

## Scientific Article

# Narrowing Racial Gaps in Breast Cancer: Factors Affecting Probability of Adjuvant Radiation Therapy



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## Abstract

**Purpose:** Adjuvant radiation therapy has historically been underused by black patients with breast cancer compared with white patients. We prospectively investigated factors, including sociocultural, psychosocial, and health care factors, that may be associated with the use or omission of adjuvant radiation therapy by both racial groups.

**Methods and Materials:** Women with primary invasive, nonmetastatic breast cancer were recruited from hospitals and through community outreach efforts in the Washington, DC, and Detroit, Michigan, areas between July 2006 and April 2011. Data were collected via telephone interviews regarding psychosocial (eg, self-efficacy) and health care factors (eg, communication) at the time they received a diagnosis. Clinical data were extracted from their medical charts after the completion of treatment. We examined the association among multiple demographic, socio-cultural, healthcare process factors and the use of radiotherapy. Logistic multivariable regression models identified associations with radiotherapy receipt.

**Results:** Among 395 eligible and consenting women, 315 had complete baseline data, and 217 were in the final analytical sample, having met criteria for adjuvant breast or chest wall radiation therapy after breast conservation surgery or mastectomy. Among women eligible for radiation, all were insured, 59% were black, the mean age was 55.4 years, and the majority had stage I or II disease. Overall, approximately 70% percent of women received adjuvant radiation therapy. On multivariable analyses, the likelihood of receiving adjuvant radiation therapy was higher for those who were black with any level of indication for radiation therapy (odds ratio 2.21;  $P < .01$ ), those for whom comorbidities were present, and those who demonstrated positive sociocultural factors such as self-efficacy and high reported rates of provider communication about radiation therapy (odds ratio 1.20;  $P < .05$ ). Among women with strong indications for radiation therapy, there was no significant association with race on multivariable analysis.

**Conclusions:** Our findings suggest that among women with any indication for radiation therapy, black patients were more likely to receive radiation therapy compared with white patients. Furthermore, data suggest improved provider communication and self-efficacy are important predictors of receipt of radiation therapy. Further studies exploring the effects of provider communication and sociocultural factors to diverse patient populations may be warranted.

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## Introduction

Racial disparities in breast cancer outcomes have been observed for decades, with black women having higher rates of breast cancer mortality compared with white women despite age-adjusted incidence.<sup>1,2</sup> Although advances in diagnosis and treatment are credited for an overall decrease in breast cancer mortality, the gap continues to widen in regard to mortality rates between black and white patients.<sup>1</sup> Explanations for these observed disparities are varied and multi-factorial, with biological, socioeconomic, treatment and health systems explanations put forth to explain portions of this disparity.<sup>3-7</sup> Discordance in survival and other breast cancer-specific outcomes have persisted even after controlling for stage and other adverse prognostic factors.<sup>1,6</sup> Therefore, differences in the utilization of treatment and health systems for breast cancer are hypothesized to contribute to disproportionate recurrence and mortality rates in black women.<sup>8-10</sup>

Multiple randomized studies have established breast conservation therapy to lead to local control and survival equivalent to that with mastectomy.<sup>11-14</sup> Breast conservation therapy can reduce the risk of local recurrence as much as 3-fold compared with surgery alone.<sup>11,14-17</sup> Adjuvant postmastectomy radiation, which is used in women with locally advanced breast cancer, has also been shown in randomized trials to significantly improve locoregional disease control and overall survival.<sup>15,18</sup>

Despite the proven benefits, there is evidence of disparities in the receipt of adjuvant radiation among patients with breast cancer by race.<sup>5,6,19,20</sup> There is wide variation in the reported use of adjuvant radiation therapy by black patients with breast cancer, ranging from 15% to 57%.<sup>5-8,19,20</sup> Although several factors have been identified as barriers to treatment, including advanced age, insurance status, lack of quality patient-provider communication and information, and access to care, the contextual factors that may be associated with receipt of radiation have not been well characterized.<sup>8-10,20</sup>

In addition to prospectively examining the association of race and adjuvant radiation therapy receipt, we also investigated factors related to the adherence model of health behavior that may be associated with the use or omission of adjuvant radiation therapy treatment, including clinical, sociocultural, process of care, and communication factors. The adherence model emphasizes constructs (eg, patient-provider interaction, sociocultural) that relate to adherence behaviors specifically within the

context of cancer therapies<sup>21</sup> and has been applied to adherence to other types of therapies (eg, systemic therapies) among patients with breast cancer.<sup>22-24</sup>

## Methods and Materials

### Setting and population

The study design has been previously described.<sup>22</sup> Figure 1 provides the schema. In brief, after institutional review board approval, we collected data from 3 hospitals in the Washington, DC, area and 1 hospital in the Detroit metropolitan area on a convenience sample of women who had recently received diagnoses of breast cancer. Inclusion criteria required women to be 21 years of age or older at the time of diagnosis and to have received a diagnosis of invasive nonmetastatic disease with plans to treat with curative intent. We oversampled black women to facilitate race comparisons and to investigate differences within race groups. Women with ductal and lobular carcinoma in situ, distant metastasis, recurrent disease, or second primaries, those who were not English speakers, those who were of other races, and those who could not give informed consent were excluded.

### Data collection

Potentially eligible patients were identified from surgery logs, pathology reports, and electronic appointment systems; patients responding to outreach recruitment self-referred to the study. Clinical research assistants confirmed eligibility and obtained consent for interviews and chart reviews. Interviews were conducted centrally by trained research staff using a standardized computer-assisted telephone survey. The average duration of the telephone interview was approximately 50 minutes. On average, women were interviewed 3 months past their definitive surgery. Clinical and treatment variables (eg, receipt of radiation, breast cancer stage) were abstracted from medical records for 12 to 18 months after the telephone interview. All women received a \$25 incentive for study participation.

The endpoint for this study was radiation therapy utilization (yes or no), a binary measure of whether or not a woman received any adjuvant radiation therapy after surgery, which was ascertained based on abstraction of the patient's medical records. We screened 678 women, of whom 477 were eligible to participate in the study.

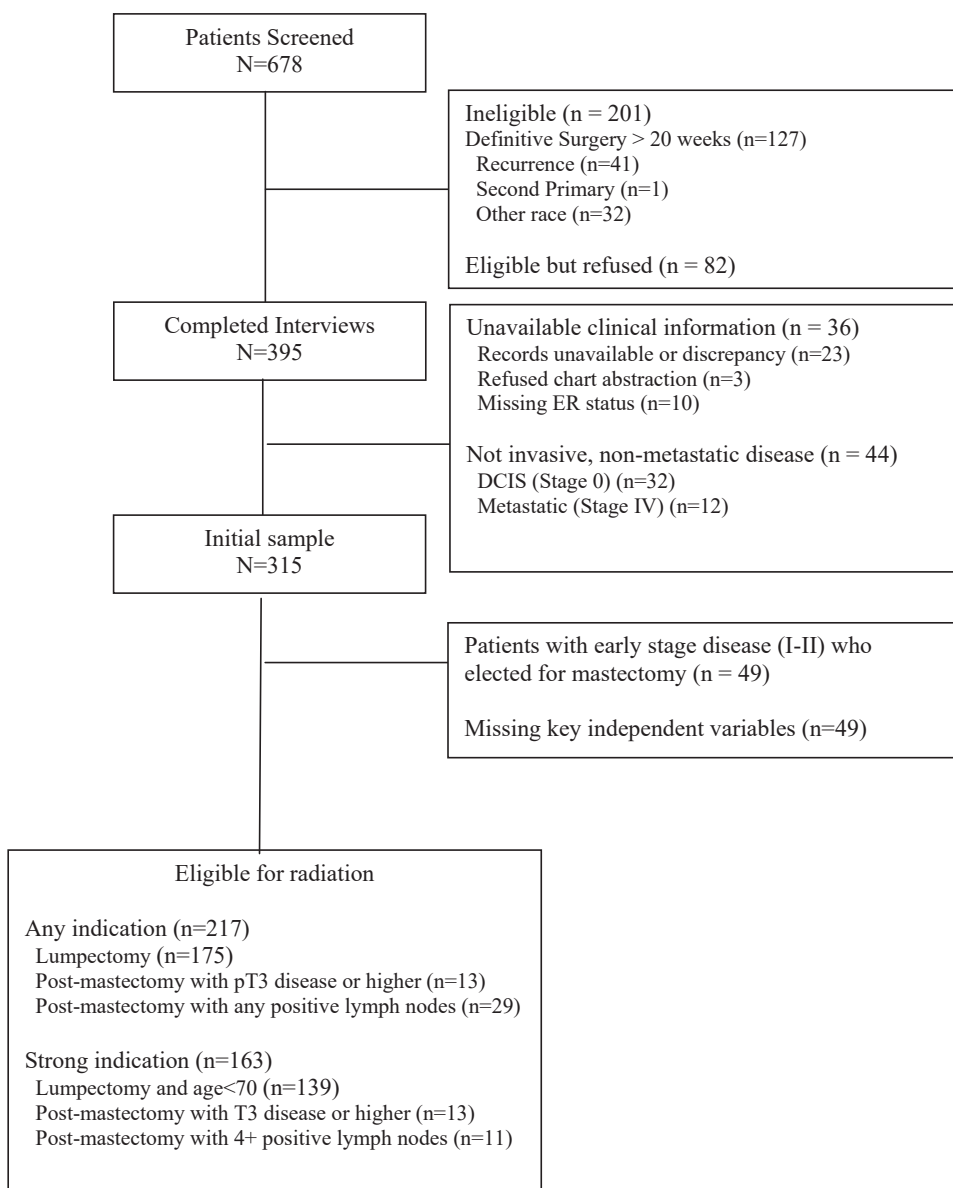


Figure 1 Study Schema.

Ultimately, 395 (82.8%) women consented. Given the exclusion of some women from analysis for missing data, such as medical charts that could not be fully abstracted, our final analytical data set included 315 women whose medical chart abstraction included whether or not the patient received radiation therapy. To evaluate the receipt of adjuvant radiation therapy concordant with National Comprehensive Cancer Network guidelines on the basis of category 1 recommendations, we identified women with strong indications for radiation therapy as women less than 70 years old who underwent lumpectomy for any stage or who experienced lymph node metastasis involving 4 or more lymph nodes after mastectomy. The remaining number of women who did not meet criteria for a strong indication was small. We therefore included these

in the cohort of any indication, defined as any woman who received a lumpectomy or mastectomy with T3 or greater disease or any positive lymph node.

**Study variables**

Socioeconomic and demographic factors include self-reported race, highest level of education (eg, any college, bachelor’s degree and above), marital status, and insurance status (eg, Medicare only, private only). Clinical variables, obtained through medical record abstraction, included breast cancer stage, surgery type (eg, lumpectomy or mastectomy), number of positive lymph nodes, hormonal status (estrogen and progesterone), chemotherapy utilization, and Charlson Comorbidity Index.

Sociocultural factors included perceived health care discrimination, religiosity, medical mistrust, perceived susceptibility, attitude toward radiation therapy, participation in care, and health care barriers. Bird and Bogart's Race-Based Experience questionnaire assessed perceived health care discrimination.<sup>25</sup> The questionnaire consisted of 7 items that asked patients to consider how they have been treated by providers. A dichotomous variable resulted from responses—any discriminatory experiences versus none. Religiosity was measured using Lukwago et al's religiosity scale, which comprises 9 Likert-scale items.<sup>26</sup> Examples of items include "I rely on God to keep me in good health" and "My spiritual beliefs are the foundation of my whole approach to life." Women with higher scores expressed greater religiosity. To measure the perceived level of collective distrust in health care practices and systems, the Group-Based Medical Mistrust Scale was used (Cronbach's alpha: overall = .84; whites = .87; blacks = .77).<sup>27</sup> Higher scores indicated greater mistrust. To measure women's perceived susceptibility to developing cancer again, we used the susceptibility subscale of the Adherence Determinants Questionnaire, which includes 4 Likert-scale items.<sup>28</sup> Higher scores represent higher perceived susceptibility to developing cancer. Attitude toward radiation therapy was measured using a 7-item scale (eg, "radiation therapy is not as good in women like me"). We assessed health care barriers using an 11-item scale that asked women if they have problems receiving care for various reasons (eg, "finding a doctor," "money"). Results were categorized into 3 groups: no barriers, 1 to 2 barriers, or 3 or more barriers.

To assess how women perceived the process of health care factors, we evaluated ratings of communication and patient satisfaction across multiple domains. The Makoul Communication Scale (7 items) was used to understand women's ratings of communication with their provider regarding radiation therapy (Cronbach's alpha: overall = .83; whites = .85; blacks = .82).<sup>29</sup> Valuable dimensions of interaction such as the giving of information (eg, "the risk of radiation was fully clarified by the doctor") and the solicitation behaviors of the physicians (eg, "the doctor did not inquire your opinion of taking radiation") were included in the scale. Scores ranged from 8 to 41, with higher scores indicating greater perceived communication. Additionally, we assessed the 18-item Patient Satisfaction Questionnaire.<sup>30</sup> Domains of this measure include the following: general satisfaction, technical quality, interpersonal manner, communication, financial aspects, and accessibility. The 18-item Patient Satisfaction Questionnaire assessed women's satisfaction with each of the domains using Likert-scale items. Higher scores were indicative of greater satisfaction with the given domain. Individuals whose responses were missing from this measure had their scores imputed based on their other responses.

## Statistical analysis

Clinical data were extracted from women's medical charts after the completion of treatment. We used *t* tests and  $\chi^2$  tests to assess bivariate relationships between radiation use and study variables. A set of multivariable logistic regression models was employed to demonstrate initiation of radiation. As discussed, this included both patients receiving mastectomy and those receiving lumpectomy for surgical management of their disease. Logistic regression models were used for multivariate analyses of associations among socioeconomic, demographic, sociocultural, health care process, and use variables and radiation therapy delivery, with odds ratios (ORs) reported. For robustness, we separately examined these relationships in the subset of women with strong indications for adjuvant radiation therapy as defined previously. All independent variables were included in the regression models. Data were analyzed with Stata/MP v15.1.

## Results

Among 395 eligible and consenting women, 315 (79.7%) had complete baseline data. All women were insured, 41% were white and 59% were black, and the mean age was 54.8 years. All women underwent definitive surgery. More underwent lumpectomy (64%) compared with mastectomy (36%). Fifty-nine percent of women received adjuvant radiation therapy, with a majority doing so after lumpectomy.

In bivariable analyses of all women in the study, several demographics were associated with receipt of radiation therapy. Of note, patients receiving radiation therapy were more likely to report being black, to be older, and to have lower levels of education compared with women who did not receive adjuvant radiation therapy. Clinically, women receiving a lumpectomy, those who had higher numbers of positive lymph nodes, those who had more comorbid disease, or those who initiated chemotherapy were more likely to receive radiation therapy. Among the sociocultural factors, self-efficacy indicators of positive attitude toward radiation and understanding and participation in care were positively associated with radiation use. Radiation communication was the only process-of-health-care factor positively associated with radiation use (Table 1).

In multivariable analyses of women with any indication for radiation, black women (OR 2.21;  $P < .001$ ) were more likely to receive radiation therapy than their white counterparts; however, this difference was not observed for women who had a strong indication to receive radiation therapy (Table 2). The likelihood of receiving adjuvant radiation therapy was higher for women who received a lumpectomy (OR = 2.80;  $P = .001$ ), who had

**Table 1** Descriptive statistics of breast cancer patients by radiation eligibility status

Demographic characteristics	All women (N = 315)			Any indication (n = 217)			Strong indication (n = 163)		
	No radiation	Radiation	P value	No radiation	Radiation	P value	No radiation	Radiation	P Value
Age, y*	53.0 (11.4)	55.9 (11.9)	.035	53.6 (11.4)	55.8 (11.5)	.19	52.3 (10.2)	55.1 (10.0)	.12
Patient race									
African American	61 (48.0)	125 (66.5)	.001	34 (51.5)	98 (64.9)	.063	20 (45.5)	71 (59.7)	.10
White	66 (52.0)	63 (33.5)		32 (48.5)	53 (35.1)		24 (54.5)	48 (40.3)	
Highest grade completed									
High school or less	21 (16.5)	49 (26.1)	.004	15 (22.7)	44 (29.1)	.16	8 (18.2)	29 (24.4)	.15
Any college	31 (24.4)	64 (34.0)		16 (24.2)	48 (31.8)		10 (22.7)	40 (33.6)	
Bachelor's and above	75 (59.1)	75 (39.9)		35 (53.0)	59 (39.1)		26 (59.1)	50 (42.0)	
Marital Status									
Divorced	32 (25.2)	51 (27.1)	.77	18 (27.3)	38 (25.2)	.91	11 (25.0)	25 (21.0)	.58
Married	66 (52.0)	90 (47.9)		33 (50.0)	75 (49.7)		20 (45.5)	65 (54.6)	
Never married	29 (22.8)	47 (25.0)		15 (22.7)	38 (25.2)		13 (29.5)	29 (24.4)	
Employment status									
Full-time	48 (38.7)	63 (36.0)	.75	24 (36.4)	56 (37.1)	.99	16 (36.4)	48 (40.3)	.80
Part-time	17 (13.7)	19 (10.9)		6 (9.1)	14 (9.3)		5 (11.4)	13 (10.9)	
Unemployed or retired	56 (45.2)	87 (49.7)		34 (51.5)	75 (49.7)		22 (50.0)	52 (43.7)	
Never worked or student	3 (2.4)	6 (3.4)		2 (3.0)	6 (4.0)		1 (2.3)	6 (5.0)	
Insurance status									
Private only	88 (69.3)	120 (63.8)	.21	43 (65.2)	98 (64.9)	1.00	31 (70.5)	85 (71.4)	.97
Medicare and private	15 (11.8)	29 (15.4)		10 (15.2)	23 (15.2)		5 (11.4)	12 (10.1)	
Public	22 (17.3)	39 (20.7)		13 (19.7)	30 (19.9)		8 (18.2)	22 (18.5)	
Uninsured	2 (1.6)	0 (0.0)		0 (0.0)	0 (0.0)		0 (0.0)	0 (0.0)	
Clinical factors									
Stage									
I	57 (46.7)	80 (43.2)	.11	24 (36.4)	70 (46.4)	.21	21 (47.7)	65 (54.6)	.74
II	51 (41.8)	67 (36.2)		30 (45.5)	50 (33.1)		11 (25.0)	26 (21.8)	
III	14 (11.5)	38 (20.5)		12 (18.2)	31 (20.5)		12 (27.3)	28 (23.5)	
Lumpectomy	55 (44.0)	147 (78.2)	<.001	48 (72.7)	127 (84.1)	.051	38 (86.4)	101 (84.9)	.81
Lymph nodes positive									
0	61 (48.0)	107 (56.9)	<.001	20 (30.3)	86 (57.0)	<.001	13 (29.5)	64 (53.8)	<.001
1-3	24 (18.9)	51 (27.1)		21 (31.8)	44 (29.1)		9 (20.5)	36 (30.3)	
4 or more	10 (7.9)	23 (12.2)		10 (15.2)	16 (10.6)		10 (22.7)	15 (12.6)	
Missing or not evaluated	32 (25.2)	7 (3.7)		15 (22.7)	5 (3.3)		12 (27.3)	4 (3.4)	
Hormone receptor status									
Negative	31 (24.4)	48 (25.5)	.82	15 (22.7)	38 (25.2)	.70	7 (15.9)	27 (22.7)	.34
Positive	96 (75.6)	140 (74.5)		51 (77.3)	113 (74.8)		37 (84.1)	92 (77.3)	
No. of comorbid diseases									
None	70 (55.1)	42 (22.3)	<.001	33 (50.0)	35 (23.2)	<.001	24 (54.5)	28 (23.5)	<.001

(continued on next page)

Table 1 (continued)

Demographic characteristics	All women (N = 315)			Any indication (n = 217)			Strong indication (n = 163)		
	No radiation	Radiation	P value	No radiation	Radiation	P value	No radiation	Radiation	P Value
1-2	41 (32.3)	75 (39.9)		24 (36.4)	59 (39.1)		14 (31.8)	48 (40.3)	
>2	16 (12.6)	71 (37.8)		9 (13.6)	57 (37.7)		6 (13.6)	43 (36.1)	
Initiated chemotherapy	43 (33.9)	94 (50.0)	.005	25 (37.9)	77 (51.0)	.075	16 (36.4)	59 (49.6)	.13
Sociocultural factors									
Religiosity*	17.3 (7.3)	16.4 (6.3)	.26	17.7 (7.8)	16.6 (6.5)	.28	18.7 (8.1)	16.6 (6.8)	.11
Medical mistrust*	28.5 (4.2)	28.7 (4.5)	.60	28.4 (4.1)	28.8 (4.4)	.46	28.1 (3.8)	28.5 (4.4)	.62
Perceived susceptibility*	14.0 (2.1)	14.4 (2.4)	.095	14.3 (2.4)	14.5 (2.2)	.42	14.6 (2.0)	14.7 (2.0)	.72
Self-efficacy: positive attitude*	14.7 (1.7)	15.1 (1.5)	.032	14.8 (1.8)	15.0 (1.6)	.33	14.8 (1.7)	15.1 (1.6)	.44
Self-efficacy: understanding and participation in care*	15.3 (1.2)	15.1 (1.3)	.28	15.5 (0.8)	15.1 (1.3)	.034	15.4 (0.9)	15.1 (1.3)	.20
No. of health care barriers									
None	37 (30.3)	65 (35.1)	.68	20 (30.3)	48 (31.8)	.75	16 (36.4)	40 (33.6)	.42
1-2	58 (47.5)	81 (43.8)		34 (51.5)	70 (46.4)		23 (52.3)	55 (46.2)	
3 or more	27 (22.1)	39 (21.1)		12 (18.2)	33 (21.9)		5 (11.4)	24 (20.2)	
Process of health care factors									
PSQ-18*	72.8 (9.8)	73.5 (8.7)	.52	74.1 (9.6)	73.8 (8.7)	.87	75.0 (10.4)	74.2 (8.6)	.61
Radiation therapy communication*	18.7 (3.3)	20.1 (3.2)	<.001	18.8 (3.7)	20.1 (3.2)	.007	19.4 (3.8)	20.1 (3.4)	.27
N	127	188		66	151		44	119	

Abbreviation: PSQ-18 = 18-item Patient Satisfaction Questionnaire.

“Any indication” is defined as any woman who received a lumpectomy, who received a mastectomy and had T3 or greater disease, or who had 1 or more positive lymph node. “Strong indication” is defined as any woman under 70 years old who received a lumpectomy, who received a mastectomy and had T3N1 or T4 disease, or who had 4 or more positive lymph nodes. *P* value reflects results from a *t* test (continuous outcomes) or  $\chi^2$  test (categorical outcomes) comparing women who did not receive radiation to those who did.

\* Continuous variables are presented as mean (standard deviation); other variables are presented as frequency (%).

**Table 2** Multivariable logistic regressions of radiation initiation by eligibility status

	Any indication (N = 217)		Strong indication (N = 163)	
	OR	95% CI	OR	95% CI
<b>Demographic characteristics</b>				
Age, y	1.03	(0.99-1.06)	1.04*	(1.01-1.06)
African American (ref: Caucasian)	2.21*	(1.53-3.19)	1.64	(0.75)
Highest grade completed (ref: high school or less)				
Any college	1.17	(0.41-3.32)	0.59	(0.24-1.45)
Bachelor's and above	1.18	(0.43-3.22)	0.58	(0.15-2.14)
Marital status (ref: divorced)				
Married	1.12	(0.22-5.73)	2.84	(0.69-11.74)
Never married	1.25	(0.61-2.56)	2.17	(0.99-4.76)
Employment status (ref: full-time)				
Part-time	0.71	(0.25-2.06)	0.53	(0.23-1.23)
Unemployed or retired	0.79	(0.3-2.11)	0.57	(0.25-1.28)
Never worked or student	1.36	(0.07-25.72)	1.34	(0.07-25.18)
Insurance status (ref: private only)				
Medicare and private	0.65	(0.15-2.86)	0.75	(0.12-4.58)
Public	0.74	(0.14-3.83)	0.74	(0.16-3.53)
<b>Clinical factors</b>				
Stage (ref: stage I)				
II	0.38*	(0.21-0.69)	0.31	(0.09-1.05)
III	0.96	(0.19-5.02)	0.39	(0.11-1.34)
Lumpectomy (ref: mastectomy)	2.80*	(1.5-5.23)	0.81	(0.23-2.79)
Positive lymph nodes (ref: no positive lymph nodes)				
1-3	0.99	(0.77-1.27)	1.61	(0.79-3.27)
4 or more	0.39	(0.09-1.64)	0.48	(0.12-1.9)
Missing or not evaluated	0.09*	(0.03-0.35)	0.15	(0.02-1.15)
Hormone receptor–positive (reference: negative)	1.42*	(1.16-1.74)	0.72	(0.48-1.1)
No. of comorbid diseases (ref: no diseases)				
1-2	1.80*	(1.18-2.74)	1.81*	(1.29-2.53)
>2	4.77†	(1.18-19.29)	6.12*	(2.26-16.56)
Initiated chemotherapy (ref: did not initiate chemotherapy)	1.71	(0.79-3.68)	1.88*	(1.13-3.1)
<b>Sociocultural factors</b>				
Religiosity scale	1.02	(0.98-1.06)	0.99	(0.93-1.06)
Medical mistrust	1.03	(0.96-1.11)	0.99	(0.93-1.05)
Perceived Susceptibility	0.98	(0.91-1.07)	0.95	(0.77-1.17)
Self-efficacy: positive attitude	1.37†	(1.05-1.77)	1.46*	(1.1-1.95)
Self-efficacy: understanding and participation in care	0.63†	(0.4-0.98)	0.67	(0.41-1.08)
No. of health care barriers (ref: no barriers)				
1-2	1.18	(0.20)	1.11	(0.51-2.4)
3 or more	2.64	(1.66)	6.57†	(1.44-30.05)
<b>Process of health care factors</b>				
PSQ-18	1.00	(0.97-1.03)	0.98	(0.95-1.01)
Radiation therapy communication	1.20*	(1.12-1.28)	1.12*	(1.08-1.15)

Abbreviations: CI = confidence interval; OR = odds ratio; PSQ-18 = 18-item Patient Satisfaction Questionnaire.

“Any indication” is defined as any woman who received a lumpectomy, who received a mastectomy and had T3 or greater disease, or who had 1 or more positive lymph node. “Strong indication” is defined as any woman under 70 years old who received a lumpectomy, who received a mastectomy and had T3N1 or T4 disease, or who had 4 or more positive lymph nodes. Odds ratios reported.

\*  $P < .01$ .

†  $P < .05$ .

stage II disease compared with stage I (OR = 0.38;  $P = .001$ ), and who were hormone-receptor positive (OR = 1.42;  $P = .001$ ) with 2 or more comorbidities (OR = 4.76;  $P = .029$ ). Regarding sociocultural and process-of-health-care factors, women with more positive

attitudes about radiation for any (OR = 1.36;  $P = .019$ ) or strong indication for radiation therapy and women with reported higher ratings of provider communication about radiation therapy were more likely to receive radiation (OR = 1.19;  $P < .001$ ). Women with 3 or more health

care barriers and a strong indication for radiation therapy were more likely to receive it (Table 2).

## Discussion

Contrary to our hypothesis and other published reports,<sup>10,19,31</sup> overall, black patients were more likely to receive radiation therapy for their breast cancer compared with white patients when considering any indication for radiation therapy. However, our data revealed no statistically significant racial disparity when considering patients with strong indication for adjuvant radiation therapy. This report is the third in a prospective investigation of patient-reported sociocultural factors, which may in part drive racially based gaps in the care of women with breast cancer. Previous reports of the receipt of adjuvant chemotherapy and surgery for this cohort of patients found that black patients were significantly influenced by the quality of communication and information from and level of trust in their providers.<sup>22,24</sup> The report of the receipt of surgery found a greater mean time from diagnosis to surgery for black patients compared with white and decreased delay with Internet use. To that end, several possible reasons underlie the lack of racial disparity in radiation therapy receipt that has historically existed. First, this study focuses on relatively well-integrated health systems in urban samples; access to radiation therapy (typically given as a daily treatment for several weeks) may be increased if transportation is easier. The notion that our sample had overall good access is further supported by the relatively high rates of insurance in the sample.

We also considered exploratory multivariable analyses to ascertain the differential associations of sociocultural and process of health care factors in predicting radiation therapy receipt by race (Table E1; available online at <https://doi.org/10.1016/j.adro.2019.07.014>). Sociocultural factors, including medical mistrust, perceived susceptibility, and self-efficacy, were predictive of radiation therapy receipt in black women but not in white women, whereas religiosity was associated with radiation therapy receipt only among white women. Of these variables, the associations were concordant in direction by race with the exception of medical mistrust. Although white women showed a positive trend with medical mistrust and radiation therapy receipt, this coefficient was significant and highly negative among the sample of black woman. Although these separate analyses have smaller sample sizes and therefore less power to detect differences in predictors across race, they do suggest that further study is needed to better understand racial variations in sociocultural factors that affect women's propensity to obtain radiation treatment. It has been reported that differences exist in patients' needs regarding preferences and style of patient–provider communication and

interactions.<sup>8,23,32–35</sup> Sheppard et al<sup>23</sup> reported in earlier work that the patient–provider relationship most influences treatment decision and that more effective communication correlates to increased adherence to recommended therapies among black patients. Regarding receipt of radiation therapy, Jagsi et al<sup>8</sup> reported a strong association with surgeon and provider influence but no associations with education or ethnicity. There is evidentiary support that the quality of information received is important, as is the source.

A limitation of our study is a lack of information regarding providers' communication style, race, and information content. It has been reported that discordance of race between patients and providers with implicit racial biases may influence quality of communication.<sup>36–38</sup> Penner et al<sup>36</sup> assessed providers' implicit racial biases using validated tools and coordinated their scores with videotaped interactions with patients and patient survey answers. They found patients of providers with higher scores of implicit racial bias were likely to have decreased immediate recall of the information, fewer patient-centered interactions, and decreased time of interaction with providers. This indirectly decreased patients' confidence in recommended treatments and increased patients' belief in the difficulty of completing treatment. In response to such observations in oncology care and in medicine in general, more efforts to provide cultural and diversity training have been incorporated into medical training programs nationally. Future research should include direct observation of encounters, mixed methods, and the effect of diversity training to evaluate communication between providers and patients and its correlation with clinical outcomes.

Although this study comprehensively assessed patients' attitudes and beliefs, it lacks information about their decision-making processes. Decision-making style and process may differ significantly among patients as a result of education level and racial and cultural background.<sup>33,37</sup> The report of chemotherapy receipt of this cohort revealed that white patients sought information outside of the patient–provider relationship; they were more likely to use the Internet. White patients were also less likely to initiate chemotherapy when they reported higher communication scores, and they received radiation therapy less often than black patients. The decision-making processes can be complex. Weber et al<sup>37</sup> described 5 basic styles for breast cancer treatment options that often overlap based on race, class, and cultural influences. This cohort suggests a possible preference for a self-efficacy decision style by white patients, whereas black patients relied more on a medical expert decision style. This is only an assumption; data regarding decision-making were not specifically collected. As more data on this process emerge, these principles can also be applied to the study of patient–provider communication.



Lastly, a limitation of our study was lack of all relevant clinical details and outcome of therapy. Clinical details including correlation between disease stage and recommended treatment were lacking because treatment details were collected from medical records. As a result, there are inherent biases. In addition, we were unable to ascertain from medical records whether women who did or did not receive radiation therapy were in agreement with their treating oncologists. Furthermore, attitudes about radiation therapy among patients who did not receive radiation and may not have met with a radiation oncologist to resolve some of their potential misconceptions about radiation (eg, becoming radioactive or infertile) may not be addressed.<sup>39</sup> Unobserved medical conditions may also have been reasons why some patients were less favorable radiation candidates; for instance, patients may have a cardiac device close to the radiation therapy field or an autoimmune condition such as lupus or scleroderma. Finally, there may be cases in which unobserved factors affected a patient's performance status and rendered risks of completion of radiation therapy higher than the benefits.<sup>38</sup>

Treatment completion information and treatment outcome would have enhanced our findings. Large randomized clinical studies and meta-analyses have consistently reported local control benefits of adjuvant breast radiation therapy with some translation to improved overall survival in some cohorts.<sup>11,14-16,40</sup> Despite its limitations, this analysis provides data among a unique population with a large proportion of black women, allowing comparisons with white counterparts. The sample draws from multiple institutions, which strengthens the data. We also have diversity among the black women, given that the institutions represented are in urban settings with an array of socioeconomic groups and education levels, though, as discussed, this tempers our findings to be most applicable to this setting as access to radiation therapy may be better compared with more rural or suburban settings.

## Conclusions

Overall, the complexity of the patient–provider relationship and its influence on the quality and outcome of breast cancer treatment leaves many unanswered questions. The influence of quality patient–provider communication may be correlated with clinical outcomes to increase the quality of care. Furthermore, as our population of patients and providers becomes more diverse and information systems expand, finding answers may be challenging. Additional research regarding processes and actions of both the patients and providers is needed. This information may in turn be used to enhance education on communication practices for providers as early as at the medical school and graduate levels as well as for patients

with the use of navigators and personalized information tools.

## Supplementary data

Supplementary material for this article can be found at <https://doi.org/10.1016/j.adro.2019.07.014>.

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