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Do Variations in Provider Discussions Explain Socioeconomic Disparities in Postmastectomy Breast Reconstruction?

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Abstract

BACKGROUND—The utilization of post-mastectomy reconstruction varies with socioeconomic status, but the etiology of these variations is not understood. We investigate whether these differences reflect variations in the rate and/or qualitative aspects of the provider's discussion of reconstruction as an option.

STUDY DESIGN—Data were collected via chart review and patient survey for Stage I - III breast cancer patients during the National Initiative on Cancer Care Quality. Multivariable logistic regression was used to identify predictors of reconstruction and discussion of reconstruction as an option. Predictors of not receiving reconstruction despite a documented discussion were also determined.

RESULTS—253 of 626 patients received reconstruction (40.4%). Younger, more educated, white women who were not overweight or receiving post-mastectomy radiation were more likely to receive reconstruction. Patients who were younger, more educated, and not receiving post-mastectomy radiation were more likely to have a discussion of reconstruction documented. If a discussion was documented, patients who were older, Hispanic, not born in the U.S., and women

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who received post-mastectomy radiation were less likely to receive reconstruction. The greatest predictor of reconstruction was medical record documentation of a discussion about reconstruction.

CONCLUSIONS—We observed disparities in the likelihood of reconstruction, which are at least partially explained by differences in the likelihood that reconstruction was discussed. However, there are also differences in the likelihood of reconstruction based on age, race, and radiation once discussions occurred. Efforts to increase and improve discussions regarding reconstruction may decrease disparities for this procedure.

INTRODUCTION

Post-mastectomy breast reconstruction is an elective, costly procedure, but an important component of the surgical care of breast cancer patients. As with many other high-cost elective procedures, previous studies have demonstrated racial and socioeconomic variations in the utilization of post-mastectomy reconstruction.^{1–10} Careful review of these studies suggests that the observed racial disparities likely reflect differences in socioeconomic status. In fact, the majority of studies that account for differences in individual SES find that race is not a significant predictor of reconstruction. The association between socioeconomic characteristics, such as income, education, and employment status, and rates of reconstruction are larger and more consistent. The underlying etiology of these socioeconomic variations has not been elucidated. Possible contributors include differences in access to care, clinical factors, patient preference or provider bias.

Previous work using data from the National Comprehensive Cancer Network suggests that factors such as provider bias and patient preference are associated with differences in the use of breast reconstruction, even amongst patients with similar access to care.⁷ In that study, patients receiving mastectomy at one of eight high-volume U.S. comprehensive cancer centers still exhibited disparities in rates of reconstruction explained in part by factors such as income, education, employment and insurance status.

Clinical factors, such as stage, co-morbidities, and the use of post-mastectomy radiation, should play a role in decision making about reconstruction, which must weigh the advantages of reconstruction against the operative risk. Beyond clinical factors, as a purely elective procedure, the decision to receive reconstruction should ultimately reside with the individual patient in keeping with her values and preferences.^{11, 12} An individual's attitudes and preferences regarding healthcare result from life experiences, which are often influenced by the socioeconomic conditions in which that person exists.^{13–15} Decisions regarding elective procedures such as reconstruction can therefore systematically vary according to socioeconomic status (SES). For particular individuals, concerns about cost, prolonged time off from work and the potential need for secondary procedures can also weigh into the decision.¹⁶ However, regardless of what factors are salient, patients cannot meaningfully participate in the decision-making process without an informative discussion of reconstruction that enables them to understand and weigh the risks and benefits.

Provider bias may contribute to the observed socioeconomic differences in at least two ways. First, amongst patients without clinical contraindications, providers can decide

whether or not to discuss the option of reconstruction based on race or socioeconomic characteristics. Second, even if providers choose to discuss the option of reconstruction, the content of those discussions may vary due to cultural, educational or language barriers between patient and provider or due to differences in the provider's presentation of the risk/benefit ratio associated with the procedure. Studies suggest that patient perception of the surgeon's preference plays a major role in patient decision-making regarding breast surgery.^{17, 18} We also know that there are racial and ethnic variations in physician-patient communication and in patient perceptions of the quality of their communication with physicians.^{19–22} Figure 1 illustrates how clinical factors, patient preference, provider bias in discussing reconstruction, and qualitative aspects of communication can contribute to whether or not a patient receives reconstruction. Understanding the role of each of these phenomena in the decision-making process is crucial in designing interventions to alleviate disparities in rates of reconstruction.

METHODS

Identification of Cohort

Data were collected as part of a larger study, the National Initiative on Cancer Care Quality (NICCQ). The methodology for this study is reported in detail elsewhere.^{23, 24}

Patients were eligible for the larger study if their first diagnosis of stage I–III breast cancer occurred during 1998 and they were registered by an American College of Surgeons (ACoS)-approved hospital cancer registry located in one of five Metropolitan Statistical Areas (MSAs): Atlanta, Cleveland, Houston, Kansas City, and Los Angeles. Participants were limited to females, 21 to 80 years of age at diagnosis, who were English-speaking, and alive when contacted to participate in this study approximately four years after diagnosis. To be eligible for this analysis, participants must have received a mastectomy as definitive treatment for their incident breast cancer.

The NICCQ research team recruited a probability sample of ACoS-approved hospital cancer registries in Los Angeles and all available registries in the other four MSAs. Using ACoS National Cancer Data Base (NCDB) data, 3,194 patients with an initial diagnosis of breast cancer during 1998 were identified. After excluding 290 patients known to be deceased and 296 for whom either the doctor refused contact, the patient was out of country, or no valid contact address was available, 2608 women were confirmed to be alive. Of these women, 1690 (65%) completed the survey and 1287 (76%) of the survey respondents also had complete medical record abstraction. Of these, 626 had mastectomy and define the analytic cohort for this report.

Data Collection

Each patient completed an 18-page survey four years after diagnosis, provided consent for medical record abstraction, and submitted a listing of all providers seen since diagnosis. The NICCQ research team requested photocopies of consenting patients' ambulatory medical records from all cancer providers and primary care physicians. When abstraction revealed cancer providers not reported by the patients, those physicians' medical records were

requested and abstracted. Twelve trained nurses abstracted all available records using a computer-based medical record abstraction instrument. Data obtained from the medical record included detailed information about tumor characteristics, staging, estrogen and progesterone receptor status, referrals and decision-making, initial cancer treatment, adjunctive medications, and comorbid conditions. We used medical record data to define mastectomy. Some variables were collected from both survey and MR abstraction. An algorithm was designed for each variable based on the reliability of the method of data collection.

Data Analysis

Rates of reconstruction and documented discussion of the option of reconstruction were calculated for the cohort. Univariate analysis was used to investigate predictors of reconstruction including: clinical characteristics (age, comorbidities, and body mass index (BMI)), socioeconomic status (employment, education, race, primary language, country of birth, and insurance status), disease stage, and treatment (use of chemotherapy or radiation therapy). The number of patients receiving reconstruction was calculated for each categorical variable and compared using the Mantel-Haenszel test for trend or chi-square test as appropriate. Age and BMI were treated as continuous variables. The mean was calculated for patients receiving and not receiving reconstruction and a t-test was used for significance testing. Results for the univariate analysis are presented in categories, but the reported p-value as based on the continuous variable. All estimates and tests were weighted to account for hospital and patient non-response.²³ For the univariate analysis, significance was set at 0.10. A similar univariate analysis was performed with the same covariates for the following three other outcomes: (1) documentation of a discussion of reconstruction; (2) reconstruction given documentation of a discussion; and (3) reconstruction without documentation of a discussion

We used multivariable logistic regression to investigate predictors that were found to be significant in the univariate analysis. Missing data ranged from 0.3% – 2.4% for individual variables. Since these numbers were small, patients with missing variables were excluded from the multivariable models. Multivariable results are presented as odds ratios with 95% confidence intervals. All estimates and tests are again weighted to account for hospital and patient non-response.²³ Sample survey logistic regression was used to account for stratification according to SEER MSA and clustering within hospitals. All potential interaction terms were tested for inclusion in the model. For the multivariable models, significance was set at 0.05. Because this analysis was exploratory, we did not adjust the type 1 error rate to account for multiple comparisons; thus, p-values should be interpreted cautiously. The number of significant associations ($p < 0.05$) in these analyses is much greater than expected by chance if there were no associations in the data. SAS 9.1 was used for all analyses.

RESULTS

Of 626 patients undergoing mastectomy as definitive treatment for Stage I, II or III breast cancer in the NCCQ database, 253 (40.4%) received reconstruction. Medical records

documented the occurrence of a discussion regarding reconstruction in 249 (39.8%) of 626 patients.

Table 1 shows the unadjusted associations between the socioeconomic and race variables and whether discussion of reconstruction was documented in the chart. Reconstruction was discussed less frequently with older, less educated and uninsured patients. The prevalence of discussion regarding reconstruction was also lower for patients who did not work full-time and spoke a primary language other than English. Clinical and disease-specific variables that were found to be significant on univariate analysis include: chemotherapy use ($p = 0.004$), XRT ($p = 0.02$), body mass index ($p = 0.04$), AJCC stage ($p = 0.01$). Neither the presence of comorbidities nor lymph node involvement was associated with documentation of a discussion regarding reconstruction on univariate analysis.

Overall, 176 of 249 (70.7%) patients with a documented discussion received reconstruction. This rate varied by the number of visits with a documented discussion of reconstruction: 65% for documentation at 1 visit; 70% at 2 and 85% for 3 visits ($p < 0.0001$). Not surprisingly, using multivariable logistic regression to adjust for other covariates, the greatest predictor of reconstruction was medical record documentation of a discussion about reconstruction (OR 5.8 (95% CI 3.3 – 10.3), $p < 0.0001$).

Table 2 examines the rates of reconstruction for the entire cohort as well as the subsets of patients who either did or did not have a documented discussion of reconstruction. The same characteristics that were associated with lower rates of a documented discussion of reconstruction (increasing age, lower education levels, not working full-time, and speaking a primary language other than English) were also associated with lower rates of actually receiving reconstruction. Non-white patients and those born outside the U.S. were also less likely to receive reconstruction. Increasing age and lower levels of education were associated with lower rates of reconstruction regardless of whether there was a documented discussion of reconstruction or not. When limited to the subset of patients where reconstruction was discussed, race, not being born in the US and speaking a primary language other than English correlated with lower rates of reconstruction.

In addition, the following clinical and disease-specific independent variables were found to be significantly associated with receiving reconstruction on univariate analysis and considered for inclusion in the final multivariable models: comorbidity ($p = 0.001$); chemotherapy use ($p < 0.0001$); XRT ($p = 0.02$); and body mass index ($p = 0.02$). AJCC stage and lymph node involvement were not associated with likelihood of reconstruction on univariate analysis. If we look specifically at the subset of patients who had a documented discussion of reconstruction, only receipt of radiation was associated with subsequent reconstruction ($p = 0.007$). There was no significant association for the receipt of chemotherapy, presence of comorbidities, AJCC stage, lymph node involvement, or body mass index. When we look at receipt of reconstruction in those patients without a documented discussion of reconstruction, the presence of co-morbidities ($p < 0.0001$), use of chemotherapy ($p < 0.0001$), and BMI ($p = 0.05$) were all significantly associated with reconstruction on unadjusted analysis. There was no association for receipt of radiation, AJCC stage or LN status for this subset of patients.

Tables 3, 4 and 5 show the results of the multivariable models for documentation of a discussion of reconstruction, reconstruction overall and reconstruction contingent on a discussion. Independent predictors of medical record documentation regarding a discussion of reconstruction that persisted on multivariable modeling include age (OR 0.59 per decade, 95%CI 0.50 to 0.71), educational level (OR 3.3 for college grad v. less than HS grad, 95%CI 1.4 to 7.8), and post-mastectomy radiation (OR 0.54, 95%CI 0.38 to 0.76). (Table 3) These same characteristics, along with body mass index, were also independently predictive of reconstruction. (Table 4) The discussion of reconstruction as an option was less likely to result in the patient actually receiving reconstruction if they were older (OR 0.55 per decade, 95%CI 0.37 to 0.80), Hispanic (OR 0.35, 95%CI 0.13 to 0.94), and received post-mastectomy radiation (OR 0.34, 95%CI 0.17 to 0.66) while patients who were born in the US were more likely to receive reconstruction given a documented discussion (OR 3.5, 95%CI 1.1 to 10.6). (Table 5)

The final model investigated predictors of reconstruction among patients who did not have a documented discussion of reconstruction. Only age (OR 0.28 per decade (95%CI 0.20 to 0.40), $p < 0.0001$) was a statistically significant predictor. No other variable added significantly to the predictive model of that single variable.

DISCUSSION

In this study, we observed variations in the likelihood of reconstruction according to age, education and race after adjusting for clinical factors. These differences appear to be at least in part related to patient-provider discussion of reconstruction as an option. Medical record documentation of a discussion regarding reconstruction was less prevalent in older, less educated patients. Furthermore, following a documented discussion of reconstruction, reconstruction was less likely if a patient was older, Hispanic or born outside of the U.S.

The eradication of racial and socioeconomic disparities in healthcare has been identified as a national healthcare priority. While few would argue with this goal, there is some ambiguity, based on the principle of patient autonomy about whether racial or socioeconomic differences that reflect patient preference or values should be included under the heading of disparities.^{25, 26} For many procedures, such as amputations, revascularization for peripheral vascular disease or renal transplant, patient preferences play a small role and disparities are more readily apparent.^{27, 28}

Patterns of use are more difficult to interpret for elective procedures, like post-mastectomy reconstruction, or procedures with equivalent outcomes, such as breast conserving surgery with radiation and modified radical mastectomy. In these cases, the choice of procedure is a complex decision, influenced by the clinical scenario, access to care, patient preferences, the providers' clinical approach and their interaction with the patient.²⁹⁻³¹ Optimally, clinical decisions in such cases should reflect individual patient preference and not bias on the part of physicians.^{21, 32-34} This requires that a discussion of potential options be presented to the patient in an informative and comprehensible manner regardless of race, education, insurance or primary language spoken.

In this paper, we investigate the role that such discussions play in explaining variations in the utilization of post-mastectomy reconstruction according to race and socioeconomic status. There were fewer discussions of reconstruction options among patients that were older and less educated. While decisions about reconstruction following mastectomy should rest primarily on clinical considerations (such as radiation and obesity), we also observed variation in the likelihood of reconstruction according to age, education and race.

Age is a complex issue with regards to reconstruction. Older patients are more likely to have more co-morbidities and poorer performance status - clinical factors that may lead physicians to discuss reconstruction less frequently, but may also influence the patient's preferences and willingness to tolerate a purely elective procedure. Additionally, marital status was not included in our data set and being a widow has been previously shown to correlate with decreased rates of reconstruction.³⁵ Other work suggests certain psychological characteristics could explain the lower rates of reconstruction observed in older patients. Perceived importance of body image, a lack of fear regarding surgery and the ability to discuss surgical choices with a partner were associated with a greater likelihood of reconstruction.¹⁷ While these issues may play a role, it's important to recognize other possible etiologies of the age disparities that have been documented in the treatment of breast cancer.^{33, 36-38} Documented variations in the patient-physician interaction based on age have been linked with differences in the likelihood that appropriate quality breast cancer care was received.^{39, 40} To avoid age bias, reconstruction should be discussed with older patients so that an informed decision based on the clinical situation and patient preferences can be reached.

While a lower prevalence of discussions regarding reconstruction appears to play a role in explaining disparities in reconstruction, our data do not address whether the physician or the patient initiated the discussion. It is possible that women who are younger and more educated are more likely to initiate a discussion of reconstruction with their provider, thus accounting for the higher rates. Whether the provider or the patient initiates the discussion, the observed differences still reflect the physician's behavior. Physicians should systematically address the issue of reconstruction, starting with whether or not the patient is a reasonable candidate based on the clinical situation, with all patients rather than relying on patients to inquire about it.

Considering Figure 1, we next wanted to investigate the factors that predict reconstruction conditional on a documented discussion. Older age was again associated with a lower likelihood of reconstruction. As suggested above, this may reflect patient preference or qualitative aspects of the patient-physician communication. On multivariable modeling the other independent predictors of reconstruction after a discussion is documented are whether the patient was born in the U.S. and Hispanic ethnicity. While this may reflect ethnic differences in patient preferences, it may also be due to communication difficulties between the patient and provider, due to language or cultural barriers or otherwise. Further evidence that the quality of the communication during the discussion of reconstruction may play a role is suggested by the lower rates of reconstruction among patients who speak a language other than English as their primary language. While 72% of patients who primarily spoke English went on to receive reconstruction after discussing it with their providers, no patient

with a primary language other than English did. The small sample size (8 patients) in this latter group limited the use of this variable in our multivariable model. In order to ensure adequate comprehension of the patient survey, the study was limited to patients who spoke English, so it is difficult to draw conclusions about the language effect. Our data do not allow us to differentiate between patient preference and qualitative differences in patient-physician communication as the underlying explanation for the different rates of reconstruction following a discussion about the option, but there are plausible reasons to think that both play a role.

Our analysis has several other important limitations. By design, the patients included in this analysis were contacted three years after diagnosis. While delay following diagnosis may ensure complete information about chemotherapy, radiation, and outcomes, it does not have any advantage for surgical analyses such as this and may lead to lower response rates and more difficulty with chart abstraction. Since documentation of reconstruction is one of the primary outcomes for this analysis, we directly investigated this potential for bias.

Twenty-two percent of patients who lacked documentation of a discussion regarding reconstruction actually received reconstruction; however, reconstruction is necessarily preceded by discussion, suggesting misclassification. This lack of documentation would alter our results only if it were related to patients' socioeconomic characteristics. In order to determine whether this was the case, we tested whether the 22% of patients with reconstruction but without documentation of a discussion differ from the patients who do not have reconstruction. Older patients were less likely to receive reconstruction in the absence of a documented discussion; however none of the other covariates were significant, suggesting minimal, if any, documentation bias related to socioeconomic factors or race.

Another important limitation to this study relates to insurance status. Given the high cost and elective nature of reconstruction, the quality of an individual's insurance plan is likely to influence their decision to pursue reconstruction. These differences are not well-measured by our binary treatment of insurance (any insurance vs. none). Differences in insurance coverage may explain a portion of the observed socioeconomic variations and cannot be adequately addressed in this study.

The likelihood of post-mastectomy breast reconstruction varies based on the race and socioeconomic status of the patient. This study suggests three potential explanations for this: (1) patient-provider discussions of the option of reconstruction occur less frequently in vulnerable populations; (2) there are differences in qualitative aspects of patient-physician communication during these discussions, potentially based on language, educational, or cultural barriers; and (3) age-based and ethnic or cultural differences in patient preferences regarding reconstruction. While patient preferences should be respected, an informative discussion of reconstruction as an option is required for meaningful decision-making. It is the responsibility of physicians to universally address the issue of reconstruction (within the constraints of the clinical situation) with all women undergoing a mastectomy regardless of age, race, or socioeconomic status. Furthermore, physician-patient communication during these discussions should be optimized through the use of interpreters and educational materials that ensure comprehension regardless of primary language, ethnicity, or

educational level. Such efforts to increase and improve discussions of reconstruction for these vulnerable populations may decrease disparities in the utilization of this procedure.

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Figure 1. Schema depicting the factors that potentially contribute to whether a patient receives reconstruction following mastectomy

Patients cannot meaningfully participate in decision-making without an informative discussion of reconstruction as an option. Once mastectomy is considered as a surgical option, reconstruction should be discussed. This discussion may or many not take place based on clinical factors; however, the may also omit the discussion due to bias based on non-clinical factors. Once the discussion is initiated, there are a number of factors that determine whether a decision is made to proceed with the mastectomy with or without reconstruction. These relate to clinical factors, patient preferences, provider preferences and how these are communicated to the patient. The provider may present incomplete data about probabilities for outcomes with as compared to without reconstruction. Patient-provider communication could be limited because of non-clinical factors (e.g., limited visit time, limited English proficiency, etc.). The factors in *italics* represent potential target areas to decrease disparities.

Table 1

Documentation of Discussion Regarding Reconstruction

Variable	n*	Documented discussion of reconstruction, n (%) [†]	p Value
Age, y			
25–34	10	3 (30)	<0.0001 [‡]
35–44	37	19 (51)	
45–54	169	74 (44)	
55–64	150	73 (49)	
65–74	155	45 (29)	
75+	105	15 (14)	
Born in US			
No	80	28 (35)	0.74
Yes	546	201 (37)	
Primary Language			
English	562	38	0.007
Other	42	18	
Race			
African American	50	13 (27)	0.13 [§]
Asian	22	11 (51)	
Hispanic	63	20 (32)	
Caucasian	523	198 (38)	
Any Insurance			
Yes	603	226 (38)	0.015
No	23	3 (12)	
Employment			
Full-time	270	119 (44)	0.0005
Part-time	72	25 (35)	
Not working	281	84 (30)	
Educational Level			
< 8 th grade	40	4 (11)	<0.0001
Some HS	28	6 (20)	
HS grad/GED	163	51 (32)	
Some college	214	84 (39)	
College grad	83	43 (52)	
> College grad	87	36 (41)	
Radiation			
Yes	234	69 (30)	0.023
No	392	160 (41)	

Variable	n*	Documented discussion of reconstruction, n (%) [†]	p Value
Co-morbidities			
Yes	243	87 (36)	0.69
No	383	143 (37)	
Chemotherapy			
Yes	377	155 (48)	0.004
No	249	74 (30)	
Positive LN			
Yes	248	98 (41)	0.20
No	378	131 (35)	
AJCC Stage			
I	266	88 (33)	0.01
II	293	116 (40)	
III	44	23 (52)	
BMI			
<20	33	17 (51)	0.04 [‡]
20 – <25	219	91 (41)	
25 – <30	213	69 (32)	
30	161	53 (33)	

For each variable, the number of patients in each category are listed, followed by the percent of those patients that have a documented discussion of reconstruction in the chart. p Values were derived using Mantel-Haenszel Test for Trend for ordered variables and chi-square for categorical variables.

* Some categories do not add up to 626 because approximately 3 of patients were missing at least one variable.

[†] Because of weighting as described in the methods section, counts and percentages may not correlate exactly due to rounding differences.

[‡] The p value is derived using a t-test treating BMI and age as continuous variables.

[§] The p value is calculated comparing Caucasian patients to all other groups.

Table 2

Rates of Reconstruction

Variable	Overall, n (%) [*]	p Value	Discussion, n (%) [*]	p Value	No discussion, n (%) [*]	p Value
Age, y						
25–34	10 (100)		3 (100)		7 (100)	
35–44	26 (71)		15 (81)		11 (62)	
45–54	99 (58)		56 (75)		43 (45)	
55–64	66 (44)	<0.0001	48 (66)	0.0019	18 (23)	<0.0001 [†]
65–74	34 (22)		28 (62)		7 (6)	
75+	7 (7)		6 (41)		1 (1)	
Born in US						
No	23 (29)		10 (37)		13 (25)	
Yes	220 (40)	0.049	146 (73)	0.0001	73 (21)	0.61
Primary language						
English	229 (41)		154 (72)		74 (21)	
Other	7 (16)	0.002	0	<0.0001	7 (20)	0.82
Race						
African American	16 (33)		9 (68)		7 (20)	
Asian	7 (31)		5 (43)		2 (20)	
Hispanic	19 (30)	0.002 [†]	9 (43)	0.018 [†]	10 (24)	0.12 [‡]
Caucasian	217 (41)		141 (71)		76 (23)	
Any insurance						
Yes	239 (40)		153 (68)		86 (23)	
No	3 (12)	0.009	3 (100)	0.25	0 (0)	0.016
Employment						
Full-time	134 (50)		83 (70)		51 (34)	
Part-time	28 (39)		15 (60)		13 (28)	
Not working	79 (28)	<0.0001	57 (68)	0.70	22 (11)	<0.0001

Variable	Overall, n (%) [*]	p Value	Discussion, n (%) [*]	p Value	No discussion, n (%) [*]	p Value
Education						
< 8 th grade	1 (3)		1 (31)		0 (0)	
Some HS	5 (17)		3 (45)		2 (10)	
HS grad/GED	49 (30)		29 (56)	0.001	20 (18)	0.0003
Some college	100 (47)	<0.0001	59 (71)		41 (31)	
College grad	38 (46)		30 (69)		8 (20)	
> College grad	45 (52)		30 (85)		15 (30)	
Radiation						
Yes	77 (33)	0.023	39 (56)	0.007	39 (24)	0.47
No	165 (42)		228 (74)		48 (20)	
Co-morbidities						
Yes	168 (44)	0.001	57 (66)	0.51	18 (12)	<0.0001
No	75 (31)		100 (70)		68 (28)	
Chemotherapy						
Yes	182 (48)	<0.0001	111 (72)	0.17	71 (32)	<0.0001
No	61 (24)		46 (62)		15 (9)	
Positive LN						
Yes	98 (38)	0.64	65 (66)	0.58	28 (19)	0.26
No	150 (40)		91 (70)		58 (24)	
AJCC Stage						
I	99 (37)		63 (72)		36 (20)	
II	120 (41)	0.98	81 (70)	0.11	38 (22)	0.65
III	14 (31)		11 (50)		2 (10)	
BMI						
<20	11 (34)		10 (59)		1 (9)	0.05#
20 – <25	103 (47)	0.02	69 (76)	0.98	34 (26)	
25 – <30	68 (32)		36 (53)		32 (22)	
30	60 (37)		42 (79)		19 (17)	

For each variable, the number and percentage of patients who receive reconstruction is presented for the entire cohort of patients as well as the subset of patients with and without a documented discussion of reconstruction as an option. p Values were derived using Mantel-Haenszel Test for Trend for ordered variables and chi-square for categorical variables.

* Due to weighting as described in the methods section, counts and percentages may not correlate exactly due to rounding differences.

[†] The p value is derived using a t-test treating BMI and age as continuous variables.

[‡] The p value is calculated comparing white patients to all other groups.

Table 3

Multivariable Model to Determine Predictors of Documentation of a Discussion Regarding Reconstruction as an Option

Variable	OR	95 CI	p Value
Age (per decade)	0.59	0.50 – 0.71	<0.0001
Education			0.020
< High school graduate	Ref		
High school graduate or some college	2.6	0.99 – 6.7	
College graduate or more	3.3	1.4 – 7.8	
Radiation	0.54	0.38 – 0.76	0.0005

n = 606 with 244 having documentation of discussion; c statistic = 0.702. The following variables were considered, but not included in the final model: AJCC stage, employment status, insurance status, African-American race, receipt of chemotherapy, body mass index.

Table 4

Multivariable Model to Determine Predictors of Reconstruction.

Variable	OR	95 CI	p Value
Age (per decade)	0.33	0.26 – 0.43	<0.0001
Race (Caucasian versus other)	2.8	1.2 – 6.6	0.016
Education			0.024
< High school graduate	Ref		
High school graduate or some college	3.3	0.94 – 11.4	
College graduate or more	4.8	1.5 – 15.3	
Radiation	0.38	0.24 – 0.59	<0.0001
BMI (per point)	0.96	0.92 – 0.99	0.029

n= 605 with 245 patients receiving reconstruction; c statistic = 0.785. The following variables were considered, but not included in the final model: employment status, receipt of chemotherapy, whether the patient was born in US, insurance status, presence of comorbid conditions.

Table 5

Multivariable Model to Determine Predictors of Reconstruction Given Documentation that a Discussion Regarding Reconstruction Took Place

Variable	OR	95 CI	p Value
Age (per decade)	0.55	0.37 – 0.80	0.002
Born in the U.S.	3.5	1.1 – 10.6	0.03
Hispanic	0.35	0.13 – 0.94	0.04
Radiation	0.34	0.17 – 0.66	0.001

n = 243 with 172 patients receiving reconstruction; c statistic = 0.675. The following variables were considered, but not included in the final model: African-American race and educational level.