Variations in Breast Carcinoma Treatment in Older Medicare Beneficiaries

Is it Black and White?

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Supported by Grant RO1 HS 08395 from the Agency for HealthCare Research and Qualtiy and the Federal Coordinating Committee on Breast Cancer, Office of Women's Health, DHHS, Grant DAMD 17-94-J-4212 from the Department of the Army, and Grant RO1 CA72908 from the National Cancer Institute.

The authors thank the women who shared their breast cancer stories with us; the OPTIONS support staff who made data collection possible; Qin Wang for data analysis support; Dr. Mary Cummings for programmatic support; Mathematica Policy Research, Inc., for data collection and management; the OPTIONS National Advisory Committee for helpful suggestions on the conduct of the project; Ms. Sandy Fournier for adminstrative support; and Trina McClendon for manuscipt preparation.

BACKGROUND. To evaluate associations between race and breast carcinoma treatment.

METHODS. Data from 984 black and 849 white Medicare beneficiaries 67 years or older with local breast carcinoma and a subset of 732 surviving women interviewed 3–4 years posttreatment were used to calculate adjusted odds of treatment, controlling for age, comorbidity, attitudes, region, and area measures of socioeconomic and health care resources.

RESULTS. Sixty-seven percent of women received a mastectomy and 33% received breast-conserving surgery. The odds of radiation omission were 48% higher (95% confidence interval [CI] 1.01–2.19) for blacks than for whites after considering covariates, but the absolute number of women who failed to receive this modality was small (11%). In race-stratified models, the odds of having radiation omitted were significantly higher among blacks living greater distances from a cancer

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Received November 12, 2001; revision received January 28, 2002; accepted May 2, 2002.

center (vs. lesser) or living in areas with high poverty (vs. low), but these factors did not affect radiation use among whites. Among those interviewed, blacks reported perceiving more ageism and racism in the health care system than whites ($P = 0.001$). The independent odds of receiving mastectomy (vs. breast conservation and radiation) were 2.72 times higher (95% CI 1.25–5.92) among women reporting the highest quartile of perceived ageism scores, compared with the lowest, and higher perceived ageism tended to be associated with higher odds of radiation omission ($P = 0.06$).

CONCLUSIONS. Older black women with localized breast carcinoma may have a different experience obtaining treatment than their white counterparts. The absolute number of women receiving nonstandard care was small and the effects were small to moderate. However, if these patterns persist, it will be important to evaluate whether such experiences contribute to within-stage race mortality disparities. ***Cancer* 2002;95:1401–14.** © *2002 American Cancer Society.*
DOI 10.1002/cncr.10025

KEYWORDS: breast carcinoma, elderly, race, Health Services Research, treatment.

At the end of the 20th century, breast carcinoma mortality rates began to decline for the first time in several decades. However, rates failed to decline for older women, and older black women actually experienced an increase in mortality rates.[1–3] The observed excess mortality rates among older black women may be due to the interaction of several complex phenomena, including poverty,[4,5] culturally based attitudes,[6,7] bias in treatment,[5,8,9] stage at presentation,[10–12] access to, or adequacy of treatment,[10,13–17] tumor biology,[18–23] and comorbid medical conditions.[24]

In this study, data from a random sample of black and white Medicare beneficiaries treated in fee-for-service settings for local breast carcinoma are used to describe the associations between race and local treatment. Our hypotheses were that black women would be less likely to receive breast-conserving surgery than whites and that when they did, they would be less likely to receive radiotherapy even after considering poverty and other covariates. We also explore whether different factors are associated with the type of treatment received by blacks and whites. Data from a survey of a subset of surviving women are also used to explore associations between women's perceptions of ageism and racism and treatment. Finally, we describe determinates of axillary lymph node dissection and systemic nonhormonal adjuvant chemotherapy.

MATERIALS AND METHODS

Population and Sampling

After obtaining IRB approval, Medicare data were obtained from the Health Care Financing Administration (HCFA; renamed The Centers for Medicare and Medicaid Services) to identify women undergoing initial treatment for breast carcinoma. Briefly, a random sample of women with codes for breast carcinoma and breast procedures noted in the 1994 HCFA 5% file were selected. Because this sample included only about 6% black women, we used the 100% claims file to identify an oversample of black women who had undergone breast carcinoma procedures. The sample was limited to women receiving care in fee-for-service settings because Medicare does not have claims from capitated health plans.

Following algorithms used by other researchers to identify breast carcinoma cases from claims data,[25, 26] we first excluded women whose claims indicated a history of a previous breast carcinoma diagnosis (i.e., women with recurrent disease or second primaries; 4.5%), women with carcinoma in situ without invasive disease (3.0%), women with codes for metastatic disease (0.6%), women who had received bilateral breast procedures (0.1%), and women with diagnoses of breast carcinoma without a surgical procedure code (4.0%). We also excluded women for whom breast surgery was not the primary procedure code (16.2%) or for whom breast carcinoma was not the primary diagnosis (13.9%). Women younger than 67 years of age (14.2%) were also excluded. The lower age limit was selected to have up to 2 years of previous Medicare claims to measure prediagnosis comorbidity. Finally, we excluded women whose claims were missing a physician identifier (1.7%), as well as women with claims on which the physician provider number could not be matched in the HCFA provider database (5.5%). After exclusions, 6998 women were identified to have breast carcinoma ($n = 3565$ from the 5% sample and 3433 blacks from the oversample).

To focus on the possible effects of race in clinical situations where the efficacy of breast conservation and radiation or mastectomy would be considered equivalent,[27] we limited study eligibility to women

with newly diagnosed primary, unilateral, histologically confirmed Stage 1, 2a, and 2b breast carcinoma (localized disease). Women with advanced-stage, isolated in situ disease, bilateral cancer, or multicentricity were excluded. We contacted surgeons to review their records to determine stage (which is not available from claims), confirm diagnoses of primary breast carcinoma, and affirm eligibility. We conducted a mail survey (two mailings with telephone follow-up) of surgical providers: 80.7% provided information for their patient(s); 10.6% were unable to supply the information; and only 8.7% refused. There was no difference in surgeon response by patient race. From the surgeons' reviews of their medical records, 849 white and 984 black women had newly diagnosed local disease and were eligible ($n = 1833$).

Between September 1997 and May 1998, a random subsample of surviving women was contacted to assess additional factors that may have been associated with treatment patterns (and with posttreatment quality of life). Trained staff of diverse racial backgrounds contacted women for 20-minute telephone interviews. Among the 1833 women, 571 (31%) were not contacted due to budget constraints and 353 (19%) were deceased. More black women had died after their breast carcinoma diagnosis than whites (24.2% vs. 13.6%, $P < 0.001$). Among the remaining sample of 909 surviving women who were contacted, 732 (81.0%) consented. There was no significant difference in consent rates by race (78.4% for blacks; 82.3% for whites, $P = 0.14$). Interview nonparticipants were similar in region and stage (Stage 1 vs. 2), but were slightly older (74.2 vs. 73.3 years, $P = 0.07$) than participants.

Data Sources and Variable Definitions

Most variables were derived from Medicare data. The 1990 Census File and 1993 and 1995 data from the Area Resource File[28] were used to create zip code level measures of socioeconomic status (SES) and health care resources. Individual socioeconomic information was also obtained from interviews.

Treatment Received

Surgical treatment was characterized as the simultaneous consideration of three options: breast conservation only, breast conservation with radiation, and mastectomy. We chose this approach for several reasons. First, based on our previous research in this population, this trichotomy was believed to best reflect the actual decision-making process.[29] Second, the groups of women who received breast conservation and radiation were very different from those receiving breast-conserving surgery only (e.g., in age and baseline health status). Therefore, combining these groups into one group for comparison with women who had mastectomies obscured some real differences. Third, given the distribution of treatments across the sample, the simultaneous consideration of all treatment options produced the most stable results. Finally, the race-related results and conclusions were similar for both modeling approaches (data not shown). For these reasons and for ease of interpretation, we present results for the simultaneous consideration of the three local treatments.

Definition of treatment from the Medicare claims was guided by algorithms developed by other researchers.[25,26,30] Breast conservation with radiation and mastectomy were considered to be definitive treatments in the period studied, although breast conservation with radiation was recommended as the preferred treatment.[27] Women who had a mastectomy less than 6 months after breast conservation were classified as having received a mastectomy (e.g., this classification includes women undergoing breast conservation but having positive margins requiring mastectomy). Women who received breast conservation were classified as having radiation if they had more than two claims for radiation in the period from 3 months before to 6 months after the date of surgery. Use of axillary lymph node dissection after breast conservation was defined as having any claims for axillary lymph node procedures within the 3 months after breast conservation. Because a very small proportion of women received a simple mastectomy ($\leftarrow$ 8%), it was assumed that all women having a mastectomy had some degree of axillary lymph node dissection. The date of surgery predated the use of sentinel lymph node biopsy. Chemotherapy use was defined as having any chemotherapy procedures or drugs specific to breast carcinoma within the 3 months before or 6 months after the date of surgery (Table 1). Data on tamoxifen use are not included in the HCFA files, but the data were obtained from the interviews. We compared self-reported treatment with treatment as coded from the Medicare claims data in a subset of the surviving women interviewed 3–4 years posttreatment. The concordance among surgical, radiation, and chemotherapy was high (96.5–98.8%) and did not differ by race.

Factors Associated with Treatment

Race was the primary variable of interest in assessing variations in treatment patterns. Patient and clinical factors that could potentially mediate the associations between race and treatment included age, comorbidity, stage, and SES. Perceptions of racism and ageism were also evaluated among interviewed women.

Race was defined from Medicare records as black

TABLE 1
Codes Used to Categorize Treatment from Medicare Claims

Treatment	ICD-9 inpatient hospital diagnosis codes	ICD-9 inpatient hospital procedure codes	HCPCS (CPT) physician procedure codes	Revenue center codes
BCS	19120, 19160, 19162, 19125	85.22, 85.23, 85.20, 85.21		
RT			772.xx-774.xx	0330, 0333, 0339, 0973
MST	19180, 19182, 19200, 19220, 19240	85.36, 85.41, 85.43, 85.45, 85.47		
AND		40.3, 40.23, 40.29	387.45, 387.40	
Chemotherapy		99.25, V58.1, V66.2, V67.2	964.00, 964.08–964.14, 964.40, 964.45, 965.45, 965.49, Q0083–Q0085, J9000, J9001, J9070, J9080, J9090–J9097, J9190, J9265	

ICD-9: 9th ed. of the International Classification of Diseases; BCS: breast-conserving surgery; RT: radiation; MST: Mastectomy; AND: axillary lymph node dissection.

or white. English-speaking Hispanic and Asian women constituted a very small proportion of the white women (0.38% Hispanic, 0.05% Asian) and were included with whites for analyses. Age was a categorical variable. Clinical status at the time of treatment was defined by pathologic summary stage (or, if unavailable, by clinical staging) as noted in medical records and preexisting comorbidity. Because there were few women with Stage 2b disease, the stage was collapsed into two categories for analysis: Stages 1 and 2. Comorbidity was measured using the Charlson index,[31] which was adapted for inpatient, outpatient, and physician Medicare claims for the period from 2 months to 2 years before surgery.[32,33]

SES was measured using two approaches. First, because Medicare files do not include these data, data from the Area Resource File on the percent of women who were 65 years and older and who were living below the poverty level in a woman's five-digit residential zip code were used as a proxy for her economic resources. We also examined other potential area-level measures of SES, including the percent of population with a high school or college education, median income, per capita income, and percent unemployment. However, none of these measures, either alone or in combination, explained as much variance as the poverty in the elderly measure. Also, these variables were collinear and produced unstable estimates if all were included in a model. Finally, we believed that poverty level in the elderly was the most directly relevant proxy for older women's economic resources. Second, for the subsample of interviewed women, survey responses on insurance coverage (supplementary, Medicare only, or Medicaid and Medicare) and education (less than a high school [HS] education vs. at least a HS education) were considered to be individual measures of socioeconomic resources. Perceptions of racism and ageism were evaluated using items modified for breast carcinoma treatment (Table 2).[8,9] The scales had very good reliability (Cronbach alpha of 0.76 and 0.72, respectively).

Controlling Variables

A number of potential ecologic measures of the health care environment that might be related to race and affect cancer care were constructed from Area Resource File data, including classification of the county where a woman lived along an urban/rural continuum (where zero was the most sparse area and nine the most populous), distance from the patient's home to a cancer center,[34,35] and concentration of surgeons and radiology physicians (number per 100,000 adult population) in the woman's county of residence. Region was included to control for the effects of other unobserved factors that may influence practice across geographic areas.

Analysis

Bivariate relationships were examined for the entire sample and for groups stratified by race using one-way analysis of variance and chi-square statistics.[36] Multinomial logistic regression analysis, which constrains the sum of the probabilities of receiving each treatment to equal 1, was used to evaluate the associations between race and initial treatment, axillary lymph node dissection, and systemic chemotherapy, after considering other covariates.[37] Race-stratified models were also used to explore potential interactions. All models were constructed by first entering race, then adding blocks of mediating variables in the following prespecified order: age, stage and comorbidity, SES, and medical care resources, region, and urban/rural continuum. In addition, parallel analyses were conducted using data from the subset of interviewed women to conduct a more indepth exploration of factors associated with treatment. We used adjusted

TABLE 2
Ageism and Racism Scales[a]

	Strongly agree	Somewhat agree	Somewhat disagree	Strongly disagree	Refused
Ageism					
Older women (older than 65) experience negative attitudes when they go to a young physicians office	1	2	3	4	9
In most hospitals, older (older than 65) and younger women (younger than 65) receive the same kind of care	1	2	3	4	9
Older women (older than 65) receive the equal care they want as equally as younger women (younger than 65)	1	2	3	4	9
Physicians treat older women (older than 65) and younger women (younger than 65) the same	1	2	3	4	9
Racism					
In most hospitals, black women and white women receive the same kind of care	1	2	3	4	9
Black women receive the care they want as equally as white women	1	2	3	4	9
Black women have fewer options for health care than white women	1	2	3	4	9
Physicians treat black women and white women the same	1	2	3	4	9

[a] Scores on each scale range from 4 to 16. All scores were calculated so that the higher the score, the higher the level of ageism or racism.

odds ratios (ORs) and 95% confidence intervals (CIs) to evaluate the magnitude and significance of associations between race and other factors and treatment. Treatment outcomes were common events (> 10% prevalence). Because the magnitude of associations between variables and treatment was generally and substantially less than 2.5, we did not correct ORs or use them to approximate relative risk.[38] Finally, because the probability of surviving and being contacted for the interview varied by race, these probabilities were used to weight the odds of treatment conditional on the probability of being interviewed. Results were similar for the weighted (not shown) and unweighted models. Unweighted results are presented for ease of interpretation.

RESULTS

Among this sample of fee-for-service Medicare beneficiaries treated in 1994, 67% received a mastectomy and 33% breast-conserving surgery. Radiation was omitted in one third of women after breast conservation. Rates of use of axillary lymph node dissection after breast conservation were fairly high (86%). Adjuvant chemotherapy use was very low (9%), but tamoxifen use was reported by 62% of the interviewed sample (Table 3). As age increased, the probability of omission of axillary lymph node dissection increased ($P = 0.001$, chi-square test for trend). Women who had axillary lymph node dissection omitted were also sicker than those who received this surgery (Charlson index of 2 vs. 1, $P = 0.01$). Almost all women who received chemotherapy (95%) had axillary lymph node dissection and chemotherapy rates, albeit extremely low, decreased as age increased ($P = 0.001$, chi-square test for trend). Black women were older, sicker, diagnosed with Stage 2 more often, and lived in areas where the elderly were more impoverished than their white counterparts. Interviewed black women perceived greater ageism and racism in the health care system than whites ($P < 0.001$). Area education and poverty were associated significantly with individual education, income, and insurance ($P < 0.001$; not shown).

Local Treatment

The unadjusted odds of a black woman receiving a mastectomy (vs. breast conservation and radiation) were 58% higher than the odds for whites. When blacks did receive breast conservation, the unadjusted odds of a black woman having radiation omitted were 89% higher than the odds for whites (data not shown). These race effects diminished almost in half after considering poverty and other factors, but the odds of black women receiving a mastectomy compared with breast conservation and radiation remained 36% higher (OR 1.36, 95% CI 1.02–1.78) than the odds for whites. The odds of having radiation omitted were 48% higher (OR 1.48, 95% CI 1.00–2.19) for blacks than for whites, independent of other factors (Table 4).

Socioeconomic factors were associated strongly and independently with treatment. For instance, the odds of having a mastectomy versus breast conservation and radiation were higher (OR 7.59, 95% CI 2.81–20.5) for women living in areas with the highest quartile of elderly residents living below the poverty level compared with areas with the lowest quartile of pov-

TABLE 3
Characteristics of Older Women with Early-Stage Breast Carcinoma by Race

	All eligible women			Survivors completing interviews		
Variable	Total (n = 1833)	Black (n = 984)	White (n = 849)	Total (n = 732)	Black (n = 331)	White (n = 401)
Age (yrs)						
67–69	471 (26)	304 (31)[d]	167 (20)	40 (56)	34 (10)[d]	6 (1)
70–74	551 (30)	293 (30)	258 (30)	245 (33)	120 (36)	125 (31)
75–79	424 (23)	193 (20)	231 (27)	226 (31)	95 (29)	131 (33)
80–84	261 (14)	127 (13)	134 (16)	149 (20)	50 (15)	99 (25)
85+	126 (7)	67 (7)	59 (7)	72 (10)	32 (10)	40 (10)
Mean age	74.4 ± 6.3	73.8 ± 6.3	75.2 ± 6.1	73.3 ± 5.4	72.5 ± 5.6	74.0 ± 5.1
Stage						
1	949 (52)	471 (48)[d]	478 (56)	417 (57)	174 (53)[e]	243 (60)
2a	650 (35)	361 (37)	289 (34)	247 (34)	116 (35)	131 (33)
2b	234 (13)	152 (15)	82 (10)	68 (9)	41 (12)	27 (7)
Surgery						
BCS + RT	399 (22)	183 (19)[d]	216 (25)	171 (23)	62 (19)[e]	109 (27)
BCS	200 (11)	117 (12)	83 (10)	55 (8)	27 (8)	28 (7)
MST	1234 (67)	684 (69)	550 (65)	506 (69)	242 (73)	264 (66)
Axillary lymph node dissection[a]						
Yes	1579 (86)	867 (88)[d]	712 (84)	650 (89)	305 (92)[d]	345 (86)
No	254 (14)	117 (12)	137 (16)	82 (11)	26 (8)	56 (14)
Chemotherapy						
Yes	172 (9)	112 (11)[d]	60 (7)	61 (8)	37 (11)[e]	24 (6)
No	1661 (91)	872 (89)	789 (93)	671 (92)	294 (89)	377 (94)
Tamoxifen						
Yes	—	—	—	456 (62)	193 (58)[e]	263 (66)
No				276 (38)	138 (42)	138 (34)
Comorbidity						
Charslon index[b]	1.5 ± 1.9	1.8 ± 2.2[d]	1.1 ± 1.5	1.1 ± 1.5	1.3 ± 1.8[d]	0.9 ± 1.3
Ageism	—	—	—	8.0 ± 2.3	8.6 ± 2.2[d]	7.6 ± 2.2
Racism	—	—	—	8.3 ± 2.2	8.9 ± 2.4[d]	7.8 ± 2.0
Area percent of elderly below poverty	13.6 ± 6.9	15.2 ± 7.3[d]	11.8 ± 5.8	13.3 ± 6.7	15.2 ± 7.3[d]	11.7 ± 5.6
Individual monthly income						
< $1000	—	—	—	275 (38)	178 (54)[d]	97 (24)
≥ $1000				315 (43)	90 (27)	225 (56)
Missing				142 (19)	63 (19)	79 (20)
Area percent of HS education	65.7 ± 7.7	64.0 ± 7.8[d]	67.8 ± 7.1	66.3 ± 7.4	64.1 ± 7.9[d]	68.2 ± 6.4
Individual education						
≤ HS	—	—	—	508 (69)	250 (76)[d]	258 (64)
> HS				224 (31)	81 (24)	143 (36)
Married						
Yes	—	—	—	290 (40)	107 (32)[d]	183 (46)
No				442 (60)	224 (68)	218 (54)
Supplemental insurance						
Medicaid	—	—	—	106 (14)	82 (25)[d]	24 (6)
Private insurance				479 (66)	141 (43)	338 (84)
Medicare				144 (20)	106 (32)	38 (10)
Mean urban–rural continuum score[c]	5.6 ± 1.8	5.9 ± 1.7[d]	5.5 ± 1.8	5.6 ± 1.8	5.7 ± 1.8	5.5 ± 1.7
Mean no. of radiology specialists per 100,000	15.5 ± 10	16.0 ± 10.4[e]	14.9 ± 10.3	15.6 ± 11	16.0 ± 11.1	15.3 ± 11.2
Mean no. of surgeons per 100,000	54.5 ± 26	57.3 ± 25.8[d]	51.2 ± 25.8	54.0 ± 26	56.5 ± 26.1[e]	51.9 ± 26.6
Median distance to cancer center	81 miles (range, 0–613)	75 miles (range, 0–449)[d]	87 miles (range, 0–613)	85 miles (range, 0–613)	83 miles (range, 0–449)[e]	88 miles (range, 0–613)
Region						
New England	61 (3)	16 (1)[d]	45 (5)	28 (4)	6 (2)[d]	22 (5)
Atlantic	833 (45)	528 (54)	305 (36)	323 (44)	186 (56)	137 (34)
Mountain	57 (3)	10 (1)	47 (6)	26 (4)	5 (2)	21 (5)
Pacific	144 (8)	55 (6)	89 (10)	53 (7)	17 (5)	36 (9)
Central	738 (40)	375 (38)	363 (43)	302 (41)	117 (35)	185 (46)

BCS + RT: breast conservation and radiation; BCS: breast conservation only; MST: mastectomy; HS: high school.

[a] Axillary lymph node dissection includes all women with mastectomy and those women with breast conservation who had axillary lymph node dissection as a separate procedure.

[b] Charlson index scores range from 0 to 44, with 0 representing no comorbidity.

[c] Urban–rural continuum scores range from 0 to 9, with 0 representing the most sparsely populated areas.

[d] Significant at $P < 0.01$.

[e] Significant at $P < 0.05$.

TABLE 4
Adjusted Odds of Different Surgical Treatments among Older Women with Early-Stage Breast Carcinoma[a]

	Mastectomy vs. breast conservation + radiation			Breast conservation only vs. breast conservation + radiation	
Variable	**All women**	**Black**	**White[b]**	**All women**	**Black**
Race					
White	1.00	—	—	1.00	—
Black	1.36 (1.05–1.78)[d]	—	—	1.48 (1.01–2.19)[f]	—
Age (yrs)					
67–69	1.00	1.00	1.00	1.00	1.00
70–74	0.93 (0.68–1.26)	0.97 (0.64–1.48)	0.86 (0.54–1.37)	0.93 (0.57–1.51)	1.03 (0.55–1.91)
75–79	1.19 (0.85–1.67)	1.36 (0.82–2.25)	1.06 (0.65–1.71)	1.02 (0.60–1.73)	1.24 (0.59–2.57)
80–84	1.70 (1.11–2.59)[d]	1.94 (1.03–3.67)[d]	1.50 (0.84–2.69)	1.99 (1.11–3.59)[d]	1.95 (0.84–4.55)
85+	4.02 (1.85–8.71)[e]	2.99 (1.01–8.84)[d]	4.77 (1.58–14.4)[e]	8.68 (3.60–20.9)[e]	6.17 (1.83–20.8)
Stage					
1	1.00	1.00	1.00	1.00	1.00
2	1.83 (1.43–2.33)[e]	1.73 (1.22–2.46)[e]	1.95 (1.38–2.75)[e]	0.91 (0.63–1.31)	0.76 (.46–1.26)
Charlson index quartiles[c]					
First	1.00	1.00	1.00	1.00	1.00
Second	1.10 (1.02–1.18)[e]	1.12 (1.01–1.24)[d]	1.06 (0.94–1.19)	1.24 (1.13–1.36)[e]	1.24 (1.11–1.41)
Third	1.20 (1.03–1.40)	1.40 (1.03–1.90)	1.12 (0.89–1.42)	1.54 (1.28–1.86)	1.95 (1.36–2.80)
Fourth	3.33 (1.23–9.00)	4.34 (1.16–16.2)	2.02 (0.49–8.37)	16.6 (4.87–56.5)	18.0 (3.74–86.9)
Area percent of elderly below poverty level quartiles[c]					
First	1.00	1.00	1.00	1.00	1.00
Second	1.17 (1.08–1.27)[e]	1.24 (1.06–1.46)[e]	1.13 (1.04–1.23)[e]	1.14 (1.02–1.27)[d]	1.26 (1.01–1.56)
Third	1.64 (1.29–2.08)	1.58 (1.13–2.20)	1.48 (1.14–1.92)	1.49 (1.06–2.12)	1.61 (1.02–2.54)
Fourth	7.59 (2.81–20.5)	6.49 (1.64–25.7)	5.93 (1.81–19.4)	5.31 (1.28–21.9)	7.14 (1.10–46.3)
Distance to cancer center quartiles[3]					
First	1.00	1.00	1.00	1.00	1.00
Second	1.08 (0.98–1.18)	1.18 (1.02–1.36)[d]	1.00 (0.90–1.11)	1.11 (0.98–1.27)	1.24 (1.06–1.46)
Third	1.19 (0.96–1.48)	1.54 (1.08–2.19)	1.00 (0.78–1.29)	1.29 (0.94–1.76)	1.58 (1.13–2.20)
Fourth	1.93 (0.85–4.39)	3.13 (1.22–8.08)	1.00 (0.37–2.71)	2.60 (0.81–8.41)	6.49 (1.64–25.7)

[a] Multinomial regression analysis controlling for the effects of all variables and area health care resources (number of surgeons per 100,000 adults, number of radiologists per 100,000 adults), urban–rural continuum, and region.

[b] Sample size with complete data for all variables: all women (n = 1770), blacks (n = 943), whites (n = 827).

[c] Quartiles are calculated based on the coefficients from the multinomial regression.

[d] Significant at $P < 0.05$.

[e] Significant at $P < 0.01$.

[f] $P = 0.05$.

erty, controlling for other covariates. Living in an area with the highest quartile of impoverished elderly residents (vs. areas with the lowest quartile) also increased the odds of having radiation omitted after breast conservation (OR 5.31, 95% CI 1.28–21.9). The effect of poverty on omission of radiation in the overall model was due to the associations between poverty and treatment for blacks. For instance, in the race-stratified models, living in an area with a higher proportion of elderly living in poverty independently increased the odds of omission of radiation after breast conservation for blacks, but not for whites (Table 4).

Comorbidity was also independently associated with treatment, with sicker women receiving a mastectomy and having radiation omitted more often than healthier women. The race-stratified models show that the effect of comorbidity on the choice of mastectomy versus breast conservation and radiation was due to associations between race and health for blacks, for whom higher levels of preexisting comorbidity increased the odds of having a mastectomy versus breast conservation and radiation ($P = 0.03$), but not for whites ($P = 0.38$). However, for both races, higher comorbidity levels were associated with omission of radiation after breast conservation. Age effects on treatment patterns were independent of these health effects and increasing age was associated most strongly with omission of radiation after breast conservation (Table 4). There was also a tendency for distance from a woman's residence to the nearest cancer center to be associated with the receipt of a mastectomy or breast conservation and radiation. For

TABLE 5
Adjusted Odds of Surgical Treatments among Survivors Completing Interviews (n = 706)[a]

Variable	Mastectomy vs. breast conservation + radiation	Breast conservation alone vs. breast conservation + radiation
Race		
White	1.00	1.00
Black	1.20 (0.76–1.89)	0.96 (0.43–2.13)
Age (yrs)		
67–69	1.00	1.00
70–74	1.03 (0.64–1.64)	0.99 (0.44–2.22)
75–79	1.08 (0.64–1.80)	0.58 (0.22–1.53)
80–84	1.52 (0.74–3.13)	1.66 (0.54–5.10)
85+	3.01 (0.64–14.1)	4.85 (0.71–33.4)
Stage		
1	1.00	1.00
2	1.88 (1.27–2.76)[c]	0.78 (0.38–1.59)
Comorbidity Charlson index quartiles[b]		
First	1.00	1.00[d]
Second	1.07 (0.94–1.23)	1.27 (1.05–1.54)
Third	1.07 (0.94–1.23)	1.27 (1.05–1.54)
Fourth	2.32 (0.45–11.9)	18.3 (1.84–180)
Ageism scores quartiles[b]		
First	1.00[d]	1.00[e]
Second	1.12 (1.03–1.22)	1.15 (1.00–1.33)
Third	1.25 (1.05–1.48)	1.32 (0.99–1.77)
Fourth	2.72 (1.25–5.92)	3.55 (0.96–13.2)
Area percent of elderly below poverty quartiles[b]		
First	1.00[c]	1.00
Second	1.19 (1.05–1.35)	1.17 (0.95–1.44)
Third	1.63 (1.14–2.31)	1.55 (0.87–2.77)
Fourth	7.44 (1.74–31.7)	6.06 (0.55–66.2)

[a] Multinomial regression analysis controlling for the effects of all variables and insurance, education, area health care resources (number of surgeons per 100,000 adults, number of radiologists per 100,000 adults), urban–rural continuum, and region.
[b] Quartiles are calculated based on the coefficients from the multinomial regression. Some categories have similar distributions due to flat, but skewed distribution.
[c] Significant at $P < 0.01$.
[d] Significant at $P < 0.05$.
[e] $P = 0.058$.

example, as the distance from a cancer center increased, the odds of women receiving a mastectomy rather than breast conservation and radiation increased ($P = 0.09$). This tendency was seen as a result of a race and distance effect for blacks, for whom greater distance significantly increased the odds of having a mastectomy versus breast conservation and radiation ($P = 0.01$), but not for whites ($P = 0.99$). Omission of radiation after breast conservation was not associated with distance from a cancer center among the women in the entire sample. However, in race-stratified models, the odds of omission of radiation after breast conservation increased with increasing distance for black women ($P = 0.02$), but not for white women ($P = 0.33$; Table 4).

Data from the subset of 732 surviving women allowed us to test whether perceived ageism, individual measures of SES, or perceived racism were associated with treatment. The odds of receiving a mastectomy compared with breast conservation and radiation were higher (OR 2.72, 95% CI 1.25–5.92) among women with the highest quartile of perceived ageism scores compared with women reporting scores in the lowest quartile. Women who perceived higher levels of ageism also tended to have odds of omission of radiation after breast conservation that were higher than those for women with lower levels ($P = 0.06$). Similar patterns of effects of SES were noted for individual measures as were observed using area proxies (Table 5). Race was not significantly associated with treatment in the subset of survivors, although we had less than 60% power to detect ORs of 1.3 for associations between race and treatment, after considering other covariates. In addition, because certain strata had sparse data, we could not test for interactions between race and perceived ageism or racism and treatment. For instance, black women who received breast conservation only or a mastectomy perceived

TABLE 6
Adjusted Odds of Axillary Lymph Node Dissection after Breast Conservation among Older Women with Early-Stage Breast Carcinoma[a]

Variable	Axillary lymph node dissection after breast conservation (yes vs. no)	
	All eligible women (n = 583)[b]	Survivors completing interviews (n = 219)[b]
Race		
White	1.00	1.00
Black	1.52 (1.03–2.26)[c]	2.93 (1.30–6.61)[d]
Age (yrs)		
67–69	1.00	1.00
70–74	0.81 (0.51–1.31)	0.61 (0.27–1.39)
75–79	0.67 (0.40–1.12)	0.79 (0.32–1.95)
80–84	0.40 (0.22–0.72)[d]	0.16 (0.04–0.55)[c]
85+	0.09 (0.03–0.25)[d]	0.10 (0.01–1.10)
Stage		
1	1.00	1.00
2	1.41 (0.97–2.06)	1.32 (0.66–2.67)
Comorbidity Charlson index quartiles[b]		
First	1.00[d]	1.00[c]
Second	0.76 (0.69–0.85)	0.73 (0.60–0.89)
Third	0.76 (0.69–0.85)	0.73 (0.60–0.89)
Fourth	0.03 (0.01–0.12)	0.02 (0.00–0.26)
Ageism quartiles[b]		
First	—	1.00
Second	—	0.89 (0.76–1.04)
Third	—	0.80 (0.58–1.08)
Fourth	—	0.36 (0.09–1.44)
Percent of elderly below poverty quartiles[b]		
First	1.00	1.00[c]
Second	0.93 (0.84–1.05)	0.78 (0.63–0.96)
Third	0.81 (0.57–1.15)	0.49 (0.27–0.89)
Fourth	0.42 (0.10–1.77)	0.05 (0.00–0.63)

[a] Logistic regression analysis controlling for the effects of all variables and insurance (survivors only), education (survivors only), area health care resources (number of surgeons per 100,000 adults, number of radiologists per 100,000 adults), urban–rural continuum residence, and region.
[b] Quartiles are calculated based on the coefficients from the multinomial regression. Some categories have similar distributions due to flat, but skewed distribution.
[c] Significant at $P < 0.05$.
[d] Significant at $P < 0.01$.

higher average levels of racism in the system (9.2 and 8.9, respectively) than blacks who received breast conservation and radiation (7.0), but these differences were not statistically significant.

Axillary Lymph Node Dissection after Breast Conservation

All women who received a mastectomy had some degree of axillary lymph node dissection, although this procedure requires additional surgery after breast conservation. Among women who received breast conservation, after considering other covariates, clinical factors were the strongest predictors of axillary lymph node dissection. Older and sicker women weresignificantly less likely to have axillary lymph node dissection than younger, healthier women (Table 6). The odds of black women receiving axillary lymph node dissection after breast conservation tended to be higher (OR 1.52, 95% CI 1.03–2.26, $P = 0.04$) than the odds for whites. In the subset of surviving women, race effects were significant (OR 2.93, 95% CI 1.30–6.61).

Systemic Treatment

Very few women received chemotherapy. The only significant predictors of chemotherapy were younger age and stage (Table 7).

DISCUSSION

This is the first study of a large, nationally representative sample of older women with confirmed local

TABLE 7
Adjusted Odds of Chemotherapy Use among Older Women with Early-Stage Breast Carcinoma[a]

Variable	Chemotherapy yes vs. no	
	All eligible women (n = 1770)	Survivors completing interviews (n = 706)
Race		
White	1.00	1.00
Black	1.34 (0.92–1.98)	1.72 (0.85–3.50)
Age (yrs)		
67–69	1.00	1.00
70–74	0.63 (0.43–0.92)[b]	0.85 (0.45–1.60)
75–79	0.34 (0.21–0.56)[c]	0.24 (0.09–0.63)[b]
80–84	0.08 (0.03–0.22)[c]	0.10 (0.01–0.75)[b]
85+	0.04 (0.06–0.27)[c]	—
Stage		
1	1.00	1.00
2	5.27 (3.52–7.88)[c]	6.64 (3.31–13.3)[c]

[a] Logistic regression analysis controlling for the effects of all variables and insurance (survivors only), education (survivors only), comorbidity, perceived ageism (survivors), area poverty in the elderly, area health care resources (number of surgeons per 100,000 adults, number of radiologists per 100,000 adults), urban–rural continuum, and region. None of the aforementioned covariates were significantly related to chemotherapy.
[b] Significant at $P < 0.05$.
[c] Significant at $P < 0.01$.

stage breast carcinoma to compare treatment received by blacks and whites in the fee-for-service sector. The results suggest that black women may have a different experience than whites in receiving care for their breast carcinomas. For instance, race and local treatment were associated with black women receiving mastectomy more often than breast conservation and radiation than whites. Further, when they did have breast-conserving surgery, blacks had radiation omitted more often than whites, even after considering poverty and other factors. In addition, distance to cancer centers, area poverty, and comorbidity were associated with the type of surgical treatment received by black women, but these factors did not affect the treatment received by white older women.

These data extend findings from previous research demonstrating that black women may receive less aggressive treatment for their breast carcinomas than whites[39–43] and that racial differences in treatment often persist after control for sociodemographic factors.[39,40,43] Our findings also suggest that black women may have different experiences in receiving care for their breast carcinoma than whites. This idea is supported by the result that blacks perceived more racism and ageism in the health care system than whites.

In other settings, distance to radiation services is associated with the odds of receiving radiation.[44,45] In our study, distance to a cancer center and area levels of poverty in the elderly affected treatment for blacks, but not whites. Although we did not have information on transportation resources, both distance and poverty may represent access barriers. For instance, several researchers have reported that there are no differences in breast carcinoma treatment or outcomes by race in equal access managed care settings, after considering area income, stage, and other factors.[46–48] Therefore, strategies to improve access for black cancer patients, such as providing full insurance coverage (without co-pays) or transportation resources, may reduce some of the disparities in treatment patterns. Alternatively, the distance result may reflect a diffusion effect, with physicians practicing closer to a cancer center being more likely to follow prevailing guidelines than those farther away from academic settings. Also, the differential effects of poverty by race may represent the bias of treating physicians, lack of social and other less tangible patient supports, or unmeasured attitudes associated with poverty.

The choice of mastectomy versus breast conservation and radiation was effected by health for blacks, but not whites, suggesting that patients or their physicians may be responding differentially by race in assessing the ability of patients to tolerate protracted treatment. In other research, comorbidity is associated with treatment, independent of age, although race interactions were not assessed.[48] Others have suggested that differential race effects on cancer treatment and outcomes are mediated by culturally based attitudes.[6] For instance, it is possible that the omission of radiation after breast conservation or the higher rates of mastectomy than breast conservation and radiation among black women may be due to culturally based attitudes toward radiation. Alternatively, unmeasured aspects of race-specific patient preferences may have contributed to our findings. For example, black women may have preferred to have surgery and "get things over with" more often than whites, or they may have chosen mastectomy to avoid out-of-pocket costs associated with radiation. Unfortunately, we did not collect data to test these competing hypotheses. If race-mediated patterns of care are based on culturally based attitudes or preferences held by black women but lead to poor outcomes, then culturally tailored patient education and assertiveness interventions could be developed to optimize treatment.[49] Conversely, if physicians offer black women different treatments than comparable white women, then physician education would be important. Qualitative research and observation of patient–provider interactions will be important in designing interventions to

ensure that women receive quality care consistent with their preferences.

Receipt of axillary lymph node dissection after breast conservation was associated most strongly with age and comorbidity, with younger, healthier women being more likely to have axillary lymph node dissection than their older, sicker counterparts. Race was also associated with axillary lymph node dissection, with black women being more likely to have received axillary lymph node dissection than whites, independent of the surgical approach. This result may be a function of unmeasured clinical factors in black women, such as black women having less favorable tumor markers, larger tumors, or positive lymph nodes on examination more often than whites within a given stage.

After initial local treatment, race had less of an effect on subsequent therapy. Only 9% of women received systemic adjuvant chemotherapy, with younger women and women with Stage 2 disease being more likely to get chemotherapy than older women and women with Stage 1 disease, after considering other factors. Unfortunately, we did not have data on estrogen receptor negativity, which is more prevalent among blacks than among whites,[50,51] to evaluate whether chemotherapy might have been indicated but was not given.

It is difficult to draw firm conclusions about the appropriateness of these observed treatment patterns without considering women's long-term satisfaction and self-rated posttreatment quality of life. Although mastectomy and breast-conserving surgery yield equivalent survival rates, the major implication of the finding that black women were more likely to have radiation omitted after breast conservation is that their risk of local recurrence is increased. This risk approaches 30–40% by 10 years after initial diagnosis and treatment.[52,53] Because the average patient-specific life expectancy (based on age, stage, and specific comorbidities) of black women in our study was 9 years (not shown), this pattern of care may place women at substantial risk for disease recurrences within their lifetimes.[54,55] Black women are also more likely to have a less favorable pattern of disease recurrence than whites, with associated decrements in quality of life.[22,56] The use of radiotherapy among older breast carcinoma patients is now the subject of clinical investigation and shifting clinical paradigms.[57,58] However, despite scientific uncertainty as to the most appropriate treatment for older women, it appears that, in the past, some black women may have been undertreated according to prevailing standards.[55]

There are several caveats that should be considered in evaluating our results, including the use of 1994 cases, focus on the fee-for-service sector, power and absolute differences in effects, use of area measures, post hoc assessment of attitudes, reliance on claims, and difficulty in controlling for unmeasured or unobservable patient and/or race-related characteristics that affected treatment. Women treated in 1994 were selected to allow for long-term follow-up of a nationally representative sample within the time frame and scope of a larger study of breast carcinoma outcomes. The rates of mastectomy have declined for all women over time. However, at the close of the 20th century, racial disparities in breast carcinoma outcomes were persistent[59] and these findings are likely to be replicated with more current data. The sample was limited to women in Medicare's fee-for-service program. In 1994, only 8.1% of Medicare beneficiaries were cared for in non–fee-for-service settings.[60] By 1999, this proportion had increased to 17% and breast carcinoma treatment patterns are similar for older women across both settings.[47]

The overall sample was constructed to yield equal numbers of black and white women and to detect differences in local treatment patterns. Unfortunately, the smaller sample of surviving women who were interviewed resulted in a less than 60% power to detect ORs of 1.3 for associations between race and treatment, after considering other covariates. The lack of a significant race effect among the survivors was not due to controlling for education and insurance. However, it might be explained by survivor bias, with black women who received more intensive treatment being more likely to be alive at the time of the follow-up interview 3–4 years later. Finally, the survivor sample was not powered to test interactions between race and racism or ageism. Although the findings from race-stratified models in the overall sample suggest race interactions, additional research with larger samples will be needed to confirm this impression.

It is noteworthy that although one third of older women who received breast conservation failed to receive radiation, overall, this represents only 11% of women failing to receive definitive treatment (i.e., breast conservation and radiation or mastectomy). However, given the substantial increase in breast conservation rates over time,[39,41,47] a larger absolute number of black women could be at risk for undertreatment if the observed magnitude of race effects persist and are experienced across the entire population.[61]

Because Medicare does not collect data on SES, area-level measures were used as a proxy for individual data. This is a standard approach, but results may be subject to confounding.[62] However, the consistency of our results for the effects of SES on treatment using

area and individual-level measures, the strong associations between individual and area measures, and the consistency with previous research argue against significant bias due to use of area-level measures.

The evaluation of ageism and racism in the health care system took place an average of 3–4 years post-surgery. Although many factors were not mutable, women's reports of perceptions of ageism (and racism) may have been influenced by subsequent adverse sequelae or other experiences. Unfortunately, it is generally not feasible to observe prospectively the role of these factors in the treatment process in such a large national sample. This would involve a burden on women at a vulnerable time and ascertainment of a large national sample in a short window between diagnosis and treatment. It will be important to conduct qualitative research to explore the prospective effects of perceived bias on cancer care. The racism scale used in this study was reliable and valid (i.e., blacks reported higher levels of perceived racism than whites). Unfortunately, the strong correlation between race and perceived racism, limited within-race variability, and the relatively small sample size of survivors limited the ability to detect effects of this construct on treatment. This will be an interesting area for future research.

Although it is possible that Medicare claims might misclassify treatment, there is no reason to believe that any misclassification was systematic. In addition, there was substantial agreement between self-report and claims for all races. Overall, in analyses linking Medicare claims to the Surveillance, Epidemiology, and End Results data, there is substantial concordance between the two sources for treatment, although neither has data on tamoxifen use.[30] There were a number of factors that we were unable to measure or may have captured incompletely, such as tumor characteristics, any unobservable selection of women to surgeons with particular treatment styles, and patient and provider preferences. Also, race effects decreased by nearly one half after controlling for SES measures, indicating that some portion of the observed race effects were attributable to SES. Therefore, some of the remaining race associations we observed may have been due partially to residual confounding.[61]

These caveats underscore the complexity of disentangling the effects of race, access to care, SES, attitudes, and experiences with the health care system.[63] Overall, our results demonstrate that black women who were older, poorer, and sicker than white women were particularly vulnerable to receiving less than definitive treatment for their breast cancercarcinomas. It will be important to evaluate whether these patterns of care contribute to within-stage race disparities in breast carcinoma mortality rates.

REFERENCES

1. National Cancer Institute. SEER. Washington, DC: Department of Health and Human Services, 1998.
2. Wingo PA, Ries LA, Rosenberg HM, Miller DS, Edwards BK. Cancer incidence and mortality, 1973–1995: a report card for the U.S. *Cancer.* 1998;82:1197–1207.
3. Chevarley F, White E. Recent trends in breast cancer mortality among white and black US women. *Am J Public Health.* 1997;87:775–781.
4. American Cancer Society. Cancer and the poor: a report to the nation. Findings of regional hearings conducted by the American Cancer Society. Washington, DC: American Cancer Society, 1989.
5. Bassett M, Krieger N. Social class and black-white differences in breast cancer survival. *Am J Public Health.* 1986;76: 1400–1403.
6. Lannin DR, Matthews HF, Mitchell J, Swanson MS, Swanson FH, Egan MK. Influence of socioeconomic and cultural factors on racial differences in late-stage presentation of breast cancer. *J Am Med Assoc.* 1998;279:1801–1807.
7. Hunter CP. Epidemiology, stage at diagnosis, and tumor biology of breast carcinoma in multiracial and multiethnic populations. *Cancer.* 2000;88:1193–1202.
8. Krieger N, Sidney S. Racial discrimination and blood pressure: the CARDIA study of young black and white adults. *Am J Public Health.* 1996;86:1370–1378.
9. Krieger N. Embodying inequality: a review of concepts, measures, and methods for studying health. *Int J Health Serv.* 1999;29:295–352.
10. Dignam JJ. Difference in breast cancer prognosis among African-American and Caucasian women. *CA.* 2000;50:50–64.
11. Yood MU, Johnson CC, Blount A, et al. Race and differences in breast cancer survival in a managed care population. *J Natl Cancer Inst.* 1991;91:1487–1491.
12. El-Tamer MB, Homel P, Wait RB. Is race a poor prognostic factor in breast cancer? *J Am Coll Surg.* 1999;189:41–45.
13. McWhorter WP, Mayer WJ. Black/white differences in type of initial breast cancer treatment and implications for survival. *Am J Public Health.* 1987;77:1515–1517.
14. Allen C, Cox EB, Manton KG, Cohen HJ. Breast cancer in the elderly: current patterns of care. *J Am Geriatr Soc.* 1986;34: 637–642.
15. Chu J, Diehr P, Feigl P, et al. The effect of age on the care of women with breast cancer in community hospitals. *J Gerontol.* 1987;42:185–190.
16. Howard J, Hankey BF, Greenberg RS, et al. A collaborative study of differences in the survival rates of black patients and white patients with cancer. *Cancer.* 1992;69:2349–2360.
17. Breen N, Wesley MN, Merrill RM, Johnson K. The relationship of socioeconomic status and access to minimum expected therapy among female breast cancer patients in the National Cancer Institute black/white cancer survival study. *Ethn Dis.* 1999;9:111–125.
18. Mohla S, Sampson CC, Khan T, Enterline JP, Leffall L Jr., White JE. Estrogen and progesterone receptors in breast cancer in black Americans: correlation of receptor data with tumor differentiation. *Cancer.* 1982;50:552–559.
19. Ownby HE, Frederick J, Russo J, et al. Racial differences in breast cancer patients. *J Natl Cancer Inst.* 1985;75:55–60.

20. Crowe JP Jr., Gordon NH, Hubay CA, Pearson OH, Marshall JS, McGuire WL. The interaction of estrogen receptor status and race in predicting prognosis for stage II breast cancer patients. *Surgery.* 1986;100:599–605.
21. Elledge RM, Clark GM, Chamness GC, Osborne CK. Tumor biologic factors and breast cancer prognosis among white, Hispanic, and black women in the United States. *J Natl Cancer Inst.* 1994;86:705–712.
22. Connor CS, Touijer KA, Krishnan L, Mayo MS. Local recurrence following breast conservation therapy in African-American women with invasive breast cancer. *Am J Surg.* 2000;179:22–26.
23. Trock BJ. Breast cancer in African American women: epidemiology and tumor biology. *Breast Cancer Res Treat.* 1996; 40:11–24.
24. Wazer DE. The role of radiation in breast conserving therapy. *Obstet Gynecol Clin North Am.* 1994;21:681–691.
25. Warren JL, Feuer E, Potosky AL, Riley GF, Lynch CF. Use of Medicare hospital and physician data to assess breast cancer incidence. *Med Care.* 1999;37:445–456.
26. Freeman JL, Zhang D, Freeman DH, Goodwin JS. An approach to identifying incident breast cancer cases using Medicare claims data. *J Clin Epidemiol.* 2000;53:605–614.
27. NIH Consensus Conference. Treatment of early breast cancer. *J Am Med Assoc* 1991;265:391–395.
28. Stambler HV. The area resource file — a briefing book. *Public Health Rep.* 2000;103:184–186.
29. Mandelblatt J, Hadley J, Kerner J, et al. Patterns of breast carcinoma treatment in older women: patient preference, clinical, and physician influences. *Cancer.* 2000;89:561–573.
30. Du X, Freeman JL, Warren JL, Nattinger AB, Zhang D, Goodwin JS. Accuracy and completeness of Medicare claims data for surgical treatment of breast cancer. *Med Care.* 2000;387: 719–727.
31. Charlson ME, Pompei P, Ales KL, MacKenzie CR. A new method of classifying prognostic comorbidity in longitudinal studies: development and validation. *J Chron Dis.* 1987; 40:373–383.
32. Deyo RA, Cherkin DC, Ciol MA. Adapting a clinical comorbidity index for use with ICD-9-CM administrative databases. *J Clin Epidemiol.* 1992;45:613–619.
33. Newschaffer CJ, Bush TL, Penberthy LE, Bellantoni M, Helzlsour K, Diener-West M. Does comorbid disease interact with cancer? An epidemiologic analysis of mortality in a cohort of elderly breast cancer patients. *J Gerontol.* 1998;53: M372–M378.
34. Garnick DW, Luft HS, Robinson JC, Tetreault J. Appropriate measures of hospital market areas. *Health Serv Res.* 1987;22: 69–89.
35. Phibbs CS, Robinson JC. A variable-radius measure of local hospital market structure. *Health Serv Res.* 1993;28:313–324.
36. Fleiss JL. Statistical methods for rates and proportions, 2nd ed. New York: John Wiley, 1981.
37. STATA reference manual. Release 5. College Station, TX: Stata Press, 1997; 2:540–554.
38. Zhang J, Yu KF. What's a relative risk? A method of correcting the odds ratio in cohort studies of common outcomes. *J Am Med Assoc.* 1998;280:1690–1691.
39. Nattinger AB, Gottlieb MS, Veum J, Yahnke D, Goodwin JS. Geographic variation in the use of breast-conserving treatment for breast cancer. *N Engl J Med.* 1992;326:1147–1149.
40. Lazovich D, White E, Thomas DB, Moe RE. Underutilization of breast-conserving surgery and radiation therapy among women with stage I or II breast cancer. *J Am Med Assoc.* 1991;266:3433–3438.
41. Lazovich D, Solomon CC, Thomas DB, Moe RE, White E. Breast conservation therapy in the United States following the 1990 National Institutes of Health consensus development conference on the treatment of patients with early stage invasive breast carcinoma. *Cancer.* 1999;86: 628–637.
42. Albain KS, Green SR, Lichter AS, et al. Influence of patient characteristics, socioeconomic factors, geography, and systemic risk on the use of breast-sparing treatment in women enrolled in adjuvant breast cancer studies: an analysis of two intergroup trials. *J Clin Oncol.* 1996;14:3009–3017.
43. Michalski TA, Nattinger AB. The influence of black race and socioeconomic status on the use of breast-conserving surgery for Medicare beneficiaries. *Cancer.* 1997;79:314–319.
44. Athas WF, Adams-Cameron M, Hunt WC, Amir-Fazli A, Key CR. Travel distance to radiation therapy and receipt of radiotherapy following breast-conserving surgery. *J Natl Cancer Inst.* 2000;92:269–271.
45. Nattinger AB, Kneusel RT, Hoffman RG, Gilligan MA. Relationship of distance from a radiotherapy facility and initial breast cancer treatment. *J Natl Cancer Inst.* 2000;93:1344–1346.
46. Velanovich V, Yood MU, Bawle U, et al. Racial differences in the presentation of surgical management of breast cancer. *Surgery.* 1999;125:375–379.
47. Riley GF, Potosky AL, Klabunde CN, Warren JL. Stage at diagnosis and treatment patterns among older women with breast cancer: an HMO and fee-for-service comparison. *J Am Med Assoc.* 1999;281:755–756.
48. Ballard-Barbash R, Potosky AL, Harlan LC, Nayfield SG, Kessler LG. Factors associated with surgical and radiation therapy for early stage breast cancer in older women. *J Natl Cancer Inst.* 1996;88:701–703.
49. Krupat E, Irish JT, Kasten LE, et al. Patient assertiveness and physician decision-making among older breast cancer patients. *Soc Sci Med.* 1999;49:449–457.
50. Elledge RM, Clark GM, Chamness GC, Osborne CK. Tumor biologic factors and breast cancer prognosis among white, Hispanic and black women in the United States. *J Natl Cancer Inst.* 1994;86:705–712.
51. Elmore JG, Moceri VM, Carter D, Larson EB. Breast carcinoma tumor characteristics in black and white women. *Cancer.* 1998;83:2509–2515.
52. Veronesi U, Luini A, Del Vecchio M, et al. Radiotherapy after breast-preserving surgery in women with localized cancer of the breast. *N Engl J Med.* 1993;328:1587–1591.
53. Fisher B, Anderson S, Redmond C, Wolmark N, Wickerham DL, Cronin WM. Reanalysis and results after 12 years of follow-up in a randomized clinical trial comparing total mastectomy with lumpectomy with or without irradiation in the treatment of breast cancer. *N Engl J Med.* 1995;333: 1456–1461.
54. Hayman JA, Fairclough DL, Harris JR, Weeks JC. Patient preferences concerning the trade-off between the risks and benefits of routine radiation therapy following conservative surgery for early-stage breast cancer. *J Clin Oncol.* 1997;15: 1252–1260.
55. Morrow M, Harris JR, Schnitt SJ. Local control following breast-conserving surgery for invasive cancer: results of clinical trials. *J Natl Cancer Inst.* 1995;87:1669–1673.

56. Pierce L, Fowble B, Solin LJ, Schultz DJ, Rosser C, Goodman RL. Conservative surgery and radiation therapy in black women with early stage breast cancer: patterns of failure and analysis of outcome. *Cancer.* 1992;69:2831–2841.
57. Martelli G, DePalo G, Rossi N, et al. Long-term follow-up of elderly patients with operable breast cancer treated with surgery without axillary dissection plus adjuvant tamoxifen. *Br J Cancer.* 1995;72:1251–1255.
58. Cancer and Leukemia Group B. Protocol no. 9343: tamoxifen vs radiotherapy and tamoxifen after breast conservation in the elderly with local disease. Washington DC: Department of Health and Human Services, 1999.
59. National Cancer Institute. The NCI strategic plan to reduce health disparities. Washington, DC: National Cancer Institute, 2000.
60. Virginia Association of Health Plans. The managed care marketplace. Alexandria, VA: Virginia Association of Health Plans, 2000.
61. Mark DH. race and the limits of administrative data. *J Am Med Assoc.* 2001;285:337–338.
62. Robinson WS. Ecological correlations and the behavior of individuals. *Am Sociol Rev.* 1950;15:351–357.
63. Freeman HP. The meaning of race in science — considerations for cancer research. *Cancer.* 1998;82:219–225.