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Local Therapy Decisional Regret in Older Women With Breast Cancer: A Population-Based Study

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Abstract

Purpose: Older women with nonmetastatic breast cancer can often choose from several surgery and radiation treatment options. Little is known regarding how these choices contribute to decisional regret, which is a negative emotion reflecting the idea that another surgery or radiation decision might have been preferable. We sought to characterize the burden of and examine potential risk factors for local therapy decisional regret among a population-based cohort of older breast cancer survivors.

Methods and Materials: National Medicare claims for age ≥ 67 female breast cancer incident in 2009 identified patients treated with lumpectomy plus whole-breast irradiation, brachytherapy, or endocrine therapy or mastectomy with or without radiation. We sampled 330 patients per treatment group (N = 1650), of whom 1253 agreed to receive a paper survey including the Decisional Regret Scale and EQ-5D-3L Health-Utility Scale. Local therapy regret was defined as neutral or worse response to questions regarding surgery- or radiation-related decisional regret.

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Local therapy regret risk factors were evaluated using a multivariable generalized linear model. Association of local therapy regret with health utility was modeled using multivariable linear regression.

Results: The response rate was 30.2% (n = 498 of 1650); 421 surveys were included in this analysis. Median diagnosis age was 72 years, and surveys were completed 6 years after diagnosis. Overall, 23.8% of respondents (n = 100) reported experiencing local therapy decisional regret. Type of local therapy was not associated with local therapy regret. Predictors of increased regret included black race (risk ratio [RR], 2.09; 95% confidence interval [CI], 1.33–3.29), high school education or less (RR, 1.87; 95% CI, 1.27–2.75), and axillary nodal dissection (RR, 2.13; 95% CI, 1.33–3.41). Local therapy regret was not associated with health utility ($P = .37$).

Conclusions: Local therapy regret afflicts nearly one quarter of our cohort of older breast cancer survivors, and it is associated with black race, less education, and more extensive nodal dissection, but not breast surgery. Regret is distinct from health utility, suggesting that it is a unique psychosocial construct that merits further study and mitigation strategies.

Summary

Older (≥ 67 years) breast cancer survivors who received a diagnosis in 2009 and were treated with 1 of 5 local therapy options (lumpectomy plus whole-breast irradiation, brachytherapy, or endocrine therapy or mastectomy with or without radiation) were surveyed to examine their local therapy treatment–related decisional regret 6 years after diagnosis. Local therapy regret afflicted nearly one quarter of our cohort, and it was associated with black race, less education, and more extensive nodal dissection, but not breast surgery.

Introduction

The number of women with breast cancer diagnosis at the age of 65 years and older has been increasing steadily during the past decade.¹ Treatment decisions among older patients often require additional considerations reflecting their physiological limitations, comorbid illnesses, and other limitations that influence their capacity to tolerate toxicities associated with the treatment.^{2,3} Although older women tend to have less aggressive tumors that may present with lower risk of local recurrence,^{4,5} the treatment decision-making process is often more complex among older patients relative to younger ones.^{4,5} These decisions can result in adverse or unexpected health outcomes; the experience of posttreatment decisional regret is therefore not uncommon.^{6,7}

Decisional regret is defined as a highly negative emotion⁸ that occurs when uncertainty about the best choice is unresolved or when an unfavorable outcome leads one to believe that, perhaps, another decision might have been preferable.^{8–10} Decisional regret is also considered to be a sensitive psychosocial outcome,⁷ the anticipation of which can lower an individual's self-confidence in subsequent decision-making.^{11–13} High levels of decisional regret could also be construed as a failure of the process of shared decision making.

Despite the established importance in clinical practice, decisional regret is a relatively new area in oncology research that has been understudied in patients with breast cancer. The few studies that examined regret associated with breast cancer care primarily focused on

decisions pertaining to receipt of prophylactic mastectomy^{14–17} or breast reconstruction after mastectomy.^{18–23} Little is known regarding the association between oncologic surgery and radiation choices and decisional regret. Perhaps even less is known about a patient's regret beyond the phase of initial treatment and into the long-term survivorship period.⁸ The purpose of this cross-sectional study was to examine the potential determinants of the burden of local therapy decisional regret in older women with breast cancer.

Methods and Materials

Cohort selection and sampling strategy

Details of this process have been published elsewhere.²⁴ Briefly, we applied a validated algorithm to nationally comprehensive Medicare claims to identify women aged ≥ 67 years with a diagnosis of nonmetastatic breast cancer in 2009 (n = 42,735).^{25,26} Patients were excluded if they were not alive as of May 2015 (n = 8299), did not receive 1 of the 5 local therapy options (n = 7414), were not enrolled with Medicare Part A and B between diagnosis and end of 2011 (n = 2), were enrolled in a health maintenance organization during this period (n = 478), or had any other cancer diagnosed after breast cancer (n = 473). Of the resulting 26,069 patients, nearly half (n = 12,731) received lumpectomy plus whole breast irradiation (Lump+WBI); this group, therefore, served as our referent group on all analyses. We randomly sampled 330 patients treated with Lump+WBI. We then used a probability proportional to size sampling without replacement method to select 330 patients from each of the remaining 4 local therapy options, such that the age distribution was similar to that in the Lump+WBI group.

Upon approval by our institutional review board and the Centers for Medicare and Medicaid Services, a flyer with a description of our study and an invitation for participation were mailed in September 2015 to 1650 women (330 each per 5 local therapy groups). Of these, 397 (24%) decided to opt out. We then mailed a paper survey and \$10 gift card to the remaining 1253 patients.

Defining local therapy for breast cancer

Guideline-concordant local breast cancer therapy often includes multiple options, each of which can result in different health outcomes.^{4,5,27–31} We used Common Procedural Terminology and International Classification of Diseases (version 9) procedure codes to classify surgery and radiation. We defined “Lump+WBI” as a lumpectomy followed by ≥ 15 external beam radiation treatments and no brachytherapy (and without a mastectomy between lumpectomy and WBI)^{27,28}; Lump+Brachy as a lumpectomy followed by brachytherapy, with no mastectomy or external beam radiation therapy³⁰; Lump-alone as a lumpectomy plus a filled prescription for endocrine therapy (determined using Medicare Part-D claims), with no mastectomy^{4,5}; Mast-alone as a mastectomy without any radiation therapy²⁷; and Mast+RT as a mastectomy followed by ≥ 15 external beam radiation treatments.^{29,31} We used Medicare claims and the accompanying enrollment files to determine receipt of additional treatment, including axillary surgery or adjuvant endocrine therapy. All treatments were received within 1 year of diagnosis.

Measuring covariates

The survey confirmed the diagnosis of breast cancer and treatment modality. It also inquired for age, race or ethnicity, education, household income, region of residence, smoking history, current height and weight, weight at diagnosis, and bra cup size. We also sought to examine the role of physician characteristics in decisional regret. The information was obtained through the American Medical Association file by National Provider Identifier number.

The patient-reported outcome measures

Cosmetic satisfaction after treatment was calculated as an arithmetic mean of a 6-item Likert-scaled “Satisfaction with Breast Cosmetic Outcome” instrument, developed by the Cancer Surveillance and Outcomes Research Team (CanSORT).³² Higher scores on this scale indicated a higher level of satisfaction. We used the BREAST-Q instrument³³ to measure other outcomes, such as the satisfaction with breasts, psychosocial well-being, physical well-being, sexual well-being, and adverse effects of radiation, when applicable. For each section on this scale, individual scores were summed, and a Rasch transformation was used to convert the sum score to a score ranging from 0 to 100. A higher score indicated a better clinical outcome.

Measuring decisional regret and health utilities

The outcome of treatment-related decisional regret was measured using a previously validated, 5-point Likert-type 5-item score Decisional Regret Scale¹¹ that assesses regret after major treatment decisions. Patients were asked to rate their experience of regret about surgery or radiation as 1 (strongly agree), 2 (agree), 3 (neither agree nor disagree), 4 (disagree), or 5 (strongly disagree) in response to the statement “I regret the choice that was made.” We conservatively grouped responses 1, 2 and 3 as “yes” and responses 4 and 5 as “no” for report of regret toward both therapy options separately, an approach that has been used previously.³⁴ A patient was defined as experiencing surgery or radiation regret if she had either a “yes” response on surgery regret (among all patients) or a “yes” response on radiation regret (only among 3 radiation groups).

Lastly, the EQ-5D-3L is a health-related quality of life instrument³⁵ that is used commonly by health economists to assign health utility, with a value of 1 indicating perfect health and a value of 0 indicating death. Health utility is commonly used in decision analyses to weigh the value of survival to calculate quality-adjusted life years.³⁶

Statistical analyses

We compared patients’ demographic and clinical characteristics by surgery or radiation regret using the Rao-Scott χ^2 goodness-of-fit tests. Similarly, we evaluated the association of surgery or radiation regret with other patient-reported outcomes. Potential risk-factors of surgery or radiation regret were evaluated using a multivariable generalized linear model. The results for this analysis were expressed as risk ratios (RRs) and 95% confidence intervals (95% CIs). The association of surgery or radiation regret with health utility was evaluated using a multivariable linear regression model. A backward selection method was used to retain variables with $P \leq .10$. As the independent variable of interest in these

analyses, regret was retained in the final model regardless of statistical significance. The results for this analysis were expressed as estimates, standard error, and 95% CI. All analyses were adjusted for weights from sample survey design and response rate to improve the generalizability of our findings. Unless indicated otherwise, $P < .05$ was considered statistically significant; all tests were 2-sided. All analyses were performed with SAS version 9.3 (SAS Institute, Cary, NC).

Results

Survey response and patient characteristics

Of the 1650 women invited to complete the survey, 498 returned the survey (30.2% response rate). Of these, 421 yielded complete responses on the Decisional Regret Scale and were included in the analyses. Comparison of patient characteristics between responders and nonresponders is presented in Table E1 (available online at <https://doi.org/10.1016/j.ijrobp.2019.01.089>). Overall, respondents varied ($P < .05$) by treatment group, age, race, region of residence, and comorbidity index. The median age among our study participants was 72 years (range, 67–87 years). Participants were primarily white (88.7%), followed by black (5.6%) and Hispanic/other (5.7%). The surveys were completed 6 years after initial breast cancer diagnosis.

Treatment and patient characteristics associated with regret

Of the total 421 patients, 252 received a lumpectomy (94 Lump+WBI, 91 Lump+Brachy, 67 Lump-alone) and 169 received mastectomy (74 Mast-alone, 95 Mast+RT; Table 1). Overall, 23.8% (95% CI, 19.8%–28.1%; $n = 100$) experienced local therapy regret. In unadjusted analyses, regret was directly proportional to the extent of local therapy received. Regret was relatively higher among women who received a mastectomy (31.9% regretted their decision; 54 of 169) compared with those who received a lumpectomy (18.3%; 46 of 252; weighted percentages 25% vs 21.7%, $P = .59$). Regret was also higher among those who received radiation after mastectomy (weighted percentage, 37.1%) compared with mastectomy alone (22.3%; $P = .05$ for unadjusted comparison). Similarly, in the lumpectomy group of patients, receipt of adjuvant WBI (22.6%) or brachytherapy (23.5%) was associated with higher regret compared with those receiving lumpectomy alone (4.8%; $P < .001$ for both unadjusted comparisons).

In adjusted analysis, however, there was no significant difference in experiencing regret after various local therapy options (Table 2). In contrast, patients who had an axillary dissection or axillary surgery reported higher regret relative to those who had a sentinel lymph node biopsy (RR, 2.13; 95% CI, 1.33–3.41; $P = .002$). Other risk factors for experiencing increased regret included black race (RR, 2.09 compared with white race; 95% CI, 1.33–3.29; $P = .001$) and having a high school education or less (RR, 1.87 compared with associate or college degree; 95% CI, 1.27–2.75; $P = .001$).

Association of decisional regret with patient-reported outcomes and health utility

Summary statistics (median), weighted mean, and 95% CI for each of the patient-reported outcomes (CanSORT and BREAST-Q) and health utilities (EQ-5D-3L) overall and stratified

by surgery or radiation regret are presented in Table 3. Patients with decisional regret reported lower satisfaction with cosmetic outcomes (weighted mean Can-SORT score, 3.32) compared with those with no regret (score, 3.62); however, the difference did not reach statistical significance ($P = .12$). Similarly, patients experiencing regret reported lower scores on all BREAST-Q outcomes. However, most of these outcome measures did not show a significant difference between regret groups, except for BREAST-Q sexual well-being. Surgery or radiation regret was associated with significantly lower score for sexual well-being ($P = .01$).

Patients who experienced local therapy regret had a slightly lower health utility score (adjusted mean health utility score, 0.78) compared with those with no regret (0.81), but this difference did not reach statistical significance ($P = .37$; Table 4). Black respondents ($P = .045$) and patients whose physicians were trained in the United States ($P = .012$) had a higher health utility score. On the other hand, those who had higher comorbidity index (2+; $P = .04$) and lower household income (<\$40,000/year; $P = .0006$) had statistically significantly lower health utility scores.

Discussion

In this first comprehensive investigation of long-term treatment-related decisional regret among a nationally diverse cohort of older female survivors of breast cancer, we found that approximately one quarter (23.8%) of our respondents regretted their surgery or radiation decisions nearly 6 years after their initial cancer diagnosis. Decisional regret was significantly more prevalent among patients who were black, had lower education, or received axillary lymph node dissection. Regret was not associated with the type of local therapy, and it did not play a significant role in patient's health outcomes and overall health utilities; however, other factors such as race, household income, and extent of comorbidities were associated with overall health utility.

Previous studies that examined treatment-related decisional regret among patients with breast cancer did not specifically focus on older women; they reported varying estimates on prevalence of regret. For example, Fernandes-Taylor et al reported a 43% prevalence of regret in their patients over any aspect of breast cancer treatment; specifically, 24% regretted surgery, and 22% regretted chemotherapy or radiation.¹² This qualitative study, however, was focused on younger breast cancer survivors, and it measured regret using an open-ended question, likely capturing a slightly broader range of this concept.¹² Other studies reported 39% regret in receipt of surgery^{37,38} and 40% overall treatment-related regret in their findings.³⁹ In contrast to these studies, however, 1 study⁴⁰ reported a significantly lower prevalence of regret, with only 11.4% of patients reporting decisional regret or ambivalence regarding choice of surgery. This study, however, did not use a validated scale to measure regret; instead, it analyzed response for regret based on a single-item from their survey. Martinez et al⁸ measured decisional regret of surgery using the decisional regret scale 9 months and 4 years after diagnosis, with 28.5% of participants being women 65 years or older. Regret appeared to increase over time in the unadjusted analysis; the association, however, was not significant after adjustment, and the study did not specifically examine outcomes in older women.⁸ In summary, the available data on decisional regret among breast

cancer survivors derive primarily from studies that were focused on relatively younger breast cancer survivors; they are often limited by shorter follow-up times and unreliability of the instruments used to measure therapy-related decisional regret.

Our results indicate possible cultural or socioeconomic contributions to decisional regret. Black women and women with lower education had nearly twice the risk of regretting their local therapy decision. A previous study that qualitatively assessed posttreatment regret in patients with breast cancer found that black women were slightly more likely to express regret than white women were; however, the association was not significant in their adjusted analyses.¹² Another study found that Latina and black women were significantly more likely than white women to report higher dissatisfaction and regret with their treatment.³⁷ In the same study, low health literacy contributed to higher dissatisfaction and regret. This study, however, was mainly focused on a relatively younger group of patients with breast cancer. Lopez et al⁴¹ reported higher regret among Latina women compared with white women, but they did not include the black population. Although patients with lower education in this study reported lower satisfaction with decision making, the association between education and decisional regret was not confirmed.⁴¹ This study also included relatively younger women with an early-stage breast cancer (ductal carcinoma in situ only) diagnosis. Similar to our findings, Lantz et al⁴⁰ reported higher regret among the socially disadvantaged group of women with lower education and those who belonged to the black community; however, they excluded older women from their study. With the continual aging of our society, there is a subsequent rise in the number of older women receiving a diagnosis of breast cancer. To our knowledge, ours is the first study to present relative data on long-term decisional regret specifically focused on older women with nonmetastatic breast cancer.

Local therapy regret was associated with more extensive nodal surgery but not more extensive breast surgery. Considering the morbidity of axillary lymph node dissection, it should not be surprising that it is the key treatment factor associated with higher levels of local therapy regret among older women with breast cancer. In addition to being the most important risk factor for lymphedema,^{42,43} axillary lymph node dissection can result in axillary pain, stiffness, and upper extremity functional impairment.⁴⁴ Correspondingly, we hypothesize that omitting axillary lymph node dissection is likely to reduce local therapy decisional regret among breast cancer survivors, provided the cancer can still be controlled. This finding supports the general movement away from axillary lymph node dissection in certain patient groups, as supported by the American College of Surgeons Oncology Group Z00-11 and Z1071 trials.^{45,46} This finding also provides further justification to support enrollment on the Alliance A011202 study that evaluates axillary radiation in place of axillary lymph node dissection for patients with residual node positivity after neoadjuvant chemotherapy.⁴⁷

We did not find a significant association between regret and most patient-reported health outcomes (except for sexual well-being), including health utilities. The finding that higher regret was associated with lower scores for sexual well-being warrants further investigation of the potential adverse effects of local therapy for breast cancer on women's sexual health. Contradictory to our understanding, regret was also not significantly associated with women's cosmetic outcomes. Decisional regret among breast cancer survivors, therefore,

seems to be a unique psychosocial construct that tracks with patient factors (race, low education, axillary surgery) but does not appear to be driven by cosmetic outcomes and appears to be distinct from overall health utility. These findings could inform how older women with nonmetastatic breast cancer approach their treatment-related decisions. The information can be incorporated into the development of decisional aids and other cost-effectiveness models focused on older breast cancer survivors to improve their knowledge and thereby enable them to bear toxicities related to local therapy for breast cancer.

Some important limitations of our study deserve mention. First, our response rate was low (30.2%), and there were significant differences between the responders and nonresponders. We observed lower participation of women who might have been likely to experience either too few or many more adverse events after their treatment. Women who received less aggressive therapy (eg, lumpectomy alone) were less likely to participate. This finding suggests that these women might not have experienced much regret from their treatment and therefore decided against participation. On the other hand, women who experienced greater toxicities from their treatment (eg, older women of nonwhite race or ethnicity and with higher comorbidities) were also less likely to participate. This limitation certainly highlights the recently observed challenges in patient recruitment and the resulting selection bias, especially around older and minority populations.^{24,48}

A second limitation is that we could not study the role of other factors such as psychosocial stress, body image anxiety after surgery, worry about the future, and the availability of emotional support to help alleviate these psychosocial concerns.¹² Similarly, we could not study the role of patients' participation in shared treatment decisionmaking on their experience of regret for receiving local therapy.⁴⁹ Past studies also indicate a temporal pattern of regret, wherein people tend to regret actions in the short term but inaction over the long term.⁵⁰ We could not study regret that perhaps may be associated with not receiving a specific type of local therapy among our patients. Furthermore, among those patients treated with mastectomy, we were unable to determine who would have been eligible for breast conservation; it is possible that regret levels among mastectomy-treated patients may differ depending on whether they were also candidates for breast conservation. Lastly, the cross-sectional nature of our study design limited our ability to capture regret or change in regret over time and to study the temporal association between our study variables.

Conclusion

One-third of the nearly 250,000 women diagnosed with breast cancer in 2017 were likely to be over the age of 65 years.^{1,8} Our study provides novel insights into longterm local therapy decisional regret in a nationally diverse cohort of older female breast cancer patients. Surgery and radiation regret afflicts nearly one quarter of older breast cancer survivors, and it is associated with black race, less education, and more extensive nodal surgery, but not more extensive breast surgery. Regret is also distinct from health utility, suggesting that it is a unique psychosocial construct that merits further study and mitigation strategies. Decisional support interventions that assist patients with anticipating these health outcomes help to promote informed decision making and thereby potentially lower the likelihood of experiencing regret in the long term, are essential.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1

Selected demographic and clinical characteristics of 421 older women (67 years old at diagnosis) with a breast cancer diagnosis in 2009

Characteristics	Surgery or radiation regret		P value
	No (n = 321)	Yes (n = 100)	
	n (%) [*]	n (%) [*]	
Demographic			
Age, y			
Median	72.3	72.0	.46
67–74	228 (79.0)	70(21.0)	
75	93 (74.4)	30 (25.6)	
Race			
White	287 [†]	75 [†]	.02
Black	15 (47.2)	13 (52.8)	
Hispanic/Other	19 [†]	11 [†]	
Education			
High school	100 [†]	35 [†]	.005
Associate or college degree	208 (85.4)	51 (14.6)	
Unknown	11 [†]	11 [†]	
Household income			
<\$40,000/year	132 (75.6)	49 (24.4)	.84
\$40,000–60,000/year	50 (80.0)	14 (20.0)	
>\$60,000/year	83 (80.5)	21 (19.5)	
Unknown	56 (74.2)	16 (25.8)	
Region			
Northeast	54 (80.4)	18 (19.6)	.80
Middle west	87 (79.7)	22 (20.3)	
South	127 (73.1)	48 (26.9)	
West	51 (78.0)	12 (22.0)	
Clinical			
Body mass index			
Underweight or normal	104 [†]	25 [†]	.61
Overweight	96 (79.6)	24 (20.4)	
Obese	106 (73.6)	37 (26.4)	
Unknown	15 [†]	11 [†]	
Charlson comorbidity index			
0	215 (75.2)	66 (24.8)	.37

Characteristics	Surgery or radiation regret		P value
	No (n = 321)	Yes (n = 100)	
	n (%) [*]	n (%) [*]	
1 +	106 (75.7)	34 (24.3)	
Bra cup size			
A-B	95 (77.8)	31 (22.2)	.84
C	91 (80.5)	25 (19.5)	
D+	85 (73.6)	23 (26.4)	
Unknown	50 (75.3)	21 (24.7)	
Type of local therapy			
Lump+WBI	74 [†]	15 [†]	.17
Lump+Brachy	72 (76.5)	19 (23.5)	
Lump-alone	60 [†]	11 [†]	
Mast-alone	56 (77.7)	18 (22.3)	
Mast+RT	59 (62.9)	36 (37.1)	
Axillary surgery			
Axillary dissection or axillary surgery NOS	151 (69.2)	64 (30.8)	.02
Sentinel lymph node biopsy	120(86.8)	23 (13.2)	
No axillary surgery	50 (77.1)	13 (22.9)	
Endocrine therapy			
No	111 (72.1)	45 (27.9)	.15
Yes	210 (80.8)	55 (19.2)	

Abbreviations: Lump-alone = lumpectomy plus endocrine therapy alone; Lump+Brachy = lumpectomy plus brachytherapy; Lump+WBI = lumpectomy plus whole-breast irradiation; Mast-alone = mastectomy alone; Mast+RT = mastectomy plus radiation therapy; NOS = not otherwise specified.

* All percentages are weighted.

[†] Cells were suppressed or data on percentages not shown to avoid compromising patient identity based on claims data in accordance with our Data Use Agreement with the Centers for Medicare and Medicaid Services.

Table 2

Adjusted risk of experiencing surgery or radiation regret among 421 older women (67 years old at diagnosis) with a breast cancer diagnosis in 2009

Characteristics	Risk ratio	95% Confidence interval	P value
Type of local therapy *			
Lump+WBI	Referent		
Lump+Brachy	1.08	0.59–1.99	.81
Lump-alone	0.25	0.03–2.43	.23
Mast-alone	0.70	0.46–1.08	.11
Mast+RT	1.01	0.61–1.69	.96
Race			
White	Referent		
Black	2.09	1.33–3.29	.001
Hispanic or other	0.65	0.12–3.65	.62
Education			
Associate or college degree	Referent		
High school	1.87	1.27–2.75	.001
Axillary surgery			
Sentinel lymph node biopsy	Referent		
Axillary dissection or axillary surgery NOS	2.13	1.33–3.41	.002
No axillary surgery	1.46	0.80–2.65	.22

Abbreviations: Lump-alone = lumpectomy plus endocrine therapy alone; Lump+Brachy = lumpectomy plus brachytherapy; Lump+WBI = lumpectomy plus whole-breast irradiation; Mast-alone = mastectomy alone; Mast+RT = mastectomy plus radiation therapy; NOS = not otherwise specified.

* In these analyses, patients who responded that they strongly agreed, agreed, or neither agreed nor disagreed to experiencing regret in receipt of surgery or radiation were considered regretful (n = 100; 23.8%). In an alternative definition of regret in which patients who either strongly agreed or agreed to experiencing regret were considered regretful, 53 patients (12.1%) reported regretting surgery or radiation.

Summary of patient-reported outcomes by surgery or radiation regret among 413 older women (> 67 years old at diagnosis) with a breast cancer diagnosis in 2009

Table 3

Patient-reported outcomes	N	Median	Weighted Mean	95% Confidence interval	P value*
CanSORT overall	413	3.7	3.6	3.4–3.7	
No regret	316	3.8	3.6	3.5–3.8	.12
Yes regret	97	3.5	3.3	2.9–3.7	
BREAST-Q satisfaction with breast overall	403	58.0	60.6	57.6–63.6	
No regret	311	59.0	61.9	58.5–65.3	.09
Yes regret	92	51.0	56.1	50.1–62.0	
BREAST-Q psychosocial well-being overall	406	82.0	80.4	77.8–82.9	
No regret	313	87.0	81.5	78.8–84.2	.15
Yes regret	93	73.0	76.2	69.6–82.9	
BREAST-Q physical well-being overall	405	81.0	81.3	79.1–83.5	
No regret	312	83.5	82.0	79.6–84.5	.22
Yes regret	93	75.0	78.8	74.2–83.4	
BREAST-Q sexual well-being overall	179	48.0	51.2	45.9–56.5	
No regret	133	57.0	55.1	49.2–61.0	.01
Yes regret	46	33.0	39.5	29.2–49.8	
BREAST-Q adverse radiation effect overall	181	100.0	88.8	86.1–91.4	
No regret	145	100.0	89.6	87.0–92.2	.34
Yes regret	36	100.0	85.7	77.9–93.4	
EQ-5D-3L overall	401	0.8	0.8	0.8–0.9	
No regret	310	0.8	0.8	0.8–0.9	.48
Yes regret	91	0.8	0.8	0.7–0.9	

*P-value from F test adjusted for weight.

Table 4

Multivariable model examining the association between surgery or radiation regret and health utilities among 406 older women (67 years old at diagnosis) with a breast cancer diagnosis in 2009

Patient characteristics	Estimate	Coefficient	SE	95% Confidence interval	P value
Intercept	0.92		0.03	0.85–0.98	<.0001
Surgery/radiation regret					
No	Referent				
Yes	–0.03		0.03	–0.09 to 0.03	.37
Patient-reported race					
White	Referent				
Black	0.09		0.04	0.00–0.18	.045
Hispanic/other	0.01		0.05	–0.09 to 0.11	.79
Household income					
\$60,000/year	Referent				
<\$40,000/year	–0.10		0.03	–0.15 to –0.04	.0006
\$40,000–\$60,000/year	–0.04		0.03	–0.1 to 0.02	.17
Charlson comorbidity index					
0	Referent				
1	–0.04		0.03	–0.1 to 0.02	.18
2	–0.08		0.04	–0.16 to 0.00	.04
Bra cup size					
A-B	Referent				
C	0.02		0.02	–0.02 to 0.07	.30
D	–0.07		0.04	–0.14 to 0.00	.06
US-trained physician					
No	Referent				
Yes	0.08		0.03	0.02–1.14	.012

The model was adjusted for patient-related factors (age, education, region of residence, smoking history, body mass index, type of local therapy received, receipt of axillary surgery, endocrine therapy) and physician-related factors (board certification, if US-trained, medical degree, decade of medical graduation, specialty, sex, and case volume).