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Treatment of Ductal Carcinoma In Situ Among Patients Cared for in Large Integrated Health Plans

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Abstract

Objective—To examine whether use of adjuvant therapy varies by race/ethnicity among patients with ductal carcinoma in situ (DCIS) at 3 integrated health plan delivery sites based in California and Massachusetts.

Study Design—Cross-sectional study nested within a cohort of women diagnosed as having DCIS between 1990 and 2001.

Methods—We reviewed medical records of 3000 non-Hispanic white (69%), black (10%), Hispanic (9%), and Asian or Pacific Islander (12%) women diagnosed as having DCIS between 1990 and 2001 and treated with breast-conserving therapy. χ^2 Test and multinomial logistic regression analysis were used to examine the association between race/ethnicity and use of adjuvant treatments after controlling for patient and clinical variables, including certain pathologic factors.

Results—We found no significant differences in DCIS adjuvant treatment among racial/ethnic groups in bivariate or multinomial analyses after adjusting for demographic characteristics, comorbidity, and clinical factors. Minority women were as likely to undergo adjuvant radiation therapy as non-Hispanic white women. However, women 70 years or older (odds ratio, 0.40; 95% confidence interval, 0.31–0.51) and women who lived in areas with low geocoded median family income (odds ratio, 0.65; 95% confidence interval, 0.48–0.89) were less likely to receive adjuvant radiation therapy. Tumor size and comedo histologic growth pattern were associated with increased likelihood of receiving radiation therapy.

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Conclusion—Use of adjuvant therapy by minority women in these managed care plans is similar to that by non-Hispanic white women, although use was less among older women and among women who lived in poorer neighborhoods.

The diagnosis of ductal carcinoma in situ (DCIS) has increased markedly because of enhanced screening mammography efforts and constitutes more than 20% of newly diagnosed breast cancer cases in the United States.[1] Despite improvements in detection, determining the most appropriate treatment strategy remains a challenge owing to the heterogeneity of DCIS lesions.[2–4] While racial/ethnic differences have been reported for the detection, diagnosis, evaluation, and treatment of invasive breast cancer, data are limited on whether there are similar disparities in the treatment of DCIS.[5–7] Recent studies[8–10] of women with invasive disease have found that racial/ethnic minority women undergo breast-conserving surgery (BCS) more frequently than white women; however, black women are at twice the risk of white women for failing to receive postsurgery chemotherapy and hormonal therapy. This racial/ethnic disparity in the receipt of adjuvant therapy for invasive disease has been reported in many settings.[5,8,10–17]

In contrast, less information on treatment disparity exists for DCIS than for invasive disease.[6,18] Because DCIS can progress to invasive disease, it is critical to determine whether modifiable and nonmodifiable factors are associated with receipt of therapy. While controversy exists regarding optimal treatment for DCIS, research indicates that women treated with BCS and subsequent radiation therapy have significantly reduced recurrence versus women treated with surgery alone.[6,19] The risk of recurrence can be further reduced by combining radiation therapy with adjuvant tamoxifen citrate treatment.[20,21] Breast-conserving surgery with adjuvant tamoxifen treatment alone is generally not a recommended option. In addition, neither cytotoxic chemotherapy nor any of the newer biologic agents are recommended for DCIS.

Previous studies[8,18,22–28] that have examined breast cancer treatment differences were based on claims data from fee-for-service settings; however, these sources offer a limited understanding of utilization. Tumor registries reliably capture information on surgery and race/ethnicity but less reliably capture adjuvant radiation therapy or hormonal treatment data.[8] Such databases generally also lack data on socioeconomic status, which may contribute to treatment differences.[8] Medical record review is resource intensive but enables more comprehensive insight into treatments used. The objective of this study was to use information abstracted from medical records to examine whether use of adjuvant therapy varied by race/ethnicity among a diverse cohort of 3000 women diagnosed as having DCIS between 1990 and 2001 and treated with BCS in 3 geographically diverse integrated healthcare delivery systems. A key advantage of this study is the additional information we captured on pathologic features and socioeconomic factors that vary by race/ethnicity and may influence treatment decisions.

METHODS

Design and Setting

This study was conducted at 3 sites participating in the Cancer Research Network, a consortium of research organizations affiliated with nonprofit integrated healthcare delivery systems and the National Cancer Institute. Study participants included women enrolled at Kaiser Permanente Northern California, Kaiser Permanente Southern California, and Harvard Pilgrim Health Care. The sites care for more than 6 million members in California and Massachusetts. We examined patient and healthcare factors associated with utilization of adjuvant cancer treatment (radiation therapy and hormonal therapy). This study was part

of a retrospective cohort study of women diagnosed as having DCIS between 1990 and 2001. The study was approved by the institutional review boards at all 3 study sites.

Study Participants

Women with DCIS were identified through the Kaiser Permanente health plans' electronic cancer registries in California. These health plans report cancer cases in specific geographic regions to the SEER (Surveillance, Epidemiology and End Results) program. At Harvard Pilgrim Health Care, claims and electronic outpatient medical records were used to identify women with DCIS.

The cohort included women from Kaiser Permanente Northern California, Kaiser Permanente Southern California, and Harvard Pilgrim Health Care who were aged 20 to 84 years at diagnosis of DCIS, were diagnosed between 1990 and 2001, had unilateral disease, were treated with BCS, had no history of DCIS or invasive cancer (breast or other site), and remained enrolled within the health plans for at least 6 months after diagnosis.

Of 3668 patients identified as potentially eligible by our cancer registries or electronic medical records, 602 were deemed ineligible for 1 or more of the following reasons based on medical record review: unavailability of medical records (n = 82), miscoding of DCIS in the cancer registry (n = 63), prior breast or other cancer (n = 216), bilateral breast cancer at diagnosis (n = 29), mastectomy for the index DCIS (n = 96), age 85 years or older at diagnosis (n = 15), or lack of follow-up in the health plan for 6 consecutive months (n = 101). Of 3066 remaining patients, 29 women had unknown treatment and 37 women had missing race/ethnicity, leaving 3000 patients for this study.

Data Sources

We used standardized medical record abstraction forms to capture information on treatment (surgery, radiation therapy, chemotherapy, and hormonal therapy), history of breast cancer among first-degree relatives, year of diagnosis, and height, weight, and age at index DCIS diagnosis. Family history of breast cancer was history of the disease in a first-degree blood relative (including mother, sisters, half sisters, or daughters) of the study patient. We recorded information on family history if it appeared in the medical record within 6 months of the study patient's DCIS diagnosis.

We also collected information on the presence of diabetes mellitus around the time of DCIS diagnosis as a surrogate measure of comorbidity because findings from studies[29,30] suggest that patients with diabetes are treated less aggressively for cancer. The analysis presented herein examines the initial course of treatment documented in the medical records in the 6 months after DCIS diagnosis. Because detection methods can vary by race/ethnicity and influence treatment decisions, we abstracted information as to whether the breast lesion was identified through palpation or screening mammography. Because prevalence of pathologic features may vary by race/ethnicity and may influence treatment decisions, we conducted a subset analysis involving 1 study site (n = 986). At this study site, we abstracted key features from the pathology reports such as surgical margins, tumor size, comedo histologic growth pattern, necrosis, and nuclear grade. Because the health plan tumor registries in California did not uniformly capture pathologic variables during the study period, we assessed these factors based on review of the original pathology report and specimens by a single study pathologist rather than through the SEER program. In this way, the pathologic variables were measured in a standard manner for all patients at this study site whether or not the patients lived in a geographic area covered by the SEER program during the study period (1990–2001).

Information on race/ethnicity was captured from the medical records or the electronic SEER-affiliated cancer registries (in California). The SEER data are based on medical records and administrative information. We grouped race/ethnicity as non-Hispanic white, black, Hispanic, or Asian or Pacific Islander. Because the health plans do not uniformly collect members' income or educational attainment, information on these factors was obtained from geocoding files based on California's 1990 census (which was closest to the DCIS diagnosis dates). In this approach, the women in the cohort were classified according to the socioeconomic characteristics of their census tract at the time of diagnosis.[31,32] Geocoded educational attainment and median family income were based on the distribution of the women in our sample (the cohort's census tract). Geocoded educational attainment was divided into 2 groups (high vs low). High geocoded educational attainment means that the percentage of women in the sample with at least some college education is greater than the percentage of women in the cohort with at most a high school diploma. Geocoded median family income was divided into quartiles. Analyses considering median family income and educational attainment were restricted to patients in California (93% of the study cohort). Similar information was not feasible to ascertain for patients in Massachusetts.

Statistical Analysis

We first conducted stratified analyses and examined the distribution of patient characteristics by race/ethnicity and DCIS treatment regimens. Two-sided *P* values were based on χ^2 test for heterogeneity. Unknown and missing values were excluded in the calculation of χ^2 values. The levels of treatment examined included BCS alone (reference group), BCS with adjuvant radiation therapy, BCS with adjuvant tamoxifen therapy, and BCS with both adjuvant treatments. Finally, adjusted odds ratios (ORs) were estimated using multinomial logistic regression analysis, which is an extension of the binary logistic regression technique in which the dependent variable (DCIS treatment regimens) has unordered multiple levels.[33] Variables examined in the models were race/ethnicity, age at diagnosis, year of diagnosis, study site, body mass index (BMI), family history of breast cancer, comorbidity (history of diabetes), geocoded educational attainment, and median family income. Cut points for BMI were based on categories of the National Heart, Lung, and Blood Institute.[34] For the subset of patients for whom we had pathologic data, the model for receipt of adjuvant radiation therapy also included tumor characteristics. All analyses were conducted using commercially available statistical software (SAS, version 9.1; SAS Institute Inc, Cary, NC[35]).

RESULTS

Participants included 292 black (10%), 263 Hispanic (9%), 370 Asian or Pacific Islander (12%), and 2075 (69%) non-Hispanic white women. We identified only 1 woman as being non-white Hispanic (this patient was included in the black category). Asian or Pacific Islanders tended to be younger at the time of DCIS diagnosis, and 38% of those women were diagnosed before age 50 years (Table 1). Within each racial/ethnic group, the percentage of women diagnosed as having DCIS increased over time, with the sharpest rise occurring after 1997 among Asian or Pacific Islanders. Within this group, the rate of diagnosis increased from 14% in 1996–1997 to 29% in 1998–1999. The percentage of women with a known family history (first-degree blood relative) of breast cancer was similar in black, Hispanic, and white women (19% in each group) and was lower in Asian or Pacific Islanders (11%).

For participants with known addresses, 77% lived in census tracts where the geocoded educational attainment included some college. Geocoded educational attainment varied by

race/ethnicity, with Asian or Pacific Islander women and white women representing the highest proportions of women who lived in census tracts with higher educational attainment (P <.001). Similarly, geocoded median family income varied by race/ethnicity, with higher percentages of black and Hispanic women living in census tracts with lower median family income (P <.001). Among participants with known weight, 58% of Asian or Pacific Islanders were of normal weight. A considerable percentage of white women were of normal weight (41%), although 57% were in the overweight and obese categories.

Detection method of DCIS was associated with race/ethnicity (P = .02) and varied by age, with more younger women having palpable lesions (P <.001). Although most lesions (83%) were detected by screening mammography, 17% were detected by palpation. Among Asian or Pacific Islanders, almost one-fourth of the lesions were detected by palpation, whereas among white women 16% were detected by palpation.

Table 2 gives adjusted ORs from the multinomial logistic regression models for the association of patient and tumor factors with DCIS treatment regimens. The reference group for each treatment regimen (the dependent variable) comprised women who underwent BCS alone. The reference group for race/ethnicity (the main independent variable) was white women. Of 3000 women, 43% (n = 1284) underwent BCS alone, whereas 57% (n = 1716) underwent adjuvant radiation therapy or tamoxifen treatment. As expected, none of the women in our cohort were treated with chemotherapy. Radiation therapy alone was the most common adjuvant regimen. About 4% (n = 129) of women underwent adjuvant tamoxifen treatment only, while 11% (n = 337) underwent a combination of adjuvant radiation therapy and tamoxifen treatment.

Race/ethnicity was not strongly associated with use of adjuvant treatments; variation differed little by these subgroups of women, as the confidence intervals (CIs) were wide and included the null. Treatment regimens also did not vary by family history of breast cancer, geocoded educational attainment, BMI, or history of diabetes. Year of diagnosis was the strongest correlate of adjuvant radiation therapy use. For example, compared with women who underwent BCS alone, the odds of adjuvant radiation therapy receipt increased over the years; adjusted ORs varied from 2.55 (95% CI, 1.75–3.71) in 1992–1993 to 4.08 (95% CI, 2.86–5.83) in 2000–2001. Women who lived in census tracts with a low geocoded median family income were significantly less likely to receive adjuvant radiation therapy (OR, 0.65; 95% CI, 0.48–0.89). Older women (>70 years) were 2.5 times more likely to receive adjuvant tamoxifen therapy (without radiation therapy) than younger women (<50 years) (OR, 2.52; 95% CI, 1.29–4.90). However, older women were dramatically less likely to receive adjuvant radiation therapy (OR, 0.40; 95% CI, 0.31–0.51). The ORs for all treatment regimens increased over the years, with the sharpest rise occurring for combined radiation therapy and tamoxifen treatment.

Of the subset of women with pathologic data (n = 986), patients with large tumors (OR, 2.45; 95% CI, 1.23–4.88) and comedo histologic growth pattern (OR, 1.89; 95% CI, 1.35–2.64) were more likely to receive adjuvant radiation therapy than BCS alone. We did not have a large enough sample size to examine the association of pathologic factors and other treatment combinations (ie, BCS with tamoxifen treatment or BCS with radiation therapy and tamoxifen treatment). During the study period (1990–2001), estrogen receptor testing was not routinely performed. Therefore, this information was not captured in relation to tamoxifen use.

DISCUSSION

Our findings suggest that receipt of adjuvant radiation therapy (with or without tamoxifen treatment) was not related to race/ethnicity in these managed care plans. However, we found that older women (>70 years) and women who lived in census tracts with low median family incomes were substantially less likely to receive adjuvant radiation therapy, despite potential equal access to care.

Our finding that minority women received adjuvant therapy as often as non-Hispanic white women in these managed care plans may be due to equal access to care. In their synthesis of research on racial/ethnic disparities in cancer treatment,[36–40] Shavers and Brown[5] similarly noted fewer differences among women receiving cancer treatment by race/ethnicity in single institutions and equal-access systems. In addition to race/ethnicity, other research indicates that treatment of invasive breast cancer differs by age at diagnosis,[9,25] tumor characteristics,[8,41] and radiation therapy initiation,[26] but few corresponding data exist for DCIS.[27,28] Patients with DCIS 70 years or older in our cohort were less likely to receive adjuvant radiation therapy. Enger and colleagues[42] similarly noted that treatment variations for invasive breast cancer may be related to age, with older women (>75 years) receiving nonstandard care compared with women aged 65 to 74 years among those treated at health maintenance organizations. A reanalysis of that study showed that almost 20% of older women (>65 years) at high risk of recurrence received chemotherapy; however, no variation was found by race/ethnicity.[43] Although the presence of comorbidities (diabetes or high BMI) differed by race/ethnicity in the present study, they were unrelated to DCIS treatment (Table 2).

This study has several strengths. Data for this investigation came from one of the largest medical record review–based studies of women diagnosed as having DCIS and included 3000 women. The study group also included a population for whom breast cancer screening is a covered benefit. Our study was able to overcome several limitations of previous studies. Out-of-pocket expense is an important known barrier to cancer treatment; however, our study group included a large insured population in which the effects of such barriers are minimized. Participants for this study were drawn from integrated health-care delivery organizations, and their care may reflect the general cancer treatment that patients receive in other delivery systems in the United States. However, our results may not be generalizable to other settings, especially those for which there is no equal access to healthcare. In addition, although our sites somewhat underrepresent the very poor and the very wealthy, the memberships include the entire socioeconomic spectrum, including some who are Medicaid recipients. The study sites, particularly those in California, have racially/ethnically diverse memberships that represent the communities they serve.

This study has certain limitations. We ascertained race/ethnicity information from medical records, which may be inaccurately documented. However, a study[44] that compared self-reported race/ethnicity with that documented in medical records demonstrated that the overall accuracy of medical records for race/ethnicity is high, although substantial inaccuracy may exist in the recording of Hispanic race/ethnicity. Underrecording of Hispanic race/ethnicity might have partially contributed to the lack of treatment disparity observed in this study. Furthermore, a limitation of geocoded median family income and educational attainment data is that they may not reflect the actual educational and household income of the individual. However, previous studies[27,45] demonstrated the usefulness of both of these geocoded variables. This study also did not examine the patient–provider interactions that influence use of adjuvant treatments. Findings from previous studies[14,46–48] demonstrate that patient-reported barriers to cancer treatment include anxiety, cultural differences, lack of physician recommendation, and transportation problems. Other than

diabetes, we could not adjust for notable comorbidities that affect breast cancer treatment decisions such as history of strokes and blood clots; however, results of studies[25,26] suggest that diabetes is on the rise and that patients with this condition are less likely to be treated aggressively for their breast cancer. It is possible that history of stroke and blood clots may have also influenced treatment choices.

Although we observed that women with larger tumor size and comedo histologic growth pattern were more likely to undergo adjuvant radiation therapy, we were unable to examine the effect of pathologic factors on receipt of other adjuvant treatments. Because use of tamoxifen was not approved for DCIS until 2000, its use was consequently low in this cohort.[20] Among women who received tamoxifen, we could not ascertain estrogen receptor status because this testing was rarely performed before 1999, when results of the first randomized clinical trial (National Surgical Adjuvant Breast and Bowel Project B-24) on the use of tamoxifen in the treatment of intraductal breast cancer were reported.[20] Data linkages with the SEER-affiliated tumor registries at 2 California study sites (Los Angeles and San Francisco Bay area) showed that information on estrogen receptor testing was missing or unknown for more than 90% of women. Therefore, our analysis included all women who underwent BCS with tamoxifen treatment regardless of estrogen receptor status.

Although few investigations of DCIS have examined treatment disparity, our study corroborates previous findings that racial/ethnic differences in cancer therapies are modest in integrated healthcare systems with equal access to care.[5] The lack of differences in treatment of DCIS by race/ethnicity observed in these integrated healthcare delivery systems may be due to coordinated clinical guidelines and multidimensional approaches to reduce barriers in care by educating physician leaders, nurse practitioners, case managers, and disease management program managers in these organizations. Older women and women who lived in census tracts with low median family incomes were less likely to receive adjuvant radiation therapy. Such groups of women may have different functionality, comorbidity burden, reduced access to transportation, less flexibility in work schedules, and other treatment preferences, all of which need to be considered in the treatment decision-making process.

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Take-Away Points

The lack of differences in the treatment of ductal carcinoma in situ by race/ethnicity observed in these integrated healthcare delivery systems may be due to coordinated clinical guidelines and multidimensional approaches to reduce barriers in care by educating physician leaders, nurse practitioners, case managers, and disease management program managers in these organizations.

- However, older women (≥70 years) and women who lived in census tracts with low median family incomes were less likely to receive adjuvant radiation therapy.
- Such groups of women may have different functionality, comorbidity burden, and treatment preferences, all of which need to be considered in the treatment decision-making process.

Table 1

Characteristics of Women at Initial Ductal Carcinoma In Situ Diagnosis Between 1990 and 2001[a]

	Race/Ethnicity, No. (%)				
Characteristic	**Black (n = 292)**	**Hispanic (n = 263)**	**Asian or Pacific Islander (n = 370)**	**Non-Hispanic White (n = 2075)**	**Total (N = 3000)**
Age at diagnosis, y					
<50	81 (27.7)	84 (31.9)	139 (37.6)	457 (22.0)	**761** (25.4)
50–59	85 (29.1)	77 (29.3)	116 (31.4)	580 (28.0)	**858** (28.6)
60–69	82 (28.1)	81 (30.8)	83 (22.4)	560 (27.0)	**806** (26.9)
≥70	44 (15.1)	21 (8.0)	32 (8.7)	478 (23.0)	**575** (19.2)
	—	—	—	—	*P* <.001
Year of diagnosis					
1990–1991	24 (8.2)	15 (5.7)	21 (5.7)	194 (9.4)	**254** (8.5)
1992–1993	35 (12.0)	24 (9.1)	27 (7.3)	264 (12.7)	**350** (11.7)
1994–1995	33 (11.3)	37 (14.1)	40 (10.8)	335 (16.1)	**445** (14.8)
1996–1997	57 (19.5)	45 (17.1)	52 (14.1)	406 (19.6)	**560** (18.7)
1998–1999	69 (23.6)	60 (22.8)	108 (29.2)	428 (20.6)	**665** (22.2)
2000–2001	74 (25.3)	82 (31.2)	122 (33.0)	448 (21.6)	**726** (24.2)
	—	—	—	—	*P* <.001
Family history of breast cancer					
Yes	53 (18.6)	48 (18.5)	41 (11.4)	393 (19.4)	**535** (18.3)
No	232 (81.4)	212 (81.5)	318 (88.6)	1633 (80.6)	**2395** (81.7)
	—	—	—	—	*P* <.001
Education[b]					
≤High school graduate	110 (48.9)	103 (45.4)	59 (19.0)	265 (17.3)	**537** (23.4)
≥Some college	115 (51.1)	124 (54.6)	252 (81.0)	1266 (82.7)	**1757** (76.6)
	—	—	—	—	*P* <.001
Median family income[b]					
Bottom 25%	115 (51.1)	84 (36.7)	60 (19.2)	317 (20.6)	**576** (25.0)
25%–50%	56 (24.9)	59 (25.8)	72 (23.1)	389 (25.3)	**576** (25.0)

Characteristic	Race/Ethnicity, No. (%)				
	Black (n = 292)	Hispanic (n = 263)	Asian or Pacific Islander (n = 370)	Non-Hispanic White (n = 2075)	Total (N = 3000)
51%–75%	34 (15.1)	56 (24.5)	75 (24.0)	411 (26.8)	**576** (25.0)
Top 25%	20 (8.9)	30 (13.1)	105 (33.7)	419 (27.3)	**574** (24.9)
	—	—	—	—	*P* <.001
History of diabetes					
Yes	34 (11.7)	30 (11.4)	30 (8.1)	126 (6.1)	**220** (7.4)
No	256 (88.3)	233 (88.6)	339 (91.9)	1945 (93.9)	**2773** (92.7)
	—	—	—	—	*P* <.001
Body mass index[c]					
Underweight	1 (0.4)	2 (0.8)	15 (4.5)	32 (1.7)	**50** (1.9)
Normal	43 (17.4)	64 (26.5)	192 (58.0)	777 (41.2)	**1076** (39.8)
Overweight	89 (36.0)	100 (41.3)	103 (31.1)	622 (33.0)	**914** (33.8)
Obese	114 (46.2)	76 (31.4)	21 (6.3)	456 (24.2)	**667** (24.6)
Unknown	45 (15.4)	21 (8.0)	39 (10.5)	188 (9.1)	**293** (9.8)
	—	—	—	—	*P* <.001
Method of detection[d]					
Palpation	55 (19.2)	47 (17.9)	83 (22.5)	334 (16.2)	**519** (17.4)
Mammography	232 (80.8)	216 (82.1)	286 (77.5)	1729 (83.8)	**2463** (82.6)
	—	—	—	—	*P* = .02
Surgical margins, mm[e]					
Involved	8 (11.4)	6 (10.2)	13 (12.0)	60 (8.7)	**87** (9.4)
Free, <2	17 (24.3)	6 (10.2)	17 (15.7)	134 (19.3)	**174** (18.7)
Free, 2–9	4 (5.7)	2 (3.4)	3 (2.8)	37 (5.3)	**46** (5.0)
Free, ≥10	25 (35.7)	20 (33.9)	34 (31.5)	238 (34.3)	**317** (34.1)
Free, unknown distance	16 (22.9)	25 (42.4)	41 (38.0)	224 (32.3)	**306** (32.9)
	—	—	—	—	*P* = .43
Tumor size, cm[e]					
≤1	23 (44.2)	29 (59.2)	43 (61.4)	316 (65.7)	**411** (63.0)

Characteristic	Race/Ethnicity, No. (%)				
	Black (n = 292)	Hispanic (n = 263)	Asian or Pacific Islander (n = 370)	Non-Hispanic White (n = 2075)	Total (N = 3000)
1–2	20 (38.5)	11 (22.5)	23 (32.9)	130 (27.0)	**184** (28.2)
>2	9 (17.3)	9 (18.4)	4 (5.7)	35 (7.3)	**57** (8.7)
	—	—	—	—	*P* = .005
Nuclear grade[e]					
Low	9 (19.2)	10 (25.0)	13 (17.8)	101 (24.9)	**133** (23.5)
Medium	18 (38.3)	13 (32.5)	30 (41.1)	136 (33.6)	**197** (34.9)
High	20 (42.6)	17 (42.5)	30 (41.1)	168 (41.5)	**235** (41.6)
	—	—	—	—	*P* = .81
Comedo histologic growth pattern[e]					
Absent	46 (61.3)	36 (57.1)	70 (64.2)	448 (61.5)	**600** (61.5)
Present	29 (38.7)	27 (42.9)	39 (35.8)	281 (38.6)	**376** (38.5)
	—	—	—	—	*P* = .84
Necrosis[e]					
Absent	0	1 (3.7)	3 (6.7)	19 (6.8)	**23** (6.2)
Present	21 (100.0)	26 (96.3)	42 (93.3)	260 (93.2)	**349** (93.8)
	—	—	—	—	*P* = .60
Treatment modality					
BCS with radiation therapy	113 (38.7)	108 (41.1)	160 (60.8)	869 (41.9)	**1250** (41.7)
BCS with tamoxifen	13 (4.5)	10 (3.8)	21 (8.0)	85 (4.1)	**129** (4.3)
BCS with radiation therapy and tamoxifen	25 (8.6)	38 (14.5)	51 (19.4)	223 (10.8)	**337** (11.2)
BCS alone	141 (48.3)	107 (40.7)	138 (52.5)	898 (43.3)	**1284** (42.8)
	—	—	—	—	*P* = .10

BCS indicates breast-conserving surgery.

[a] *P* values are based on χ^2 test. Unknown values were excluded in this analysis. Column totals do not add up to 3000 due to missing numbers.

[b] Education and median family income represent geocoded data for California sites. Quartiles are bottom 25%, less than $44,688; 25% to 50%, $44,689 to $60,438; 51% to 75%, $60,439 to $78,361; and top 25% (>$78,361).

[c] Calculated as weight in kilograms divided by height in meters squared. Underweight is lower than 18.5; normal, 18.5 to 24.9; overweight, 25 to 29.9; and obese, 30 or higher.

[d] Method of detection varied by age (χ^2 = 19.20; P = .001).

[e] Surgical margins and pathologic data were available for 986 patients at 1 study site only. Races/ethnicities were black, 75 patients; Hispanic, 63 patients; Asian or Pacific Islander, 110 patients; and white, 738 patients.

Table 2

Ductal Carcinoma In Situ Adjuvant Treatment Modalities by Characteristics of Women

Variable	Treatment Modality, Adjusted Odds Ratio (95% Confidence Interval)			
	BCS Alone (n = 1284)	BCS With Radiation Therapy (n = 1250)	BCS With Tamoxifen (n = 129)	BCS With Radiation Therapy and Tamoxifen (n = 337)
Patient and Surgical Characteristics				
Race/ethnicity				
Black	1.00 [Reference]	0.89 (0.67–1.18)	0.83 (0.43–1.60)	0.67 (0.41–1.10)
Hispanic	1.00 [Reference]	0.90 (0.66–1.22)	0.80 (0.39–1.66)	1.09 (0.69–1.70)
Asian or Pacific Islander	1.00 [Reference]	0.87 (0.67–1.13)	1.23 (0.70–2.15)	0.88 (0.60–1.31)
Non-Hispanic white	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]
	—	*P* = .60	*P* = .78	*P* = .33
Age at diagnosis, y				
<50	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]
50–59	1.00 [Reference]	0.95 (0.76–1.18)	1.91 (0.98–3.75)	1.27 (0.90–1.80)
60–69	1.00 [Reference]	0.70 (0.56–0.88)	2.55 (1.34–4.85)	0.92 (0.64–1.32)
≥70	1.00 [Reference]	0.40 (0.31–0.51)	2.52 (1.29–4.90)	0.32 (0.20–0.50)
	—	*P* <.001	*P* = .04	*P* <.001
Year of diagnosis				
1990–1991	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]
1992–1993	1.00 [Reference]	2.55 (1.75–3.71)	5.36 (1.16–24.71)	7.10 (2.68–18.80)
1994–1995	1.00 [Reference]	3.05 (2.14–4.35)	2.53 (0.52–12.45)	1.75 (0.58–5.25)
1996–1997	1.00 [Reference]	3.71 (2.62–5.23)	2.84 (0.61–13.22)	1.57 (0.52–4.70)
1998–1999	1.00 [Reference]	4.13 (2.91–5.86)	10.33 (2.43–43.94)	17.97 (7.07–45.69)
2000–2001	1.00 [Reference]	4.08 (2.86–5.83)	20.01 (4.78–83.77)	38.39 (15.25–96.64)
	—	*P* <.001	*P* <.001	*P* <.001
Family history of breast cancer				
Yes	1.00 [Reference]	0.94 (0.76–1.17)	0.99 (0.60–1.62)	1.06 (0.76–1.48)
No	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]
	—	*P* = .20	*P* = .99	*P* = .29
Education[a]				
≤High school graduate	1.00 [Reference]	1.04 (0.79–1.37)	1.49 (0.84–2.65)	0.83 (0.53–1.31)
≥Some college	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]
	—	*P* = .76	*P* = .41	*P* = .37
Median family income[a]				
Bottom 25%	1.00 [Reference]	0.65 (0.48–0.89)	0.51 (0.26–1.00)	0.60 (0.36–0.99)
25%–50%	1.00 [Reference]	0.84 (0.64–1.10)	0.51 (0.28–0.94)	0.70 (0.45–1.07)
51%–75%	1.00 [Reference]	1.00 (0.77–1.31)	0.72 (0.41–1.27)	0.95 (0.63–1.42)
Top 25%	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]

Variable	Treatment Modality, Adjusted Odds Ratio (95% Confidence Interval)			
	BCS Alone (n = 1284)	BCS With Radiation Therapy (n = 1250)	BCS With Tamoxifen (n = 129)	BCS With Radiation Therapy and Tamoxifen (n = 337)
	—	*P* = .06	*P* = .32	*P* = .19
History of diabetes				
Yes	1.00 [Reference]	1.08 (0.78–1.49)	1.20 (0.63–2.29)	1.08 (0.66–1.77)
No	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]
Body mass index[b]				
Underweight	1.00 [Reference]	0.75 (0.39–1.41)	1.16 (0.31–4.35)	0.90 (0.32–2.59)
Normal	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]
Overweight	1.00 [Reference]	0.95 (0.77–1.16)	1.08 (0.67–1.74)	1.11 (0.81–1.54)
Obese	1.00 [Reference]	0.90 (0.72–1.13)	0.98 (0.57–1.70)	0.96 (0.67–1.38)
Unknown	1.00 [Reference]	0.50 (0.37–0.68)	0.85 (0.45–1.62)	0.54 (0.33–0.88)
	—	*P* <.002	*P* = .99	*P* = .04
Method of detection				
Palpation	1.00 [Reference]	0.93 (0.76–1.16)	1.12 (0.69–1.85)	0.89 (0.63–1.26)
Mammography	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]
	—	*P* = .72	*P* = .88	*P* >.99
Surgical margins, mm				
Involved	—	1.00 [Reference]	—	—
Free, <2	—	1.26 (0.70–2.28)	—	—
Free, 2–9	—	1.06 (0.47–2.40)	—	
Free, ≥10	—	1.16 (0.67–1.99)	—	—
Free, unknown distance	—	1.02 (0.59–1.76)	—	—
	—	*P* = .28	—	—
Tumor Characteristics Among Women With Pathologic Data (n = 986)				
Tumor size, cm				
≤1	—	1.00 [Reference]	—	—
1–2	—	1.76 (1.17–2.65)	—	—
>2	—	2.45 (1.23–4.88)	—	—
	—	*P* = .008	—	—
Nuclear grade				
Low	—	1.00 [Reference]	—	—
Medium	—	0.99 (0.59–1.65)	—	—
High	—	1.39 (0.80–2.40)	—	—
	—	*P* = .49	—	—
Comedo histologic growth pattern				
Absent	—	1.00 [Reference]	—	—
Present	—	1.89 (1.35–2.64)	—	—

Variable	Treatment Modality, Adjusted Odds Ratio (95% Confidence Interval)			
	BCS Alone (n = 1284)	BCS With Radiation Therapy (n = 1250)	BCS With Tamoxifen (n = 129)	BCS With Radiation Therapy and Tamoxifen (n = 337)
	—	*P* <.001	—	—
Necrosis				
Absent	—	1.00 [Reference]	—	—
Present	—	2.11 (0.80–5.60)	—	—
	—	*P* = .07	—	—

BCS indicates breast-conserving surgery.

[a]Education and median family income represent geocoded data for California sites. Quartiles are bottom 25%, less than $44,688; 25% to 50%, $44,689 to $60,438; 51% to 75%, $60,439 to $78,361; and top 25% (>$78,361).

[b]Calculated as weight in kilograms divided by height in meters squared. Underweight is lower than 18.5; normal, 18.5 to 24.9; overweight, 25 to 29.9; and obese, 30 or higher.