCR. Guideline for enhancing Hispanic-Latino identification: Revised NAACCR Hispanic/Latino identification algorithm [NHIA v2.2]. 2009. http://www.naaccr.org/LinkClick.aspx?fileticket=i6MN9F8c1eU%3D&tabid=92
15. Hou N, Huo D. A trend analysis of breast cancer incidence rates in the United States from 2000 to 2009 shows a recent increase. Breast Cancer Res Treat. 2013; 138(2):633–641. [PubMed: 23446808]
16. Islami F, Kahn AR, Bickell NA, Schymura MJ, Boffetta P. Disentangling the effects of race/ethnicity and socioeconomic status of neighborhood in cancer stage distribution in New York City. Cancer causes control CCC. 2013; 24:1069–1078. [PubMed: 23504151]
17. Lannin DR, Mathews HF, Mitchell J, Swanson MS, Swanson FH, Edwards MS. Influence of socioeconomic and cultural factors on racial differences in late-stage presentation of breast cancer. JAMA. 1998; 279:1801–1807. [PubMed: 9628711]
18. MacKinnon JA, Duncan RC, Huang Y, et al. Detecting an association between socioeconomic status and late stage breast cancer using spatial analysis and area-based measures. Cancer Epidemiol Biomarkers Prev. 2007; 16:756–762. [PubMed: 17416767]
19. Merkin SS, Stevenson L, Powe N. Geographic socioeconomic status, race, and advanced-stage breast cancer in New York City. Am J Public Health. 2002; 92:64–70. [PubMed: 11772763]
20. Richardson JL, Langholz B, Bernstein L, Burciaga C, Danley K, Ross RK. Stage and delay in breast cancer diagnosis by race, socioeconomic status, age and year. Br J Cancer. 1992; 65:922–926. [PubMed: 1616865]
21. Smith-Bindman R, Miglioretti DL, Lurie N, et al. Does utilization of screening mammography explain racial and ethnic differences in breast cancer? Ann Intern Med. 2006; 144:541–553. [PubMed: 16618951]
22. (CDC). CfDCaP. Behavioral Risk Factor Surveillance System Prevalence and Trends Data. U.S. Department of Health and Human Services, Centers for Disease Control and Prevention; 2013. http://apps.nccd.cdc.gov/brfss/
23. Cross CK, Harris J, Recht A. Race, socioeconomic status, and breast carcinoma in the U.S: what have we learned from clinical studies. Cancer. 2002; 95:1988–1999. [PubMed: 12404294]
24. Jones CE, Maben J, Jack RH, et al. A systematic review of barriers to early presentation and diagnosis with breast cancer among black women. BMJ Open. 2014; 4(2):e004076.
25. Plescia M, Richardson LC, Joseph D. New roles for public health in cancer screening. CA Cancer J Clin. 2012; 62(4):217–219. [PubMed: 22573193]

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Table 1

Characteristics of study population by NBCCEDP enrollment status and odds ratios among women diagnosed with breast cancer, 2004–2009

Enrollment status	NBCCEDP enrollee		Non-NBCCEDP enrollee		Enrollee versus non-enrollee	
	Count	(%)	Count	(%)	OR	95 % CI
Total	22,858	(100)	149,675	(100)		
Age*						
40–49	8,204	(35.9)	49,367	(33.0)	1.15	1.10, 1.20
50–55	6,373	(27.9)	39,333	(26.3)	1.17	1.12, 1.22
56–59	3,909	(17.1)	27,923	(18.7)	1.04	0.99, 1.09
60–64	4,372	(19.1)	33,052	(22.1)	1.0[b]	–
Race*,[a]						
White	16,997	(74.6)	119,895	(80.7)	1.0[b]	–
Black	3,549	(15.6)	19,408	(13.1)	1.66	1.57, 1.76
AIAN	205	(0.9)	773	(0.5)	1.86	1.55, 2.23
API	1,932	(8.5)	7,960	(5.4)	2.21	2.06, 2.36
Other	93	(0.4)	457	(0.3)	1.11	0.87, 1.43
Ethnicity*						
Non-Hispanic	16,940	(74.1)	137,114	(91.6)	1.0[b]	–
Hispanic	5,918	(25.9)	12,561	(8.4)	3.82	3.63, 4.01
Region*						
Northeast	1,849	(8.1)	16,441	(11.0)	1.0[c]	–
Midwest	2,675	(11.7)	19,373	(12.9)	1.44	1.35, 1.54
South	6,085	(26.6)	50,323	(33.6)	1.10	1.04, 1.16
West	12,249	(53.6)	63,538	(42.5)	1.37	1.30, 1.45
Year of diagnosis*						
2004	3,304	(14.4)	23,591	(15.8)	1.0[b]	–
2005	3,347	(14.6)	23,914	(16.0)	0.99	0.94, 1.05
2006	3,734	(16.3)	24,444	(16.3)	1.11	1.05, 1.17
2007	3,977	(17.4)	25,398	(17.0)	1.13	1.07, 1.19

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Enrollment status	NBCCEDP enrollee		Non-NBCCEDP enrollee		Enrollee versus non-enrollee	
	Count	(%)	Count	(%)	OR	95 % CI
2008	4,149	(18.2)	26,053	(17.4)	1.15	1.09, 1.21
2009	4,347	(19.0)	26,275	(17.6)	1.19	1.12, 1.25

AIAN American Indian and Alaska Native, *API* Asian-Pacific Islander

[*] The distribution of each factor displayed is statistically significantly ($p < 0.0001$) different for NBCCEDP enrollees and non-enrollees

[a] Records with missing/unknown race were excluded ($n = 82$)

[b] From a conditional logistic model including terms for age, race, Hispanic ethnicity, and year of diagnosis

[c] From an unconditional logistic model including terms for age, race, Hispanic ethnicity, and year of diagnosis

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Table 2

Breast cancer stage distribution among non-NBCCEDP enrollees by demographic factors with odds ratios and 95 % confidence limits

Summary stage 2000	**Age at diagnosis**							
	40–49		**50–55**		**56–59**		**60–64**	
	n	**(%)**	***n***	**(%)**	***n***	**(%)**	***n***	**(%)**
In situ	10,625	(22.0)	8,402	(21.9)	5,520	(20.2)	6,116	(19.0)
Local	21,089	(43.8)	17,593	(45.8)	13,196	(48.4)	16,532	(51.2)
Regional	14,746	(30.6)	10,815	(28.1)	7,271	(26.7)	8,148	(25.3)
Distant	1,728	(3.6)	1,622	(4.2)	1,294	(4.7)	1,465	(4.5)
Total	48,188	(100)	38,432	(100)	27,281	(100)	32,261	(100)
% Late stage		34.2		32.4		31.4		29.8
Adjusted OR (95 % CI)[a]	**1.22**	(1.18, 1.26)	**1.13**	(1.09, 1.16)	**1.08**	(1.04, 1.12)	1.00	
Summary stage 2000	Race							
	White		Black		AIAN		API	
	n	(%)	*n*	(%)	*n*	(%)	*n*	(%)
In situ	24,727	(20.9)	3,888	(20.3)	126	(16.8)	1,922	(24.3)
Local	56,550	(47.8)	7,802	(40.8)	347	(46.4)	3,711	(47.0)
Regional	32,562	(27.5)	6,161	(32.2)	240	(32.1)	2,017	(25.5)
Distant	4,559	(3.9)	1,269	(6.6)	35	(4.7)	246	(3.1)
Total	118,398	(100)	19,120	(100)	748	(100)	7,896	(100)
% Late stage		31.4		38.9		36.8		31.4
Adjusted OR (95 % CI)[a]	1.00		**1.29**	(1.23, 1.35)	**1.09**	(0.92, 1.29)	**0.89**	(0.84, 0.94)
Summary stage 2000	Ethnicity							
	Hispanic				Non-Hispanic			
	n		(%)		*n*		(%)	
In situ	2,460		(20.3)		28,203		(21.0)	

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Summary stage 2000	**Age at diagnosis**							
	40–49		**50–55**		**56–59**		**60–64**	
	n	**(%)**	***n***	**(%)**	***n***	**(%)**	***n***	**(%)**
Local	5,299			(43.6)		63,111		(47.1)
Regional	3,859			(31.8)		37,121		(27.7)
Distant	523			(4.3)		5,586		(4.2)
Total	48,188			(100)		134,021		(100)
% Late stage				36.1				31.9
Adjusted OR (95 % CI)[a]	**1.12**			(1.07, 1.18)		**1.00**		

Summary stage 2000	Year of diagnosis											
	2004		2005		2006		2007		2008		2009	
	n	(%)	*n*	(%)	*n*	(%)	*n*	(%)	*n*	(%)	*n*	(%)
In situ	4,720	(20.6)	4,727	(20.3)	4,823	(20.2)	5,238	(21.1)	5,474	(21.5)	5,681	(22.1)
Local	10,634	(46.4)	10,895	(46.7)	11,182	(46.9)	11,686	(47.1)	11,988	(47.0)	12,025	(46.7)
Regional	6,626	(28.9)	6,778	(29.0)	6,860	(28.8)	6,857	(27.6)	6,943	(27.2)	6,916	(26.9)
Distant	961	(4.2)	942	(4.0)	961	(4.0)	1,032	(4.2)	1,081	(4.2)	1,132	(4.4)
Total	22,941	(100)	23,342	(100)	23,826	(100)	24,813	(100)	25,486	(100)	25,754	(100)
% Late stage		33.1		33.1		32.8		31.8		31.5		31.2
Adjusted OR (95 % CI)[a]	1.00		1.00	(0.96, 1.04)	0.98	(0.94, 1.02)	**0.94**	(0.91, 0.98)	**0.93**	(0.89, 0.97)	**0.92**	((0.88, 0.96)

Summary stage 2000	Region							
	Northeast		Midwest		South		West	
	n	(%)	*n*	(%)	*n*	(%)	*n*	(%)
In situ	3,791	(23.5)	3,960	(21.1)	9,838	(20.0)	13,074	(21.0)
Local	7,288	(45.3)	8,832	(47.0)	22,822	(46.4)	29,468	(47.4)
Regional	4,256	(26.4)	5,231	(27.8)	14,254	(29.0)	17,239	(27.8)
Distant	767	(4.8)	783	(4.2)	2,228	(4.5)	2,331	(3.8)
Total	16,102	(100)	18,806	(100)	49,142	(100)	62,112	(100)

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Summary stage 2000	Age at diagnosis							
	40–49		50–55		56–59		60–64	
	n	(%)	*n*	(%)	*n*	(%)	*n*	(%)
% Late stage		31.2		32.0		33.5		31.5
Adjusted OR (95 % CI)[b]	1		1.06	(1.01, 1.11)	1.09	(1.05, 1.14)	1.03	(0.99, 1.07)

AIAN American Indian and Alaska Native, *API* Asian-Pacific Islander

[a] From a conditional logistic model including terms for age, race, Hispanic ethnicity, and year of diagnosis

[b] From an unconditional logistic model including terms for age, race, Hispanic ethnicity, year of diagnosis, and region

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Table 3

Breast cancer stage distribution and odds ratios* with 95 % confidence intervals by NBCCEDP enrollment status, race and ethnicity**

Summary stage 2000	All races[a]					
	NBCCEDP enrollee		Non-NBCCEDP enrollee		Adjusted odds ratio (OR)	95 % confidence interval (CI)
	n	%	*n*	%		
In situ	3,407	15.1	30,777	21.0	**0.76**	0.73, 0.79
Local	9,825	43.7	68,591	46.8	**Ref**	–
Regional	8,096	36.0	41,125	28.1	**1.30**	1.25, 1.34
Distant	1,165	5.2	6,119	4.2	**1.25**	1.16, 1.34
Summary stage 2000	Whites[b]					
	NBCCEDP enrollee		Non-NBCCEDP enrollee		Adjusted odds ratio (OR)	95 % confidence interval (CI)
	n	%	*n*	%		
In situ	2,506	14.9	24,727	20.9	**0.75**	0.72, 0.80
Local	7,391	44.0	56,550	47.8	**Ref**	–
Regional	6,031	35.9	32,562	27.5	**1.32**	1.26, 1.37
Distant	857	5.1	4,559	3.9	**1.37**	1.26, 1.49
Summary stage 2000	Blacks[b]					
	NBCCEDP enrollee		Non-NBCCEDP enrollee		Adjusted odds ratio (OR)	95 % confidence interval (CI)
	n	%	*n*	%		
In situ	512	14.5	3,888	20.3	**0.73**	0.64, 0.83
Local	1,440	40.9	7,802	40.8	Ref	–
Regional	1,351	38.4	6,161	32.2	**1.20**	1.09, 1.33
Distant	216	6.1	1,269	6.6	0.86	0.72, 1.04
Summary stage 2000	Hispanics[c]					
	NBCCEDP enrollee		Non-NBCCEDP enrollee		Adjusted odds ratio (OR)	95 % confidence interval (CI)

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Summary stage 2000	**All races**[a]					
	NBCCEDP enrollee		**Non-NBCCEDP enrollee**		**Adjusted odds ratio (OR)**	**95 % confidence interval (CI)**
	n	**%**	***n***	**%**		
	n	%	*n*	%		
In situ	1,053	18.1	2,491	20.3	0.86	0.77, 0.96
Local	2,486	42.6	5,362	43.7	Ref	–
Regional	2,086	35.8	3,904	31.8	1.07	0.98, 1.20
Distant	209	3.6	525	4.3	0.76	0.61, 0.94
Summary stage 2000	API[b]					
	NBCCEDP enrollee		Non-NBCCEDP enrollee		Adjusted odds ratio (OR)	95 % confidence interval (CI)
	n	%	*n*	%		
In situ	345	18.2	1,922	24.3	**0.74**	0.62, 0.89
Local	874	46.1	3,711	47	Ref	–
Regional	599	31.6	2,017	25.5	**1.25**	1.07, 1.47
Distant	79	4.2	246	3.1	1.28	0.88, 1.86

API Asian-Pacific Islander

* Bold number represents statistically significant

** Race AIAN (American Indian and Alaska Native) was excluded from the table due to small cell size

[a] From a conditional logistic model including terms for age, race, Hispanic ethnicity, and year of diagnosis

[b] From a conditional logistic model including terms for age, Hispanic ethnicity, and year of diagnosis

[c] From a conditional logistic model including terms for age, race, and year of diagnosis