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Factors Associated with Patient Involvement in Surgical Treatment Decision Making for Breast Cancer

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Abstract

Objective—To evaluate factors associated with women’s reported level of involvement in breast cancer surgical treatment decision making, and the factors associated with the match between actual and preferred involvement in this decision.

Methods—Survey data from breast cancer patients in Detroit and Los Angeles was merged with surgeon data for an analytic dataset of 1,101 patients and 277 surgeons. Decisional involvement and the match between actual and preferred amount of involvement were analyzed as three-level dependent variables using multinomial logistic regression controlling for clustering within surgeons. Independent variables included patient demographic and clinical factors, surgeon demographic and practice factors, cancer program designation, and two measures of patient-surgeon communication.

Results—We found variation in women’s decisional involvement and match between actual and preferred involvement. Women with a surgeon-based or patient-based (vs. shared) decision were significantly ($p \leq 0.05$) younger. Women who had too little decisional involvement (vs. the right amount) were younger, while women with too much involvement had less education. Patient-surgeon communication variables were significantly associated with both involvement and match, and higher surgeon volume as associated with too little involvement.

Conclusion—Patient factors and patient-surgeon communication influence women’s perception of their involvement in breast cancer surgical treatment decision making.

Practice Implications—Decision tools are needed across surgeons and practice settings to elicit patients’ preferences for involvement in treatment decisions for breast cancer.

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Keywords

breast cancer; surgical treatment; decision making; involvement

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1. Introduction

Shared decision making in cancer treatment has been advocated based on the premise that patient involvement in medical decisions enhances quality of care¹. Increasing shared decision making has been particularly emphasized for preference-sensitive care, or care situations in which there are two or more treatment options that are medically justified². Many policy makers, clinicians and patients have argued that surgical treatment for breast cancer represents an excellent opportunity for shared decision making between patient and provider given that both mastectomy and breast conserving surgery (BCS) with radiation offer equivalent survival rates for women with early stage breast cancer^{3–6}. Though the debate over appropriate surgical treatment has been mainly focused on stages I, II, and some stage III breast cancer, research from our team suggest that the decision-making issues are largely the same for women with stage 0 cancer (i.e., ductal carcinoma in situ, DCIS)⁷. Moreover, recent clinical data found that, similar to invasive disease, rates of recurrence and survival for women with DCIS treated with mastectomy and BCS with radiation were similar⁸.

This emphasis on the importance of the decision making process has motivated provider and health system efforts to increase patient involvement in breast cancer surgical treatment decision making. These efforts include expanding patient access to multidisciplinary provider teams at the time of diagnosis, and developing information tools designed specifically to assist patients with decision making^{9–13}.

There are significant challenges to increasing patient involvement in breast and other cancer treatment decision making. The many treatment recommendations in cancer are based on increasingly complicated clinical algorithms^{14, 15}. Patients must absorb this information at the time of diagnosis and engage many different clinicians and staff in the treatment planning. Research shows that there is marked variation in patients' desire for involvement in different cancer treatment decisions, and that not all patients desire an active role in all decisions^{16–18}. Furthermore, a substantial proportion of patients report a mismatch between their actual versus preferred role in surgical treatment decisions, with patients reporting having both too little and too much involvement^{4, 19, 20}. This mismatch is associated with lower patient satisfaction with both the decision making process and choice of treatment⁴.

There is remarkably little research on the factors associated with patient involvement in decision making and virtually none to shed light on factors associated with achieving a match between preferred and actual involvement in treatment decisions. The few studies that have done so did not examined clinician or health system factors that may be associated with patient involvement in decision making. Understanding factors associated with patient reports of their actual and preferred role in breast cancer treatment decision making can inform strategies to improve patient satisfaction with care and the quality of patient-provider communication.

This paper addresses the following two research questions: 1) what are the patient, surgeon and healthcare system factors associated with women's actual involvement in surgical breast cancer treatment (i.e., mastectomy vs. BCS with or without radiation therapy) decision making; and 2) what are the patient, surgeon and healthcare system factors associated with the match between women's actual and preferred levels of involvement in this decision?

2. Methods

2.1. Study sample

The patient and surgeon samples used in this study have been described elsewhere^{4, 7, 21–27}. Briefly, we performed a survey of a population-based sample of 2,645 women with breast cancer diagnosed in Detroit and Los Angeles metropolitan areas (12/2001–1/2004), of whom 2,382 were eligible for the study. Patients were identified from the area Surveillance, Epidemiology and End Results (SEER) databases; all those with ductal carcinoma in situ (DCIS) and an approximate 20% random sample with invasive (but not metastatic) disease were accrued during the study period. African American women were oversampled to provide sufficient numbers to evaluate patterns of treatment and/or decision making related to race. The response rate was 77.4% (N=1,844). Pathology reports were used to identify surgeons (N=456) for 98.5% of the patient sample. Surgeons were contacted by mail and asked to participate in a brief, self-administered survey to evaluate their perspectives about surgical treatment for breast cancer. We followed the Dillman method for both patient and surgeon surveys - which involved a postcard reminder and subsequent mailings to non-responders - to maximize response rates^{28, 29}. A telephone interview was requested for surgeons who did not complete the mailed survey (n=10). The surgeon response rate was 80.0% (N=365).

Surgeon respondents were linked to patient respondents using unique identifiers derived from the pathology reports (94.6%). The final merged dataset contained complete patient-surgeon dyad information for 65.0% of accrued and eligible patients (N=1,547) and 69.7% of accrued surgeons (N=318). Patients who were excluded because of not having a surgeon match did not differ significantly from included patients on basic demographics. Surgeons who were not matched with patients (i.e., patient survey data was incomplete) were more likely to have lower self-reported breast procedure volume.

For this analysis, we included women whose documented summary stage in SEER was DCIS, I, II or III based on treatment guidelines of both the National Cancer Institute Physician Data Query (NCI-PDQ) database and the National Comprehensive Cancer Network (NCCN) that describe both mastectomy and BCS with radiation as viable options for these stages of cancer^{14, 15}. We excluded women with tumors of 5cm or larger since these guidelines recommend against BCS in this case. In addition, we excluded approximately 10% of the merged sample who potentially had a clinical contraindication to BCS, based on a review of SEER information, and were therefore not candidates for receipt of either treatment. When these exclusions were made, our final analytic sample was 1,101 patients of 277 surgeons.

The patient survey procedures followed protocol established by the SEER registries for contacting patients. The study protocol was approved by the Institutional Review Boards of the University of Michigan, the University of Southern California, and Wayne State University.

2.2. Measures

Both the patient and surgeon surveys were developed based on extensive pilot testing. Several articles using these instruments have been published^{4, 7, 21–27}. Further detail regarding the measures used in this analysis are described below.

2.2.1. Dependent variables—We used two dependent variables for this analysis, both taken from the patient survey: 1) actual involvement in the breast cancer surgery decision (actual involvement); and 2) match between actual and preferred involvement in this decision (match). The first dependent variable was measured using the Control Preferences Scale (CPS) developed by Degner (1992)³⁰ where respondents were asked to choose the best response from the following list: a) my doctor(s) made the surgery decision with little input from me; b) my

doctor(s) made the surgery decision but seriously considered my opinion; c) my doctor(s) and I made the surgery decision together; d) I made the surgery decision after seriously considering my doctor(s) opinion; or e) I made the surgery decision with little input from my doctor(s). For purposes of these analyses, we re-coded this into three categories: 1) doctor-based (options a or b); 2) shared/collaborative (option c); or 3) patient-based (options d or e). This re-categorization is consistent with two prior papers from our research team evaluating patient involvement in breast cancer treatment decision making^{4, 21} and has been also been applied in other research^{12, 21}. Since one might argue that categories (b) and (d) represent sufficiently different constructs than (a) and (e), we also did the analysis using all five categories. The results for categories (b) and (d) were not significantly different than those of (a) and (e), respectively; thus, we retained our 3-level categorization.

A modified version of the CPS was used to measure women's preferred role in the surgery decision. After answering the CPS, respondents were asked to choose the response that best fit how they preferred that the surgery decision had been made. The same categories were used, from (a) I would have preferred that the surgery decision was made by my doctor(s) with little input from me to (e) I would have preferred to have made the surgery decision with little input from my doctor(s). Responses to this question were compared with responses to the 5-level CPS to develop several categories of match between actual and preferred involvement. These categories were then categorized into three level: 1) respondents who felt they had **too little involvement** in the surgery decision; 2) respondents who felt they had **the right amount of involvement**; and 3) respondents who felt they had **too much involvement** in the surgery decision. The three-level categorization of match has been used in a prior publication with these data⁴.

2.2.3. Patient-related independent variables—We evaluated demographic and clinical variables taken from the patient survey. Patient demographics included age, race/ethnicity (white, nonwhite), and education (high school graduate or less, some college or more). We grouped respondents who were African American (n=249), Hispanic/Latina (n=93), or of other racial/ethnic backgrounds (n=20) together because of small sample sizes. We evaluated age both as a continuous and categorical (29–44, 45–64, 65–79) variable. The clinical variables used in the analysis were from the SEER record and included the tumor size in centimeters and tumor behavior (DCIS or invasive). We chose these variables because this information is generally available at the time of surgery consultation, while tumor pathologic stage is not available until after the biopsy.

2.2.4. Healthcare system independent variable—We evaluated one variable to measure the cancer program designation for the sites where patients in our sample were treated. We obtained information on the cancer program designation of the patient's treatment location from the SEER data. This variable was categorized into three groups: 1) NCI-designated cancer center; 2) American College of Surgeons (ACOS) cancer program; or 3) no specific cancer program.

2.2.5. Surgeon-related independent variables—We evaluated two sets of surgeon-level independent variables: 1) breast cancer procedure volume; and 2) demographics. To measure volume, we recoded the reported number of total breast procedures in the past year into two categories: low (<50 procedures per year) vs. high (≥ 50 procedures per year). Demographics included gender and years in practice.

2.2.6. Patient-surgeon communication variables—We used three variables from the patient survey as measures of two underlying mechanisms that may affect patients-surgeon communication. The first communication variable, treatment discussion, was defined as patient report of whether treatment options were discussed, with response options of: 1) yes-both

discussed; 2) no-only BCS discussed; 3) no-only mastectomy discussed. The second communication variable, patient request/surgeon recommendation, was created from two variables from the patient survey. The first was the patient's report of whether she requested a treatment recommendation from her surgeon (yes vs. no), and the second was the patient's report of whether her surgeon made a treatment recommendation (yes vs. no). From these two variables, we created the four-level patient request/surgeon recommendation variable: 1) patient asked for and received a treatment recommendation; 2) patient asked for but did not receive a treatment recommendation; 3) patient did not ask for but did receive a treatment recommendation; and 4) patient did not ask for and did not receive a treatment recommendation. We used this combined four-level variable rather than including patient request and surgeon recommendation as separate variables because of our hypothesis that the potential concordance (or discordance) between a patient asking for and/or receiving a treatment recommendation is an underlying mechanism related to her feelings of decisional involvement.

2.3. Analysis

We first generated descriptive statistics for the patient and surgeon variables described above. We then evaluated bivariate associations, including potential multicollinearity, between independent and dependent variables.

2.3.1. Correlates of involvement in decision making—We then conducted multinomial logistic regression for both of our three-level dependent variables. For the first model—patient actual involvement in the surgery decision—we used the shared decision as the base category (i.e., reference category). We regressed the 3-level actual involvement outcome on all variables described above (patient-level, surgeon-level, healthcare system, and patient-surgeon communication variables).

For the second model—match between preferred and actual involvement in the surgery decision—we used the right amount of involvement as the base, or reference, category. We followed the same procedures as in the first model, regressing the 3-level match dependent variable on the patient-level, surgeon-level, healthcare system, and patient-surgeon communication variables.

We accounted for clustering of patients within surgeons and controlled for site (Detroit vs. LA) in each model. For each model, we also conducted a Hausman test for independence of irrelevant alternatives (IIA test) to ensure that our three-level comparison for each outcome was correctly specified³¹. Only variables that were significantly correlated with each outcome at $p \leq 0.05$ are listed in the tables.

2.3.2. Confounding by surgeons—In separate analyses we evaluated the distribution of patients across surgeons to determine if any associations found were due to clustering of certain types of patients with specific surgeons (between-surgeon effect) or because associations were more common for certain types of patients seeing the same surgeon (within-surgeon effect)^{32, 33}.

3. Results

The final sample size for this analysis was 1,038 patients of 270 surgeons due to missing responses from patients and/or surgeons. Patients excluded from the analysis did not differ significantly from included patients on demographic or clinical variables, while excluded surgeons were more likely to be low-volume providers. The mean time between the date of definitive surgical treatment and response to the survey was 6.9 months. Over 90% of women

reported that they had completed radiation and chemotherapy treatment by the time they participated in the survey.

3.1. Actual involvement in decision making and match

Thirty-eight percent of women reported a shared surgical treatment decision, 39% reported a patient-based decision, and 22% reported a surgeon-based decision. Two-thirds (66%) reported a match between actual and preferred involvement in the breast cancer surgery decision, while 21% reported having more involvement than they preferred, and 13% reported having less involvement than they preferred.

3.2. Patient and surgeon characteristics

The mean age of patients was 59 years (range 29–79). Table 1 shows that the majority were white (68%), followed by other race (32%). Almost two-thirds reported having some college or more educational attainment. Approximately half the women had DCIS (44%) and invasive breast cancer (56%). About half were treated in a facility with an American College of Surgeons cancer program (55%), 12% were treated in a NCI-designated cancer center, with the remainder (33%) treated in a facility with no cancer program designation. Seventy percent of respondents reported that their surgeon discussed both treatment options with them, while 8% reported that their surgeon discussed only mastectomy and 22% that only BCS was discussed. There was substantial variation in the four categories of the patient request/surgeon recommend variable: 1) women who asked for and received a treatment recommendation (48%); 2) women who asked for but did not receive a treatment recommendation (20%); 3) women who did not ask for but did receive a treatment recommendation (16%); and 4) women who did not ask for and did not receive a treatment recommendation (16%). On quarter of women reported receiving mastectomy (25%), with the remainder (75%) receiving BCS (with or without radiation therapy).

Of the 270 surgeons included in this analysis, 15% were female and the mean number of years in practice was 17 (range: 1–39). Approximately half the surgeons reported performing 50 or more breast cancer related procedures per year (51%).

3.3. Patient-surgeon distribution and confounding

The mean number of patients per surgeon was 4.4 with a range of 1 to 30. The distribution of patient factors across surgeons was not uniform for patient age and race, suggesting the possibility of a “within-surgeon” effect³². We controlled for this clustering in our regression models.

3.4. Factors associated with actual involvement

Table 2 shows the multinomial logistic regression results for factors significantly associated ($p \leq 0.05$) with women’s reports of their actual involvement in the breast cancer surgery decision. Those who reported a shared decision were the reference category. The second column shows the adjusted odds ratio for patient report of a surgeon-based vs. a shared decision for each variable listed compared to the appropriate reference group. The odds ratio for reporting a surgeon-based vs. shared decision was 1.73 (95% CI: 1.19–2.51) for women age 45–64 compared to women age 65–79. The odds of reporting a surgeon-based vs. shared decision was significantly higher among women who reported that only one type of surgery was discussed (OR: 2.50; 95% CI: 1.22–5.14, OR: 3.26; 95% CI: 2.22–4.81 for mastectomy-only and BCS-only, respectively).

The third column of Table 2 shows adjusted odds ratios for patient report of a patient-based vs. shared decision. Patient age was not significantly associated with patient’s reports of a

patient-based vs. a shared decision. However, women treated at a facility with an ACoS cancer program had a greater odds of reporting a patient-based decision than a shared decision than women treated at a facility with no cancer program (OR: 1.43, 95% CI: 1.03–2.00). The odds of reporting a patient-based vs. shared decision was lower for women who said BCS only was discussed (OR: 0.39; 95% CI: 0.24–0.62), but higher for women who said they either did not ask for and did not receive a treatment recommendation (OR: 2.06; 95% CI: 1.31–3.25) or who said they did ask for but did not receive a treatment recommendation (OR: 1.97; 95% CI: 1.33–2.96). No other patient or surgeon factors were associated with likelihood of reporting either a surgeon- or a patient-based (vs. shared) decision.

3.5. Factors associated with match between actual and preferred level of involvement

Column 2 of Table 3 shows the odds of reporting having too little involvement vs. the right amount. The odds of reporting too little involvement vs. the right amount was higher for younger women (age 29–44 years) (OR: 3.33; 95% CI: 1.41–7.89) compared to those age 65–79 years, and women age 45–64 years were also more likely than the older group to report having too little involvement (OR: 2.12; 95% CI: 1.33–3.41). The odds of reporting too little vs. the right amount of involvement was significantly higher for women with high volume surgeons than for women with low volume surgeons (OR: 1.68; 95% CI: 1.07–2.63). Women who said their surgeon discussed mastectomy or BCS only were significantly more likely to report having too little vs. the right amount of involvement (OR: 3.90; 95% CI: 1.56–8.91 for mastectomy-only; OR: 3.18; 95% CI: 2.13–5.00 for BCS-only).

Column 3 of Table 3 shows the factors significantly associated with women's report of too much vs. the right amount of involvement. Women with a high school or lower educational level were more likely (OR: 1.46; 95% CI: 1.02–2.14) to perceive having too much involvement (vs. the right amount) than more educated women. Discussing one of the treatment options (vs. discussing both) did not influence the odds of reporting too much involvement, however women who said that they asked for but did not receive a treatment recommendation were more likely (OR: 1.67; 95% CI: 1.09–2.69) to report that they had too much involvement. No other patient, surgeon or healthcare setting factor was significantly associated with women's reports of involvement mismatch (too little or too much) compared to the right amount of involvement.

4. Discussion and conclusion

We found variation in women's reports of their actual involvement in breast cancer surgical treatment decision making and whether or not they felt they had the right amount of involvement. This variation existed regardless of whether women had DCIS or invasive breast cancer. These results are consistent with other studies which demonstrated a discrepancy between patients' actual and preferred levels of involvement in breast cancer treatment and other medical decisions^{19, 20, 34}, and research showing variation in patients' preferences for participating in medical decision making^{16, 35}. Moreover, prior work by our research team⁴ and others²⁰ has shown that achieving a match between actual and preferred involvement in breast cancer treatment decision making is a strong predictor of patient satisfaction, which is in turn, a key determinant of quality care¹. Yet ours one of very few studies to evaluate factors associated with involvement in decision-making.

4.1. Discussion

Our findings suggest that desire for involvement may vary according to patient age and/or educational status. Thus, targeted interventions to evaluate patient preferences for decision making may be needed to improve physician-patient communication and decrease mismatch between actual and preferred involvement levels.

Although concerns over lack of patient involvement in surgical breast cancer decision making has motivated laws in 20 states mandating that surgeons discuss both treatment options with eligible patients^{36–38}, we found almost one-third of patients reported that their surgeon only discussed one treatment option, primarily BCS. Women tended to perceive too little involvement if they were presented one surgical treatment option, suggesting that failure to discuss both options is a mechanism driving patients' perceptions of mismatch in decisional involvement.

Another mechanism related to mismatch was the surgeon's response to patient requests for treatment recommendations. Some women perceived too much involvement if they asked for a treatment recommendation but did not get one. This finding suggests that there are circumstances where surgeons may not be aware of patients' preferences for increased surgeon involvement in the treatment decisions. By not providing a requested recommendation, surgeons may have forced women to have more responsibility for the final decision than these women preferred (i.e., "too much involvement"). Others have found that surgeons are not able to predict their patients' desire for involvement in breast cancer treatment decision making^{33, 39}. Our results suggest that for some patients, more proactive input from surgeons—especially when prompted by the patient—is desirable.

We found that higher surgeon volume was associated with women's reports of too little involvement. Several studies have shown that surgeon procedure volume is associated with patterns of surgery treatment in their patients⁴⁰. However, prior research has not demonstrated a link between procedure volume and more effective communication. Our findings suggest that clinical experience may not necessarily translate into communication styles that are responsive to patients' preferences for involvement. Thus, the challenge to improve patient-surgeon communication, from the patients' perspective, remains across a wide range of clinician experience and practice settings.

Our results need to be interpreted in the context of some limitations. First, all data was self-reported providing opportunity for problems with recall. Patients were from two geographic areas which limited generalizability to all breast cancer patients in the U.S. and we did not have representation of all racial/ethnic groups affected by breast cancer. We lost some data on both surgeons and patients when we linked the datasets, and missing surgeons were more likely to be those with lower caseloads of breast cancer patients. While we recognize the limitations of the CPS as a measure of patient involvement in decision making, its use allows us to compare findings with research that has used this measure. Finally, we did not have information about whether surgical choices were presented as reasonable options, however we do know that over 85% of women reported being satisfied with the amount of information they received. Further work to validate patient reports of involvement and interactions with surgeons is needed.

4.2. Conclusion

Our results underscore the importance of addressing patient preferences for involvement in decision making in current strategies to improve patient-provider communication for surgical treatment decision making in both DCIS and invasive breast cancer. Our findings are consistent with a recent review by Kiesler and Auerbach⁴¹ which concluded that there is a need for interventions designed to assist physicians in improving "preference sensitive" care that incorporate patients' preferences for decisional involvement as well as treatments⁴¹. Our results are also in line with those of others¹⁷ who emphasize the challenge for providers in eliciting the preferences of individual patients and including them in clinical decision making.

4.3. Practice implications

Existing strategies focused on increasing the quality of cancer treatment decisions need to address patients' preferences for involvement, particularly for specific patient populations, such as younger women and those with lower levels of education. One simple strategy could involve the implementation of a feedback loop whereby physicians inquire about patients' preferences for decisional involvement at the beginning of the clinical encounter and assess patients' level of satisfaction at the end¹⁸. Decision tools could be used to deliver information and incorporate patients' preferences for involvement prior to the clinical encounter. Our results motivate more research on the impact of innovations in decision support strategies aimed at improving decision making for cancer treatment.

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Table 1
 Characteristics of breast cancer patients in Detroit and Los Angeles Metropolitan Areas, 2002 (n=1,038)

Characteristics	%
Actual involvement in surgery decision	
Patient-based	39
Shared	38
Surgeon-based	22
Match between actual and preferred involvement in surgery decision	
Too little involvement	13
Just right amount of involvement	66
Too much involvement	21
Site	
Detroit	52
Los Angeles	48
Categorical age	
Age 29–44	10
Age 45–64	56
Age 65–79	34
Race/ethnicity	
White	68
Nonwhite	32
Education	
High school graduate or less	36
Some college or more	64
Tumor behavior	
DCIS	44
Invasive cancer	56
Treatment received	
Mastectomy	25
Breast conserving surgery (with or without radiation)	75
Cancer program affiliation of treatment location	
None	33
American College of Surgeons cancer program	55
NCI-designated cancer center	12
Treatment discussion	
Mastectomy only discussed	8
BCS only discussed	22
Both options discussed	70
Patient request/surgeon recommendation	
Did not ask for and did not receive	16
Did not ask for but did receive	16
Asked for but did not receive	20
Asked for and did receive	48

Table 2

Factors Associated with Patients' Reports of their Actual Involvement in Surgical Breast Cancer Treatment Decision-Making

Correlates ⁺ [^]	Actual Involvement in Decision	
	Surgeon-based vs. Shared OR (95% CI)	Patient-based vs. Shared OR (95% CI)
Patient and Surgeon Independent Variables		
Patient age:		
29–44	1.61 (0.79–3.11)	0.75 (0.39–1.43)
45–64	1.73 (1.19–2.51)*	1.34 (0.93–1.91)
65–79	Referent	Referent
Healthcare System Variables		
Cancer program designation:		
ACoS Cancer Program	1.14 (0.74–1.75)	1.43 (1.03–2.00)*
NCI-designated Cancer Center	1.21 (0.58–2.55)	0.95 (0.51–1.78)
None	Referent	Referent
Patient-Surgeon Communication		
Treatment discussion:		
Mastectomy only discussed	2.50 (1.22–5.14)*	1.02 (0.52–2.01)
BCS only discussed	3.26 (2.22–4.81)*	0.39 (0.24–0.62)*
Both options discussed	Referent	Referent
Patient request/surgeon recommendation:		
Did not ask for and did not receive	1.23 (0.72–2.10)	2.06 (1.31–3.25)*
Did not ask for and did receive	1.53 (0.93–2.50)	1.06 (0.63–1.79)
Asked for and did not receive	0.79 (0.43–1.42)	1.97 (1.33–2.96)*
Asked for and did receive	Referent	Referent

⁺ note site (Detroit vs. LA) is controlled for.

[^] controlling for all variables (race/ethnicity, education, tumor behavior, tumor size, surgeon gender, surgeon years in practice, surgeon volume).

* significant at $p \leq 0.05$.

Table 3

Factors Associated with Match Between Patients' Actual and Preferred Involvement in Surgical Breast Cancer Treatment Decision-Making

Correlates ⁺ [^]	Match between Actual and Preferred Involvement in Decision	
	Too little vs. Right amount OR (95% CI)	Too much vs. Right amount OR (95% CI)
Patient and Surgeon Independent Variables		
Patient age:		
29–44	3.33 (1.41–7.89) *	0.92 (0.46–1.83)
45–64	2.12 (1.33–3.41) *	0.85 (0.57–1.27)
65–79	Referent	Referent
Patient education:		
High school or less	1.31 (0.77–2.12)	1.46 (1.02–2.14) *
Some college or more	Referent	Referent
Surgeon volume:		
50 or more breast procedures/year	1.68 (1.07–2.63) *	0.87 (0.58–1.36)
Less than 50 breast procedures/year	Referent	Referent
Patient-Surgeon Communication		
Treatment discussion:		
Mastectomy only discussed	3.90 (1.56–8.91) *	1.69 (0.79–3.67)
BCS only discussed	3.18 (2.13–5.00) *	0.74 (0.72–1.26)
Both options discussed	Referent	Referent
Patient request/surgeon recommendation:		
Did not ask for and did not receive	0.71 (0.37–1.34)	0.95 (0.56–1.62)
Did not ask for but did receive	1.43 (0.83–2.47)	0.72 (0.41–1.26)
Asked for and but not receive	0.63 (0.30–1.31)	1.67 (1.09–2.69) *
Asked for and did receive	Referent	Referent

⁺ note site (Detroit vs. LA) is controlled for.

[^] controlling for all variables (race/ethnicity, tumor behavior, tumor size, surgeon gender, surgeon years in practice, cancer program designation),

* significant at $p \leq 0.05$.