
Disparities

Racial/Ethnic Disparities in Knowledge about Risks and Benefits of Breast Cancer Treatment: Does It Matter Where You Go?

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Objective. To evaluate the association between provider characteristics and treatment location and racial/ethnic minority patients' knowledge of breast cancer treatment risks and benefits.

Data Sources/Data Collection. Survey responses and clinical data from breast cancer patients of Detroit and Los Angeles SEER registries were merged with surgeon survey responses ($N = 1,132$ patients, 277 surgeons).

Study Design. Cross-sectional survey. Multivariable regression was used to identify associations between patient, surgeon, and treatment setting factors and accurate knowledge of the survival benefit and recurrence risk related to mastectomy and breast conserving surgery with radiation.

Principal Findings. Half (51 percent) of respondents had survival knowledge, while close to half (47.6 percent) were uncertain regarding recurrence knowledge. Minority patients and those with lower education were less likely to have adequate survival knowledge and more likely to be uncertain regarding recurrence risk than their counterparts ($p < .001$). Neither surgeon characteristics nor treatment location attenuated racial/ethnic knowledge disparities. Patient-physician communication was significantly ($p < .001$) associated with both types of knowledge, but did not influence racial/ethnic differences in knowledge.

Conclusions. Interventions to improve patient understanding of the benefits and risks of breast cancer treatments are needed across surgeons and treatment setting, particularly for racial/ethnic minority women with breast cancer.

Key Words. Disparities, breast cancer, treatment, knowledge

Persistently high rates of mastectomy and wide geographic variation in surgical treatments for early stage breast cancer (National Institutes of Health 1990; Nattinger et al. 2000; Morrow et al. 2001; Wennberg 2002; Baxter et al.

2004) have raised concerns that many women may not be fully informed about surgical treatment options (Katz and Hawley 2007). These concerns have motivated laws in 20 states mandating that surgeons discuss both breast conserving surgery (BCS) with radiation and mastectomy with all eligible patients to ensure treatment decisions are informed (Nayfield et al. 1994; Montini 1997). As well, having accurate knowledge of the risks and benefits associated with treatment options has been identified as a key element of an informed and a high quality medical decision (Rimer et al. 2004; Sepucha et al. 2007). Yet, studies have found low knowledge about the risks and benefits associated with mastectomy and BCS with radiation even among women who have been through treatment (Bluman et al. 2001; Fagerlin et al. 2006). Moreover, racial/ethnic difference differences in breast cancer treatment knowledge suggest that more vulnerable populations may be at a particular disadvantage when it comes to making an informed treatment decision (Maly, Leake, and Silliman 2003; Siminoff, Graham, and Gordon 2006; Polacek, Ramos, and Ferrer 2007).

However, few studies have evaluated whether racial/ethnic differences in breast cancer treatment knowledge are associated with other factors, such as the type of provider and/or treatment setting. Although there is considerable research showing that certain provider characteristics (e.g., procedure volume) and treatment setting factors (e.g., access to multidisciplinary care) have positive impacts on quality of care (Gabel, Hilton, and Nathanson 1997; Chang et al. 2001; McKee et al. 2002; Hu et al. 2003; Birkmeyer et al. 2005; Hiotis et al. 2005; Hawley et al. 2006; Newman et al. 2006; Gilligan et al. 2007), it is not clear whether these factors influence informed decision making. As well, while there is research documenting the importance of physician-patient communication to patient satisfaction with the breast cancer treatment decision making process (Bruera et al. 2002; Liang et al. 2002; Janz et al. 2004; Maly, Leake, and Silliman 2004; Lantz et al. 2005; Thind and Maly 2006), less is known about whether this interaction influences treatment knowledge. Furthermore, there is virtually no research evaluating whether racial/ethnic

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disparities in informed treatment decision making are associated with provider characteristics or with where patients receive their treatment. The purpose of this analysis was to evaluate the association between surgeon characteristics, treatment setting, and knowledge about the risks and benefits of mastectomy and BCS with radiation among racially/ethnically diverse breast cancer patients.

METHODS

Study Population

The patient and surgeon samples used in this study have been described elsewhere (Katz et al. 2005a, b, 2007; Lantz et al. 2005; Fagerlin et al. 2006; Hawley et al. 2006). Briefly, we performed a survey of a population-based sample of 2,645 women with breast cancer diagnosed in Detroit and Los Angeles (LA) metropolitan areas (12/2001–1/2003) and reported to the Surveillance, Epidemiology and End Results (SEER) registry, of whom 2,382 were eligible. Inclusion criteria were (1) primary diagnosis of ductal carcinoma in situ (DCIS) or invasive but not metastatic breast cancer, (2) no prior breast cancer diagnosis, (3) age 79 years or younger, (4) receipt of a definitive surgical procedure, and (5) ability to complete a self-administered questionnaire in English or Spanish. Women with lobular carcinoma in situ were excluded because of different treatment recommendations for this type of cancer. Asian women in Los Angeles were also excluded because they were enrolled in other SEER studies. All cases of DCIS and an approximate 20 percent random sample of invasive breast cancer cases were accrued into the study from December 2001–January 2003. African American women were also over-sampled to increase their representation in the dataset. The response rate was 77.4 percent ($N = 1,844$). Nonrespondents to the survey were more likely to be older, nonwhite, and have advanced disease based on SEER data. The median time between diagnosis and survey response was approximately 7 months. Pathology reports were used to identify surgeons in the Detroit and LA areas ($N = 456$) for 98.5 percent 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. The surgeon response rate was 80.0 percent ($N = 365$). Surgeons who did not complete the survey did not differ significantly from included surgeons on gender or years in practice.

Data Collection and Management

The data collection and management procedures for the patient and surgeon surveys have been described in detail elsewhere (Katz et al. 2005a, b; Lantz et al. 2005; Fagerlin et al. 2006; Hawley et al. 2006). The patient survey protocol involved alerting physicians listed on the SEER record of the intention to survey their patients (<1 percent of potential respondents were excluded because of physician concerns). Potential participants were mailed an introductory letter, followed by a telephone call to ascertain eligibility. Eligible subjects were mailed the questionnaire in English or Spanish and a small incentive (\$10 grocery store coupon). We followed the Dillman method for both patient and surgeon surveys—which involved a postcard reminder and subsequent mailings to nonresponders—to maximize response rates (Dillman 1978). SEER clinical data were gathered from medical records and merged with patient survey data by SEER staff using patient identification numbers. This research followed established protocols of the SEER registries in both Detroit and LA for population-based research. All protocols were reviewed and approved by Institutional Review Boards of the University of Michigan, Wayne State University, and The University of Southern California.

Merged Dataset and Analytic Sample

Surgeon respondents were linked to patient respondents using unique identifiers derived from the pathology reports (94.6 percent). The final merged dataset contained complete patient–surgeon dyad information for 65.0 percent of accrued and eligible patients ($N = 1,547$) and 69.7 percent of accrued surgeons ($N = 318$). Patients who were excluded from the merged dataset because of lack of a surgeon match did not differ from included patients on age at diagnosis, race/ethnicity, educational attainment, or disease behavior. We restricted this analysis to women whose documented summary stage in SEER was ductal carcinoma in situ (DCIS) I or II, and tumors of <5 cm 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 types of cancer (National Cancer Institute 2007; NCCN 2007). We excluded approximately 10 percent of the patient sample who potentially had a clinical contraindication to BCS or mastectomy, based on SEER information. These exclusions were predominantly because of a contraindication to BCS, with the primary reason being a large tumor size

relative to small breast size. With these exclusions, our final analytic sample was 1,132 patients of 277 surgeons.

Measures

Dependent Variables. We evaluated two dependent variables, each reflecting patient knowledge about the benefits and risks associated with mastectomy and BCS with radiation (Fagerlin et al. 2006). The first dependent variable was survival knowledge, measured with the question, “the chances of being alive 5 years after surgery is the same for mastectomy as it is for lumpectomy with radiation,” with response options “true,” “false,” or “don’t know.” Because there is clinical consensus that the two surgical options afford equivalent 5-year survival (EBCTCG 2005), this measure was re-coded into two categories; the proportion responding “true” (correct answer) versus those responding “false” or “don’t know” (incorrect answer). The second dependent variable was recurrence knowledge, measured with the question, “the chance that my breast disease will come back after treatment is the same for mastectomy as for lumpectomy with radiation,” with the same response options (true, false, don’t know). To account for the fact that recent data suggest greater equivalence in local recurrence risk between mastectomy and BCS with radiation than was generally believed in 2002 when this study was implemented (EBCTGC 2005), the three response options were retained in analysis of recurrence knowledge.

Independent Variables. Patient demographics included age at diagnosis, race/ethnicity (white, African American, Latina/other), education (high school graduate or less versus some college or more), and marital status (married or partnered versus not married). We also evaluated annual family income, including a missing category to account for the high proportion of respondents who did not answer this question (\geq \$50,000 per year, $<$ \$50,000 per year, missing). These variables were taken from the patient survey, and age at diagnosis and race/ethnicity were updated from the SEER record if missing on the survey. Race/ethnicity was assessed using the National Health Interview Survey format with race and ethnicity as separate questions. Respondents of mixed race/ethnicity were allowed to choose “other” for race, ethnicity, or both questions. The final categories used for these analyses were: non-Hispanic white (white), non-Hispanic African American (AA), or Latina/other.

The clinical variables used in the analysis taken from the SEER record were 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. We also evaluated respondents' self-reported family history of breast cancer (first-degree relative, other relative, none).

We included a measure of the treatment setting where the patient was treated based on prior work showing an association between a multidisciplinary setting and higher quality outcomes (Gabel, Hilton, and Nathanson 1997; Chang et al. 2001; Birkmeyer et al. 2005; Newman et al. 2006). We hypothesized a similar association might exist for patient knowledge of treatment risk and benefits. This variable was taken from SEER and categorized into three groups: (1) NCI-designated cancer center, (2) American College of Surgeons (ACoS) cancer program, or (3) no specific cancer program. We evaluated two sets of surgeon-level independent variables: (1) breast cancer procedure volume and (2) demographics (years in practice and gender). The surgeons' gender was included based on work showing that patients perceive different communication styles between male and female physicians (Roter and Hall 2004; Beran et al. 2007). To measure volume, we recoded the surgeons' reported number of total breast procedures in the past year into low (<50 procedures per year) versus high (≥ 50 procedures per year). Surgeon procedure volume was included based on research demonstrating that higher procedure volume is associated with better clinical outcomes (McKee et al. 2002; Hu et al. 2003; Hiotis et al. 2005; Billingsley et al. 2007; Gilligan et al. 2007). Finally, we evaluated one measure of patient–surgeon communication: the patient's report of which treatment options were discussed (both mastectomy and BCS, mastectomy only, BCS only). We included this variable because of our hypothesis that patient–surgeon communication would be associated with patient knowledge of treatment risk and benefit, regardless of the treatment setting or other surgeon characteristics.

Mechanistic Variables. Two variables were evaluated to shed light on potential mechanisms for how patient involvement in decision making related to knowledge of treatment risk and benefit. The first was respondent' attitudes about their actual involvement in the treatment decision, using the Control Preference Scale, or CPS (Degner, Sloan, and Venkatesh 1997). The second was a measure of patient attitude toward the concordance between their

actual and preferred involvement in the decision (Lantz et al. 2005; Hawley et al. 2007).

Analysis

A sampling weight was calculated for each subject based on the probability of selection into the study. These probabilities varied by strata defined by stage at diagnosis (DCIS versus invasive), race/ethnicity (white, AA, Latina/other), and site (Detroit versus LA). The total weight was then normalized for each site to maintain the original sample size for statistical testing (Katz et al. 2005a; Lantz et al. 2005). The weighting scheme thus reflects the knowledge of non-Asian women diagnosed with DCIS or nonmetastatic invasive breast cancer in Detroit and Los Angeles during the study period. We first generated descriptive statistics (frequencies, contingency tables and correlation coefficients) for the patient and surgeon variables. We then evaluated bivariate associations, including potential multicollinearity, between independent and dependent variables. To evaluate the impact of surgeon factors, treatment setting and patient–surgeon communication, we conducted three multivariable logistic regressions of survival knowledge (correct versus incorrect). In model 1, we regressed survival knowledge on the patient demographic and clinical variables. In model 2, we added the surgeons' characteristics and treatment location. Model 3 then added the patient–surgeon communication variable. A final model controlled for all two-way interactions between patient race/ethnicity, surgeon characteristics, treatment location, and patient–surgeon communication.

We conducted multinomial logistic regression of recurrence knowledge in order to retain the three response options, with “don't know” being the base, or referent, category to which the other options were compared. We ran the same three models, plus the model evaluating interactions, for recurrence knowledge as for survival knowledge. All models accounted for clustering of patients within surgeon and controlled for site (Detroit or LA). In each model, variables with missing response categories, with the exception of income, were dropped (less than 3 percent of the analytic sample).

In separate analyses, we evaluated whether patient attitudes toward involvement in decision making were possible mechanisms for explaining knowledge about treatment risks and benefits. We used the measures described earlier (CPS and concordance between actual and preferred involvement). We assessed the impact of these variables on race/ethnicity,

surgeon factors, treatment setting in the final models of survival, and recurrence knowledge.

RESULTS

Sample Description

The mean age of women was 60 (range: 29–79). Approximately 73 percent of the women were white, 18 percent African American (AA) and 9 percent Latina/other. Approximately two-thirds reported having some college education or more and 44.8 percent were married. Close to half (46 percent) reported family incomes of less than \$50,000/year. The weighted proportion of women with DCIS was 22 percent. Eleven percent of patients were treated at an NCI-designated cancer center, 56 percent at a ACoS facility, and 33 percent at a setting with no designated cancer program. The majority reported both treatments were discussed (73 percent), 21 percent that BCS only was discussed, and 6 percent that mastectomy only was discussed.

The mean number of years in practice for surgeons was 17 (range: 1–39) and 15 percent were female. Approximately half of the surgeons reported a high breast-related procedure volume (≥ 50 procedures/year).

Survival and Recurrence Knowledge

Overall, 51 percent of respondents had survival knowledge. About half (48 percent) reported that they did not know the answer to the recurrence question, while 15 percent indicated the answer was false and 37 percent indicated that the answer was true (Table 1).

Bivariate Results

Younger women and those with higher levels of education were significantly ($p < .001$) more likely to have survival knowledge than their counterparts. Women with invasive breast cancer were significantly more likely than those with DCIS to have survival knowledge ($p < .001$). Reporting that the surgeon discussed both treatment options was associated with having survival knowledge. There was much more uncertainty associated with recurrence knowledge, with 42 percent–60 percent of women in each racial/ethnic group reporting “don’t know.” Older women and those with less education were more likely ($p < .001$) than their counterparts to indicate they did not know the answer to this question. Women who reported that their surgeon discussed both treatment options were significantly less likely to indicate that they were

Table 1: Characteristics of Sample of Breast Cancer Patients ($N = 1,132$)

<i>Patient Characteristics</i>	<i>N</i>	<i>Weighted %</i>
Age		
<50 years	97	8.5
50–64 years	625	55.2
65+ years	410	36.3
Race/ethnicity		
White	816	72.9
African American	206	18.4
Latina/other	97	8.6
Missing	12	1.2
Education		
High school or less	401	35.3
Some college or more	676	59.1
Missing	55	5.6
Marital status		
Not married	507	44.8
Married	624	55.2
Annual family income		
<\$50,000	521	46.0
≥ \$50,000	408	36.0
Missing	204	18.0
Tumor behavior		
DCIS	244	21.6
Invasive	888	78.4
Treatment location		
NCI cancer center	128	11.3
ACoS cancer program	631	55.8
No cancer program	373	32.9
Type of treatment discussed		
Both discussed	835	72.9
BCS only discussed	223	20.7
Mastectomy only discussed	74	6.4
Survival knowledge		
The chances of being alive 5 years after surgery is the same for mastectomy as for lumpectomy with radiation		
True	542	47.9
False	68	6.0
Don't know	522	46.1
Missing	5	0.4
Recurrence knowledge		
The chances that my breast disease will come back after treatment are the same for mastectomy as for lumpectomy with radiation		
True	168	37.0
False	419	14.8
Don't know	539	47.6
Missing	6	0.5

Stage 0, I, or II breast cancer, tumor <5 cm, and no clinical contraindications to either BCS with radiation or mastectomy.

ACoS, American College of Surgeons; BCS, breast conserving surgery; DCIS, ductal carcinoma in situ; NCI, National Cancer Institute.

uncertain on this question than women whose surgeons discussed mastectomy or BCS only ($p < .001$). Bivariate analyses showed significant ($p \leq .001$) racial/ethnic differences in survival knowledge (57 percent of whites, 34 percent of AAs, and 37 percent of Latina/other) (Figure 1a). As well, significant racial/ethnic differences in recurrence knowledge was found, with whites being significantly ($p \leq .05$) more likely to answer “true” and significantly less likely to answer “don’t know” than AA or Latina/other women (Figure 1b).

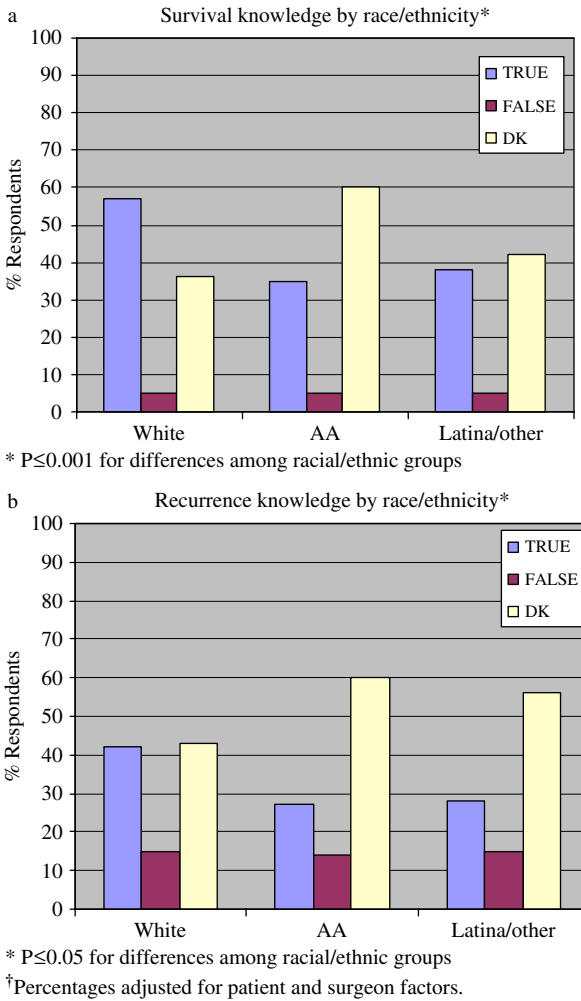
Multivariable Logistic Regression of Survival Knowledge

Model 1 of Table 2 shows that African American and Latina/other women were significantly less likely than white women to have survival knowledge, controlling other demographic and clinical factors (OR: 0.36; 95 percent CI 0.26–0.50 and 0.43; 95 percent CI 0.25–0.73 for AA and Latina race/ethnicity, respectively). Women with higher levels of education and those who were married had, more often, survival knowledge than their counterparts (OR: 1.41; 95 percent CI: 1.07–1.84 for education; OR: 1.56; 95 percent CI: 1.16–2.10 for marital status). Compared with women with family incomes of \$50,000 or more/year, those with lower incomes or those without income data were significantly less likely to have survival knowledge (OR: 0.64; 95 percent CI: 0.47–0.87 for $< \$50,000$; OR 0.62; 95 percent CI: 0.40–0.95 for those missing income data). Women with invasive cancer were more likely than those with DCIS to have survival knowledge (OR: 1.69; 95 percent CI: 1.32–2.17). Model 2 shows that the inclusion of surgeon factors and treatment setting did not change the racial/ethnic differences in survival knowledge, nor were any of these factors significantly independently associated with survival knowledge. Model 3 shows that although patient–surgeon communication did not attenuate the racial/ethnic differences in survival knowledge, women who reported that both treatments were discussed were significantly more likely to have survival knowledge than those who reported that only one treatment was discussed (OR: 0.26; 95 percent CI: 0.14–0.47 for mastectomy only; OR: 0.64; 95 percent CI: 0.47–0.88 for BCS only).

Multinomial Logistic Regression of Recurrence Knowledge

Table 3 shows the final model (equivalent to Model 3 of Table 2) of recurrence knowledge. Response options “true” and “false” were both compared with “don’t know,” which served as the base or referent category in this regression. This table shows that AAs and Latina/other women were less likely than white women to respond “true” to the recurrence question (versus responding

Figure 1: (a) Survival Knowledge by Race/Ethnicity.*† (b) Recurrence Knowledge by Race/Ethnicity.*†



“don’t know”) (OR: 0.41; 95 percent CI: 0.29–0.59 for AAs; OR: 0.55, 95 percent CI: 0.31–0.97 for Latina/other) but were no more likely to respond “false” versus “don’t know.” As with the survival knowledge outcome, including the surgeon factors, treatment setting factors, and patient–surgeon communication did not affect racial/ethnic differences in recurrence knowl-

Table 2: Multivariable Logistic Regression of Knowledge about the Survival Benefit of Mastectomy versus BCS with Radiation (Survival Knowledge)

	<i>Model 1</i>	<i>Model 2</i>	<i>Model 3</i>
<i>Patient factors</i>			
Age	0.97 (0.95, 0.98)	0.97 (0.95, 0.98)	0.97 (0.95,0.98)
Race/ethnicity			
White	Referent	Referent	Referent
African American	0.36 (0.26, 0.50)	0.34 (0.24, 0.48)	0.35 (0.25, 0.50)
Latina/other	0.43 (0.25, 0.73)	0.45 (0.25, 0.72)	0.47 (0.26, 0.81)
Education: some college or more (versus <high school or less)	1.41 (1.07, 1.84)	1.43 (1.10,1.88)	1.34 (1.01, 1.77)
Marital status: married (versus not married)	1.56 (1.16, 2.10)	1.60 (1.18,2.16)	1.59 (1.16, 2.17)
Income			
≥ \$50,000/year	Referent	Referent	Referent
< \$50,000/year	0.64 (0.47, 0.87)	0.65 (0.48,0.90)	0.68 (0.49, 0.94)
Missing	0.62 (0.40, 0.95)	0.63 (0.41, 0.98)	0.61 (0.39, 0.96)
Tumor behavior: invasive (versus DCIS)	1.69 (1.32, 2.17)	1.66 (1.30, 2.13)	1.59 (1.22, 2.03)
<i>Surgeon factors and treatment setting</i>			
Surgeon years in practice		0.99 (0.97, 1.01)	0.99 (0.96, 1.01)
Surgeon gender: male (versus female)		1.29 (0.90, 1.83)	1.25 (0.85, 1.81)
Surgeon breast procedure volume: high (versus low)		0.99 (0.74, 1.33)	0.98 (0.71, 1.35)
Treatment setting			
No cancer program		Referent	Referent
ACoS program		1.11 (0.82, 1.50)	1.09 (0.79, 1.50)
NCI cancer center		1.31 (0.85, 2.01)	1.48 (0.91, 2.39)
<i>Patient-surgeon communication</i>			
Communication			
Both treatments discussed			Referent
Mastectomy only discussed			0.26 (0.14, 0.47)
BCS only discussed			0.64 (0.47, 0.88)

All models applied sampling weights and control for tumor size, geographic location, and clustering by surgeon. Including family history of breast cancer did not affect the results. Models including patient involvement in decision making and all two-way interactions between race/ethnicity and other factors are not shown.

ACoS, American College of Surgeons; BCS, breast conserving surgery; DCIS, ductal carcinoma in situ; NCI, National Cancer Institute.

edge. Also, women who reported that only one option was discussed (either mastectomy only or BCS only) were significantly ($p < .001$) less likely than those who reported discussing both options to respond “true” (versus “don’t know”) or “false” (versus “don’t know”).

Table 3: Multinomial Logistic Regression of Knowledge about the Recurrence Risk of Mastectomy versus BCS With Radiation (Recurrence Knowledge)

	<i>The Chances That My Breast Disease Will Come Back after Treatment Are the Same for Mastectomy as for Lumpectomy with Radiation</i>	
	<i>True versus Don't Know</i>	<i>False versus Don't Know</i>
	<i>OR (95% CI)</i>	<i>OR (95% CI)</i>
<i>Patient factors</i>		
Age	0.96 (0.95, 0.97)	0.94 (0.92, 0.96)
Race/ethnicity		
White	Referent	Referent
African American	0.41 (0.29, 0.59)	0.74 (0.46, 1.20)
Latina/other	0.55 (0.31, 0.97)	0.51 (0.24, 1.06)
Education: some college or more (versus <high school or less)	1.30 (0.97, 1.75)	1.53 (1.03, 2.28)
Marital status: married (versus not married)	1.55 (1.13, 2.11)	1.58 (1.10, 2.27)
Income		
≥ \$50,000/year	Referent	Referent
<\$50,000/year	0.76 (0.54, 1.07)	1.02 (0.68, 1.55)
Missing	0.66 (0.41, 1.07)	0.91 (0.48, 1.74)
Tumor behavior: invasive (versus DCIS)	1.77 (1.31, 2.38)	0.87 (0.63, 1.22)
<i>Surgeon factors and treatment setting</i>		
Surgeon years in practice	0.99 (0.97, 1.01)	1.00 (0.98, 1.02)
Surgeon gender: male (versus female)	1.23 (0.85, 1.79)	0.88 (0.52, 1.47)
Surgeon breast procedure volume: high (versus low)	1.06 (0.76, 1.48)	1.03 (0.74, 1.43)
Treatment setting		
No cancer program	Referent	Referent
ACoS program	1.04 (0.74, 1.43)	1.08 (0.75, 1.53)
NCI cancer center	1.09 (0.70, 1.69)	0.92 (0.49, 1.60)
<i>Patient-surgeon communication</i>		
Communication		
Both treatments discussed	Referent	Referent
Mastectomy only discussed	0.36 (0.19, 0.66)	0.20 (0.08, 0.50)
BCS only discussed	0.69 (0.49, 0.96)	0.44 (0.28, 0.70)

Multinomial base, or referent, category is “don’t know.”

Prior models included: (1) patient factors only; (2) patient factors, surgeon factors, and treatment setting. Results did not differ significantly from those presented in this full model (patient factors, surgeon factors, treatment setting, and patient–surgeon communication).

All models applied sampling weights and controlled for geographic site, tumor size, and clustering by surgeon. Inclusion of family history of breast cancer did not affect the results.

Models showing patient involvement in decision making and all two-way interactions not shown. ACoS, American College of Surgeons; BCS, breast conserving surgery; DCIS, ductal carcinoma in situ; NCI, National Cancer Institute.

Interactions and Mechanistic Analyses

Neither patient reported involvement nor concordance between actual and preferred involvement were significantly associated with either survival or recurrence knowledge outcomes (results not shown). Importantly, including these variables in the model did not impact any of the prior results; observed racial/ethnic differences remained in both knowledge measures. None of the two-way interactions included in the multivariate regression were significantly associated with either type of knowledge (results not shown). Including the interactions also did not impact the racial/ethnic disparities observed in survival or recurrence knowledge.

DISCUSSION

Results from this analysis confirm that knowledge about the risks and benefits of breast cancer treatment options needs to be improved among all patients (Nold et al. 2000; Bluman et al. 2001; Fagerlin et al. 2006), but particularly for racial/ethnic minorities (Maly, Leake, and Silliman 2004; Siminoff, Graham, and Gordon 2006; Polacek, Ramos, and Ferrer 2007). Perhaps the most concerning finding from this analysis was the persistence of racial/ethnic differences in breast cancer treatment knowledge despite controlling for surgeon characteristics, treatment location, and patient–surgeon communication. Having adequate knowledge of risks and benefits of treatment options is a key element of an informed and a high quality breast cancer treatment decision (Rimer et al. 2004; Sepucha et al. 2007). Moreover, the discussion of both treatment options with eligible breast cancer patients is mandated by law in 20 states, including MI and CA (Nayfield et al. 1994; Montini 1997). These results are consistent with our argument in prior research that efforts to improve the quality of breast cancer care should focus on improving the process of decision making (Katz and Hawley 2007), and that efforts to improve decision making are especially needed for racial/ethnic minority women with breast cancer (Polacek, Ramos, and Ferrer 2007).

Research has shown that provider characteristics, such as high procedure volume, and treatment setting factors, such as access to multidisciplinary care, are associated with positive clinical outcomes (Gabel, Hilton, and Nathanson 1997; Chang et al. 2001; McKee et al. 2002; Hu et al. 2003; Birkmeyer et al. 2005; Hiotis et al. 2005; Hawley et al. 2006; Newman et al. 2006; Billingsley et al. 2007; Gilligan et al. 2007). However, little has been done to link these factors to decision outcomes, such as knowledge about treatment options

or satisfaction with the decision process. Results from a recent pilot study showed that including patients in multidisciplinary clinic discussions related to breast cancer treatment planning was highly valued by patients themselves (Choy et al. 2007). A few studies have shown that a multidisciplinary approach to breast cancer care, such as referral to a radiation oncologist, medical oncologist, or plastic surgeon, before initial surgical decision influences the treatment chosen (Alderman et al. 2008; Keating et al. 2003; Baldwin et al. 2004). Liang and colleagues have demonstrated an association between higher breast procedure volume and a surgeon's likelihood of initiating treatment discussions with patients (Liang et al. 2002). A recent study by our team found higher satisfaction with breast cancer treatment decision making among patients with a high volume surgeon (Waljee et al. 2007). These studies provide a possible connection between factors typically linked to high quality care and high quality decision making, yet none evaluated this issue with respect to racial/ethnic minority women with breast cancer. Our results showed that neither provider characteristics nor treatment setting attenuated observed racial/ethnic disparities in knowledge, nor were these factors independently associated with knowledge about breast cancer treatment risks and benefits. These results suggest that factors linked with quality care may be less important for informed decision making, and that improvements in how treatment information is communicated to patients is needed across providers and practice settings.

In fact, our results suggest that the gap in the delivery of accurate risk and benefit information from surgeons to patients may be especially large for racial/ethnic minority women. This analysis found that having a surgeon who discussed both treatment options significantly improved both survival and recurrence knowledge but did not attenuate racial/ethnic disparities. These results imply that while it is critical for surgeons to effectively deliver information about treatment options, this information may be comprehended differently by patients of different racial/ethnic groups. There has been considerable work documenting the importance of communication and shared decision making in patient satisfaction with breast cancer treatment decisions (Mandelblatt et al. 2001; Liang et al. 2002; Maly, Leake, and Silliman 2004; Siminoff, Graham, and Gordon 2006). Yet few studies have objectively evaluated the role of communication on patient knowledge of the risks and benefits of treatment options, and virtually none have assessed this issue for racial/ethnic minority women. Siminoff, Graham, and Gordon (2006) found that providers communicated differently about breast cancer treatment with patient of different race/ethnicities, educational and income levels. Gordon and colleagues (Gordon et al. 2006) also found African American patients received

less information about different medical treatments than white patients. These studies, with our results, underscore the need for providers to communicate information effectively to all patients. Our results also support the literature suggesting that improving the communication skills and cultural competency of providers a necessary step to reducing health disparities (Johnson et al. 2004; Betancourt 2006; Giger, Davidhizar, and Fordham 2006; Lloyd et al. 2006). Our results are consistent with the conclusion of a recent review by Polacek, Ramos, and Ferrer (2007), specifically in that ensuring high quality breast cancer outcomes for all women is dependent on culturally and ethnically appropriate professional support.

Increasing patient involvement in decision making has also been identified as a potential mechanism for achieving informed treatment decisions in breast cancer (National Cancer Policy Board 1999; Mandelblatt et al. 2001; Maly, Leake, and Silliman 2003). Yet some research suggests that helping patients achieve their desired amount of involvement is more important than simply increasing their participation in the decision (Bruera et al. 2002; Janz et al. 2004; Maly et al. 2004; Lantz et al. 2005). We evaluated patient attitudes about their involvement in the surgical treatment decision as possible mechanisms for explaining differences in treatment knowledge. We found that neither actual involvement nor concordance between actual-preferred involvement attenuated racial/ethnic differences in knowledge or was independently associated with knowledge. Temple and colleagues (2006) found that only 14% of breast cancer patients reported having enough information. This result, combined with that described above, suggests that while improving patient involvement in decision making is an important goal, the content of the discussion is clearly more important for ensuring accurate knowledge of treatment risk and benefit.

Our study has some limitations. First, despite a large population-based patient sample, it is only representative of two cities in the United States and of non-Asian women. Although we achieved very high surgeon (80 percent) and patient (77 percent) response rates, the fact that not all patients were merged to surgeons could affect the generalizability of the results. Second, there is the limitation of possible recall bias, due to the self-reported nature of measures and that the mean time between diagnosis and survey was 7 months. In addition, there is the potential limitation of selection bias, because patients with higher knowledge initially may be more likely seen at NCI cancer centers or other multidisciplinary centers. However when we re-ran analyses including a variable measuring whether women selected or were referred to their surgeon, we did not find any significant differences in the results. Third, our outcome measures, reflecting knowledge of the risks and benefits of the two surgical treatment

options, do not account for the many other types of treatments often required by breast cancer patients. Finally, because this was a cross-sectional survey, our results demonstrate associations between factors rather than causal relationships.

Despite significant gains in the longevity of patients with breast cancer, there continues to be evidence of racial/ethnic disparities in breast cancer treatment (Morris et al. 2000; Jatoi, Becher, and Leake 2003; Hershman et al. 2005; Naeim et al. 2006; Simon et al. 2006). The ability to make an informed treatment decision is not only an important indicator of quality care, it is mandated in 20 states (Nayfield et al. 1994; Montini 1997). We found racial/ethnic disparities in knowledge about risks and benefits of breast cancer surgical treatment options were not affected by factors typically associated with high quality care, such as surgeon volume and treatment setting. Patients' reporting that both treatment options were discussed was the strongest predictor of survival knowledge, but did not attenuate racial/ethnic disparities. Implications from this study include the need for more attention to the way in which information about the risks and benefits of treatment options are communicated to patients by their providers. Decision tools to improve informed decision making for breast cancer patients are needed across surgeons and treatment settings, and may need to be tailored to race/ethnicity, acculturation, and literacy. These approaches to improving the delivery of information to breast cancer patients faced with surgical treatment decisions are likely to result in measurable reductions in racial/ethnic disparities in informed decision making and improvements in decision quality.

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SUPPLEMENTARY MATERIAL

The following supplementary material for this article is available online:

Appendix SA1: Author Matrix.

Appendix SA2: Other Contributions.

This material is available as part of the online article from <http://www.blackwell-synergy.com/doi/abs/10.1111/j.1475-6773.2008.00843.x> (this link will take you to the article abstract).

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