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# Patient Views and Correlates of Radiotherapy Omission in a Population-Based Sample of Older Women with Favorable Prognosis Breast Cancer

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## Abstract

**Background—**Radiotherapy omission after lumpectomy is a reasonable option for many older women with favorable prognosis breast cancer. We sought to evaluate patient perspectives regarding decision-making about radiotherapy (RT).

**Methods—**Women age 65–79 with stage I and II breast cancer reported to the Georgia and Los Angeles County SEER registries were surveyed (response rate=70%) regarding radiotherapy decisions, the rationale for omitting RT, decision-making values, and understanding of recurrence risk. We also surveyed their corresponding surgeons (response rate=77%). We evaluated patient

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characteristics associated with omission of RT using multilevel, multivariable logistic regression, accounting for patient clustering within surgeons.

**Results—**Of 999 patients, 135 omitted RT (14%). Older age, lower grade, and estrogen receptor-positive disease were each strongly associated with omission of RT in multivariable analyses, whereas number of comorbidities was not. Non-English speakers were more likely to omit RT (adjusted OR 5.9, 95% CI 1.4–24.5).

The most commonly reported reasons for RT omission were that a physician advised the patient it was not needed (54% of patients who omitted RT) and patient choice (41%). Local recurrence risk was overestimated by all patients, by about 2-fold among those who omitted radiation and 8-fold among those who received radiotherapy. Distant disease recurrence risk was overestimated 3-fold on average.

**Conclusions—**To some extent, decisions about radiotherapy omission are appropriately influenced by age, grade, and estrogen receptor status, but do not appear to be optimally tailored according to competing comorbidities. Many women who are candidates for radiotherapy omission overestimate their risk of recurrence.

## Condensed Abstract

Radiotherapy omission among older women with early stage breast cancer was appropriately associated with age, grade, and estrogen receptor status, but did not appear to be tailored according to comorbid disease. Despite their favorable prognosis, many older women with early stage breast cancer markedly overestimate the risk of local and distant recurrence.

### Keywords

breast cancer; radiotherapy omission; risk perception; geriatric oncology; decision-making

## Introduction

There is growing concern about overtreatment in older women with early stage breast cancer because they are often more likely to die of competing comorbidities than breast cance.[1] Two trials (CALGB 9343 and PRIME II) have shown that among older women with stage I, estrogen receptor (ER)-positive invasive breast cancer that is treated with breast conserving surgery and endocrine therapy, adjuvant radiotherapy significantly reduces the incidence of local recurrence, but without an apparent influence on the rate of metastasis or breast cancer mortality.[2, 3] Guidelines now consider omission of RT after BCS as an acceptable treatment option for women age ≥70 with stage T1, clinically node negative, ER-positive breast cancer who receive endocrine therapy.[4]

Some have argued that all older women with characteristics similar to the eligibility requirements for CALGB 9343 and PRIME II should not receive radiotherapy, whether infirm or fit.[5] Others have advocated for a more individualized approach to decisions about RT that accounts for tumor characteristics, comorbidity, and patient preferences.[3] The lack of consensus regarding the treatment approach in this scenario is evident in several practice patterns studies that revealed only a modest decline in RT utilization after publication of

CALGB 9343 results.[6–10] Our previous work evaluating clinician views on radiotherapy omission in this context found that many clinicians overestimate the benefits associated with radiotherapy and continue to consider RT omission to be substandard therapy.[11]The frequency with which older patients are offered treatment without RT is uncertain, and little is known about their understanding of the risks and benefits of this treatment approach.

In this setting of evolving views on the treatment paradigm for older women with favorable prognosis breast cancer, we sought to evaluate patients' perspectives on the decision about radiotherapy omission as part of a survey that included a sizable sample of older women recently diagnosed with early stage breast cancer, as identified by the population-based Georgia and Los Angeles SEER registries. To our knowledge, this is the first study to evaluate patient views on radiotherapy omission. Our objectives were 1) to evaluate patient characteristics associated with radiotherapy omission; 2) explore patients' rationale for not receiving radiotherapy; and 3) assess patients' understanding of recurrence risk.

## Methods

### Patient Sample and Data Collection

The Individualized Cancer Care (iCanCare) Study is a large survey study of women with early-stage breast cancer between age 20–79 years who were reported to the population-based Surveillance, Epidemiology and End Results (SEER) registries of Los Angeles County, California and Georgia. Racial minorities were oversampled. Patients with tumors larger than 5cm or stage III to IV disease were excluded. From the iCanCare study, we selected women age ≥65 for the present analysis.

Between July 2013 and August 2015, we identified 7,303 women who were confirmed to be eligible for the study. Surveys were completed a median of 6.8 months (SD 3.2) after diagnosis, with a response rate of 69.6% (n = 5080). The analytic sample (n=999) for the present study consisted of patients age 65–79 with unilateral invasive breast cancer treated with breast conserving surgery (online supplementary figure 1). Within this sample, 74% of patients had stage I disease and 23% stage II (table 1). Given that we observed a non-negligible rate of radiotherapy omission in stage II patients (12%), we also included stage II patients in multivariable models of radiotherapy omission.

Surveys were mailed with a $20 cash incentive; a modified Dillman method was used to improve the response rate.[12] Materials were mailed in English; Spanish-translated materials were added for women with surnames that suggested Hispanic ethnicity.[13] Each SEER registry provided SEER data that were stripped of identifiers and merged to survey data. This study was approved by the University of Michigan Institutional Review Board, the University of Southern California, Emory University, and the public health departments of Georgia and California.

### Measures

We developed the questionnaire iteratively with input from survey design experts and cognitive interviews with patients and clinicians to assess content validity, as described previously.[14]

The definitive surgical procedure was determined by asking patients to indicate the surgery that was performed after biopsy, and whether additional surgeries were performed. As the primary outcome measure, radiotherapy receipt was determined by asking patients, “Did you or are you planning to have radiation therapy to treat your breast cancer?” as well as whether radiotherapy (RT) was completed, ongoing, or planned. Information on endocrine therapy receipt was available for 62% of the analytic sample (n=619) who completed the survey module on endocrine therapy.

Patient preferences and values were assessed by asking, “When decisions were being made about your treatments, how important was it to you that your treatments…” followed by several prompts (detailed in figure 4), such as, “kept you from worrying about the cancer coming back,” each rated on a 5 point Likert-type scale ranging from “not at all important” to “very important.” Women who omitted radiotherapy were asked to indicate the reasons for their decision in a “mark all that apply” format. Responses were aggregated into higher (i.e. a lot, quite a bit, or somewhat) and lower (i.e. not at all or a little bit) categories for analysis.

We evaluated patient perceptions of recurrence risk by asking, “After receiving all the planned treatments, what do you think is the chance that your cancer will come back in the breast or the area around it within 10 years?” with instructions to write in a number from 0% to 100%. A similar question was asked about “the chance that your cancer will spread to other parts of your body within 10 years.” We asked patients how often they had worried about their cancer coming back within the past month, with responses on a 5-point scale ranging from “almost never” to “almost always,” dichotomizing those who reported “sometimes,” “often,” or “almost always” worrying from those reporting worrying “rarely” or “almost never.” We asked how much doctors discussed the chance of cancer recurrence, ranging from “not at all” to “a lot” on a 5-point scale. Patients’ decision control preferences were evaluated by asking if they “preferred to make [their] own decisions,” with responses as “quite a bit of the time” or “all of the time” dichotomized from “some of the time,” “a little of the time,” and “none of the time.”

Additional covariates included patient-reported information on comorbidities, race/ethnicity (white, black, Asian, Latina, other), education (no college vs at least some college), income (<$20, $20–40, $40–60, $60–90, >$90, in thousands), insurance (private, Medicare, Medicaid, other), marital status (married, divorced/separated, never married, widowed), and travel time to the nearest radiation oncology facility (<15, 15–30, 31–60, >60 minutes). We asked patients to indicate which language they primarily speak.

## Surgeon Sample and Data Collection

Patients were asked to identify their surgeons. From the patient analytic sample, 960 women were linked to 311 treating surgeons, of whom 240 completed a surgeon-specific survey (77%). A mean of 3 patients (IQR 1–4) were linked to each surgeon. Surgeons were asked about their annual breast cancer patient volume, whether the practice included residents and fellows, and number of years in practice. Surgeons were also asked, “How involved are you in the selection of adjuvant radiation therapy approach in your post-lumpectomy patients?” with answers ranging from “not at all involved” to “very involved” on a 5-point scale.

**Statistical Analysis—**We first calculated the proportion of women omitting radiotherapy overall and by all demographic and treatment factors. Bivariate associations with radiotherapy omission were evaluated using the Rao-Scott $\chi^2$ test. Multivariable, multilevel logistic regression was used to explore the adjusted associations with radiotherapy omission, with patients as the primary units of observation and the surgeon identifiers as the secondary units (i.e. patients clustered within surgeon) [15]. Models were constructed beginning with patient-level covariates, incorporating surgeon clustering, and finally adding surgeon-level covariates. Area under the receiver-operator curve (AUC) was reported to measure the model's discriminatory ability. All statistical analyses incorporated weights to account for the differential probability of sample selection and survey nonresponse. Additionally, though survey and SEER item nonresponse was low (<5%) for most covariates, we multiply imputed missing items using sequential multiple imputation techniques[14, 16] to prevent potential bias when using complete-case methods in the presence of missing data. P-values 5% or less were considered significant throughout. All analyses were conducted using the SAS system version 9.4 (Cary, NC, USA).

## Results

### Radiotherapy Receipt

Table 1 and online supplementary table 1 show the distribution of patient and surgeon characteristics. Overall, 14.4% of women in this sample of older women omitted radiotherapy after breast conserving surgery, with 15.7% omission in the subset of patients with ER+, Stage I disease. Among those who received radiotherapy, 48.1% received conventionally fractionated whole breast RT, 26.6% received hypofractionated whole breast RT, 11% received accelerated partial breast RT, 2.2% reported "other" or the duration was not specified, and 12.1% were scheduled to receive RT but had not yet received it at the time of survey. On bivariate analysis, age, grade, ER status, SEER region, and income were associated with RT omission. Figure 1 shows the results of a multilevel logistic regression model that includes patient-level variables, SEER site, and surgeon identity. Older patient age, lower grade, and ER-positive disease were each strongly correlated with RT omission. Age 75–79 had a dominant effect, with an odds ratio of 14.4 (95% CI 5.6–37.1) when compared to age 65–69. The odds of non-English speakers omitting RT were greater when compared to English speakers (OR 5.9, 95% CI 1.4–24.5). It is noteworthy that patient comorbidities were not associated with RT omission on either bivariable or multivariable analysis (OR 1.3 for ≥2 vs 0 comorbidities, 95% CI: 0.6–2.9). Surgeon variables were not significantly associated with radiotherapy omission and were therefore not retained in the final model.

The multilevel model predicted RT omission well, with an AUC of 0.83 (95% CI 0.79–0.87). When analyzing clustering according to the surgeon identifier, the odds of a patient omitting radiotherapy would be predicted to increase approximately two-fold (OR 1.83, 95% CI 0.87–3.87) if she were to see a surgeon with a practice approach one standard deviation above the RT omission rate of an average surgeon (while adjusting for other model covariates). However, this trend for surgeon influence was not statistically significant. In a model restricted to the subgroup of patients with information on hormonal therapy, use of

endocrine therapy was not significantly associated with radiotherapy omission, although there appeared to be a trend for women who omit radiotherapy to also omit endocrine therapy (OR 2.22, 95% CI 0.87–5.65; data not shown). In a model limited to patients with ER+, stage I disease, we again observed that age, grade, and non-English speakers were significantly correlated with radiotherapy omission, without significant association with comorbidities, similar to the model derived from the larger analytic sample.

## Risk Perception and Communication

In the subset of patients with ER+, Stage I disease, 33.1% of women overestimated their risk of local recurrence after all treatments were received as being >10% at 10 years. Among those who omitted RT, when asked to approximate their risk of local recurrence at 10 years, the mean estimate was 19% at 10 years (compared to the CALGB finding of 10%), and among women who received RT, the mean estimate was 17% (in contrast to CALGB 9343 finding of 2%; figure 2).[2] The risk of distant disease recurrence risk was similarly overestimated, with 46% of women approximating their risk of distant recurrence as being >5% at 10 years. The mean estimate of 10-year distant recurrence risk was 16.0% (compared to the CALGB finding of 5% both among those who received and omitted RT).[2] In this group of older women with favorable prognosis, approximately a quarter (26.9%) reported that within the last month, they had “sometimes,” “often,” or “almost always” worried about their cancer coming back, without significant differences for women who received or omitted RT.

Regarding communication with providers, 46.2% of patients in the overall sample reported that their physicians used numeric estimates to describe the risk of the cancer coming back. Approximately one-third (37.9%) reported that their doctors discussed the chance of the cancer coming back “not at all” or “a little bit.” Although the majority of women (70.0%) reported that they preferred that their doctors tell them what to do for breast cancer treatment, women who omitted radiotherapy were more likely to report that they preferred to make their own decisions about breast cancer treatments than women who received RT (45.8% vs 35.7%, p=0.03).

## Patient Preferences and Values

Among women who omitted radiotherapy, the most commonly reported reasons were that a physician told the patient it was not needed (53.8% of patients who omitted RT) and that the decision was left to the patient and she chose to omit RT (40.9%, figure 3). Concerns about placing an excessive burden on family and absence of discussion with a doctor about RT were uncommon reasons for omitting RT (≤5%). Although 11.8% of patients reported “quite a bit” or “a lot” of worry about current or future financial problems as a result of breast cancer and treatments, <1% of women who omitted radiotherapy reported that cost motivated their treatment decision.

When asked about considerations that were important in their decision-making, the most commonly reported priorities were that the treatment kept them from worrying about the cancer coming back (74.0%), had a low possibility of complications (73.9%), and allowed them to continue caring for their home and family (73.6%, figure 4). Women who omitted

radiotherapy more commonly endorsed the importance of avoiding exposure to radiation (69% vs 37%, p<0.001) and the need for fewer trips for treatment visits (49.2% vs 37.2%, p=0.008).

## Discussion

In this large, contemporary survey of older women with early stage breast cancer, we observed that to a substantial extent, decisions about radiotherapy omission appear to be appropriately tailored based on older age, ER-positive disease, and lower grade tumor. However, the higher rate of RT omission in non-English speakers and the lack of association with comorbidity observed here are concerning. Incorporation of age and pathology findings into the decision to omit RT may be viewed as a starting point, but there remains a great need to further consider comorbidity status and remaining life expectancy to ensure that decisions about radiotherapy are appropriately individualized.[17]

We found that despite having an excellent prognosis, a sizeable proportion of older women with Stage I, ER+ breast cancer overestimate their risk of local recurrence, with an average two-fold overestimation in women who omitted RT and 8-fold overestimation in women who received RT. Nearly half of women perceived that their risk of distant recurrence was higher than has been reported in clinical trials, with an average 3-fold overestimation. This unrealistically pessimistic view of recurrence risk is reflected in the report from a quarter of women that they had frequently worried about cancer recurrence within the preceding month.

Our observations are consistent with prior reports that notwithstanding a favorable prognosis, a large proportion of the most favorable subgroup in our sample of older women felt they were likely to develop a local or distant recurrence and die from breast cancer, resulting in psychological distress, frequent worry, and lower quality of life.[18, 19] Overestimation of recurrence risk may lead to a multiplicative overestimation of risk reduction from interventions,[20] resulting in overly generous attribution of benefits obtained from treatment. This might underlie the correlation that has been observed between worry about recurrence and receipt of radiotherapy in prior research.[21, 22] It is notable that one of the highest priorities that influenced decision-making for women in our study was that the treatment minimize the worry about cancer recurrence. Although radiotherapy undoubtedly does reduce the risk of local recurrence,[2, 3] our results indicate a need to more clearly communicate the favorable prognosis in this group, and to more directly address worry about recurrence and ensure that decisions are optimally informed.

The effects of patient overestimation of recurrence risk may well relate to physician overestimation that has been demonstrated in other work. In a nationwide survey, 19% of radiation oncologists and 32% of surgeons overestimated the 10-year risk of local recurrence.[11] The reluctance of many surgeons and radiation oncologists to consider radiotherapy omission to be a reasonable option in select older women is particularly problematic given the findings of the current study demonstrating that the most common reason given by women for the decision to omit radiotherapy was advice from a doctor that radiotherapy was not needed. Furthermore, most women (70%) preferred that their doctors

tell them what to do regarding their breast cancer treatment. Therefore, physicians' attitudes and approaches to communication may be particularly important to ensure that patients do indeed consider all options and their risks and benefits. Many potential mechanisms have been considered as possible drivers of physicians' poor communication practices in this setting, including lack of up-to-date knowledge of clinical trial results,[23] heuristics like risk aversion and anticipatory regret that may motivate physicians and patients alike to embrace overly aggressive treatments,[24] lack of training in effective risk communication skills,[25] and financial incentives that reimburse the delivery of care rather than its omission.[7] Our data suggest a compelling need to evaluate the relative roles of these underlying drivers further in order to develop appropriately targeted interventions that encourage clinicians to improve communication in this regard. We find it striking that one-third of women reported minimal discussions with their providers about the risk of recurrence, which is absolutely essential for a patient to understand the relative impact of interventions like radiotherapy.

Our data suggest that surgeons, who are the first breast cancer clinicians to outline a plan of care, may play an important role in decisions regarding radiotherapy omission. Although we did not detect a statistically significant impact of the surgeon on the likelihood of radiotherapy omission, this may be due to the sample size and distribution of patients across surgeons within our sample. We did, however, observe a notable trend, and others have shown that among women with short life expectancy, the probability of receiving RT varies substantially across primary surgeons.[26]

We also found that non-English speakers were significantly more likely to omit radiotherapy, even after adjustment for race, income, employment and education. This finding may reflect barriers to high quality decision-making in a vulnerable population. Numerous reports describe non-English speakers as a vulnerable population, particularly Latinas with low acculturation.[27–30] Latina women who are less acculturated have previously been found to have greater desire for information, lower satisfaction with breast cancer decision-making,[30] and perceived powerlessness in medical encounters,[31] highlighting a need for greater attention to support these patients and identify potential barriers.[32] Although disparities are often viewed in the context of undertreatment of an aggressive cancer, with vulnerability related to known risk factors such as lower education or minority race, it is interesting to note that vulnerability to overtreatment may be an entirely distinct concept that primarily affects classically privileged populations, as has been observed with trends in contralateral prophylactic mastectomy.[33, 34] The association between language barrier and RT omission is worthy of further exploration in future studies.

We observed a trend for patients who omit radiotherapy to also omit endocrine therapy. This is a particularly concerning finding that merits further evaluation, as receipt of endocrine therapy is known to have a substantial impact in reducing local recurrence[35] and is believed to be a key factor in leading to the acceptable rates of local failure observed in trials like CALGB 9343 as compared to historical studies where endocrine therapy was not required.[36, 37] Endocrine therapy non-adherence and discontinuation are known to be an issue for nearly half of women with breast cancer in general,[38] and if women who omit radiotherapy are even more likely to omit endocrine therapy, rates of recurrence may be higher than expected.

Aspects of the study merit comment. Strengths include a contemporary, diverse, population-based sample with a high response rate and specific measures of patients' clinical decision making. Multiple imputation and weighting were used to account for potential bias related to missing data, and to ensure that the results were representative of the overall population. Limitations include data obtained from 2 large SEER regions (Georgia and Los Angeles County), which might not reflect the entire US population. The number of patients who omitted radiotherapy is small. Patient responses are necessarily retrospective and may be subject to recall bias. Finally, our study evaluated patients' views of radiotherapy omission, but did not explore views about omitting endocrine therapy rather than radiotherapy.[39] Nonetheless, our study offers a novel and clinically relevant view of decision-making in older women with favorable prognosis breast cancer.

In conclusion, our findings indicate several targets for interventions to improve the quality of older women's decision-making in the context of radiotherapy after lumpectomy. First, although decisions about radiotherapy omission are influenced by some clinical factors, interventions are necessary to ensure that decisions reflect not only considerations of age and tumor characteristics but also patients' health status and remaining life expectancy. Second, communication must improve, as patients cannot share in the making of preference-concordant decisions when they are not optimally informed about key facts such as recurrence risk and report that their providers had little discussion with them regarding this. Ultimately, we believe that a combination of physician-facing and patient-facing interventions are necessary, as it appears that both patients and physicians play important roles in the predominant intervention bias that has resulted in overtreatment of many older women with early stage breast cancer.[7] Our results demonstrate that most older women with breast cancer care about avoiding complications and about avoiding worry about recurrence. Therefore, decision aids that present risk information in understandable formats, such as pictographs,[40] constitute particularly promising avenues for the improvement of decision quality in practice. Clear information and communication is critical, both for the subset of older patients with favorable risk disease in whom radiotherapy omission is a reasonable and guideline-concordant option if it accords with individual preferences, and also for the subset with more aggressive or advanced tumors, for whom radiotherapy remains a fundamental component of cure.

## Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Conflicts of Interest

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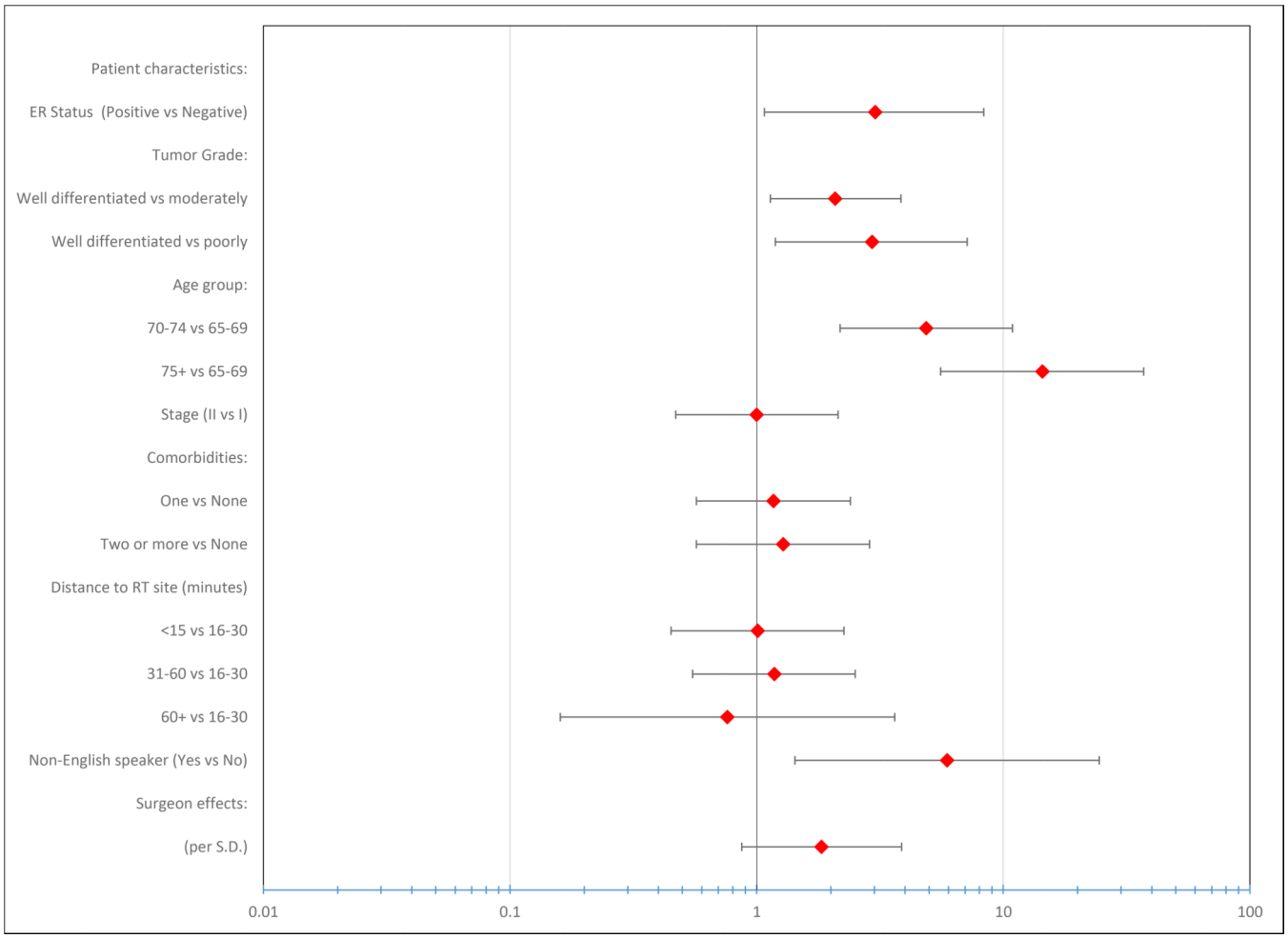


**Figure 1:**

Odds ratios from a model estimating radiotherapy omission. Odds ratios from a multilevel logistic regression model estimating radiotherapy omission. The model was adjusted for race, income, education, insurance, marital status, BMI, and SEER site. The odds ratio for the surgeon effect represents the amount by which a patient's odds of radiotherapy omission are multiplied if they see a surgeon associated with a rate of radiotherapy omission that is one standard deviation above the average surgeon.

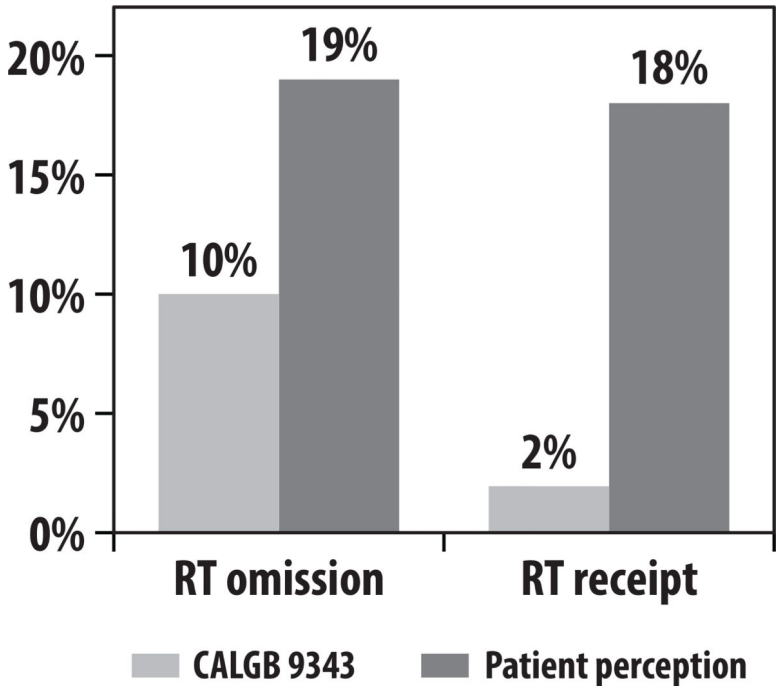


**Figure 2:**
Patient-reported estimates of 10-year risk of local recurrence in patients aged 65–79 with stage I, estrogen receptor positive invasive breast cancer compared to CALGB 9343 results.

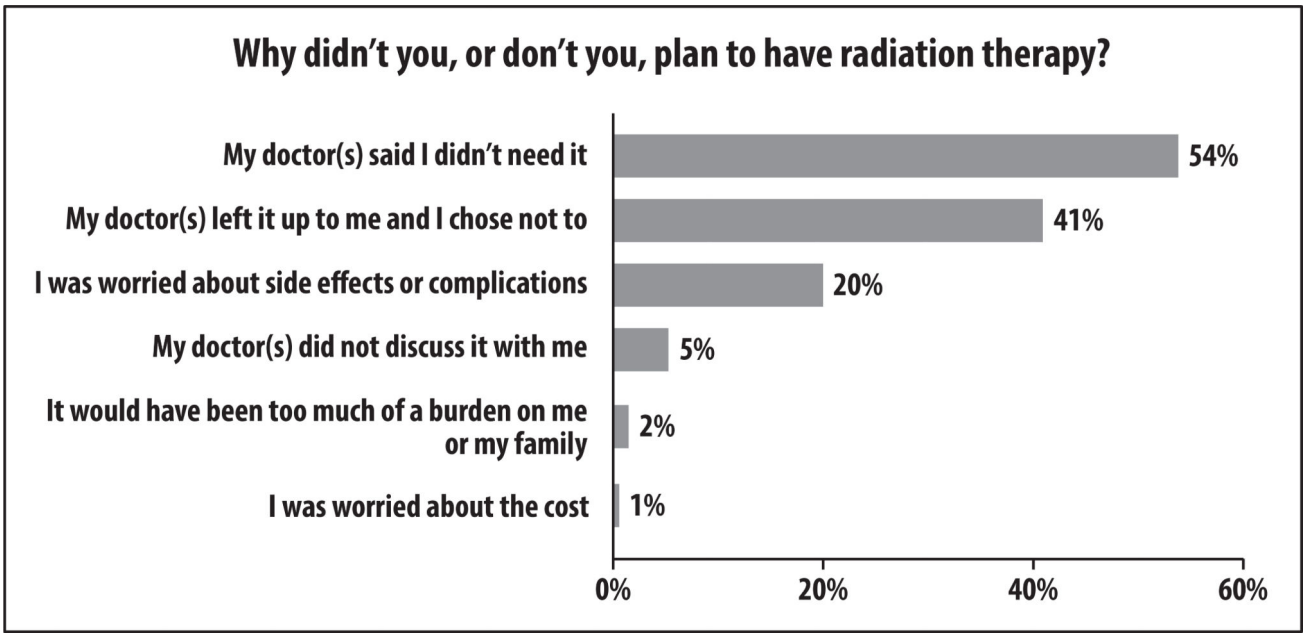


**Figure 3.**
Patient reported reasons for omission of radiotherapy. Responses are not mutually exclusive.

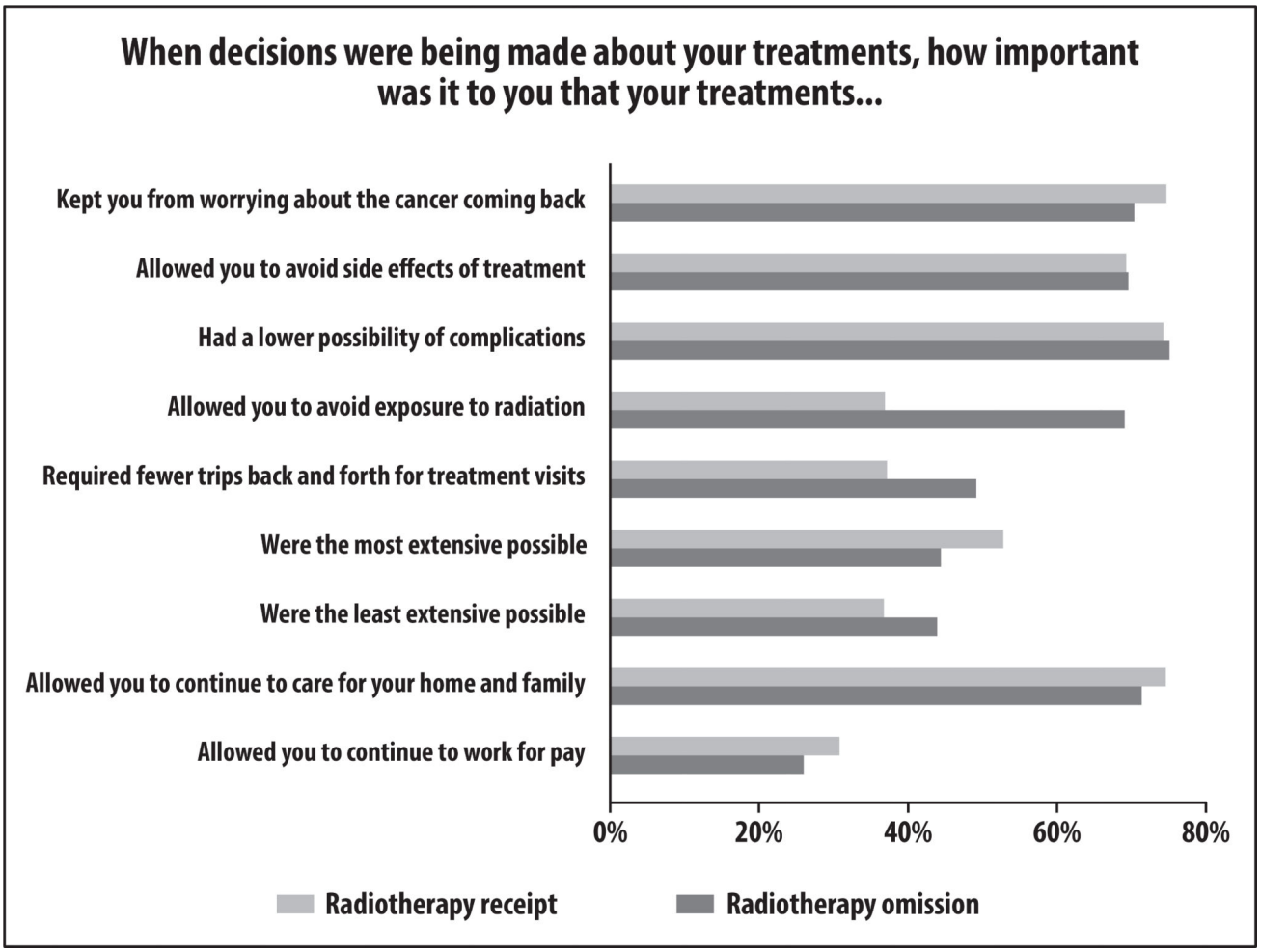


**Figure 4.**
Patient reported considerations that influenced decisions about breast cancer treatment.

**Table 1:**

Patient Characteristics

| | No. N=999) | Weighted % | % Omitting RT* | P† |
|---|---|---|---|---|
| **Age** | | | | |
| 65–69 | 410 | 40.2 | 5.4 | <0.0001 |
| 70–74 | 337 | 34.1 | 16 | |
| 75–79 | 252 | 25.7 | 26 | |
| **SEER Stage** | | | | 0.5404 |
| 1 | 749 | 73.5 | 14.3 | |
| 2 | 218 | 23.2 | 12.2 | |
| Not reported | 32 | 3.2 | 28.2 | |
| **ER status** | | | | 0.0164 |
| Positive | 857 | 85.5 | 15.3 | |
| Negative | 111 | 11.5 | 5.2 | |
| Not reported | 31 | 3.0 | 20.2 | |
| **SEER Grade** | | | | 0.0029 |
| 1 | 346 | 34.8 | 18.1 | |
| 2 | 430 | 43.4 | 14.4 | |
| 3 | 187 | 18.2 | 6.1 | |
| Not reported | 36 | 3.7 | 17.8 | |
| **Comorbidities** | | | | 0.2995 |
| 0 | 482 | 49.5 | 13.6 | |
| 1 | 315 | 30.3 | 12.8 | |
| 2+ | 190 | 18.9 | 17.8 | |
| Not reported | 12 | 1.3 | 21.8 | |
| **Receipt of endocrine therapy**‡ | | | | 0.2222 |
| Yes | 449 | 71.1 | 13.6 | |
| No | 170 | 26.8 | 17.7 | |
| Not reported | 15 | 2.1 | 18.5 | |
| **Site** | | | | 0.0113 |
| Georgia | 522 | 49.3 | 11.2 | |
| Los Angeles County | 477 | 50.7 | 17.2 | |
| **Primarily speak language other than English** | | | | 0.1279 |
| Yes | 896 | 90.9 | 13.5 | |
| No | 89 | 7.8 | 20.4 | |
| Not reported | 14 | 1.3 | 30.4 | |
| **Race** | | | | 0.3019 |
| White | 631 | 67.5 | 14.9 | |
| Black | 160 | 13.9 | 10.3 | |

| | No. N=999) | Weighted % | % Omitting RT* | P† |
|---|---|---|---|---|
| Latina | 136 | 11.3 | 14.9 | |
| Asian | 52 | 5.2 | 10.9 | |
| Other, unknown, or missing | 20 | 2.1 | 26.6 | |
| **Income** | | | | 0.0265 |
| <20K | 163 | 15.3 | 15.3 | |
| 20K – <40K | 183 | 17.6 | 9.6 | |
| 40K – <60K | 136 | 13.4 | 15.5 | |
| 60K – <90K | 134 | 14.4 | 10.4 | |
| 90K+ | 147 | 16.8 | 11.4 | |
| Don't know/not reported | 236 | 22.6 | 21 | |
| **Education** | | | | 0.5094 |
| At least some college | 614 | 63.4 | 13.8 | |
| No college | 365 | 34.8 | 15.4 | |
| Not reported | 20 | 1.8 | 8.6 | |
| **Type of insurance** | | | | 0.1035 |
| Medicaid | 104 | 9.9 | 15.3 | |
| Medicare | 641 | 66.1 | 14.5 | |
| Private | 121 | 12.2 | 6 | |
| Other | 7 | 0.6 | 14.7 | |
| Not reported | 126 | 11.2 | 20.9 | |
| **Marital status** | | | | 0.5347 |
| Married/partnered | 523 | 53.3 | 13.5 | |
| Not partnered | 457 | 44.8 | 15 | |
| Not reported | 19 | 1.9 | 20.5 | |
| **BMI** | | | | 0.1281 |
| Underweight (<18.5) | 8 | 0.7 | 33.5 | |
| Normal weight (18.5–25) | 262 | 27.8 | 17.4 | |
| Overweight (>25–30) | 323 | 32.7 | 12.5 | |
| Obese >30 | 371 | 35.7 | 12.7 | |
| Not reported | 35 | 3.2 | 18.4 | |
| **Bra cup size** | | | | 0.5723 |
| A/B | 289 | 29.0 | 15.9 | |
| C | 322 | 32.1 | 14.7 | |
| D | 197 | 19.7 | 13.3 | |
| DD+ | 156 | 15.8 | 11 | |
| Not reported | 35 | 3.4 | 17.1 | |
| **Distance to nearest radiation oncology clinic**‡ | | | | 0.5430 |
| ≤30 minutes | 350 | | 11.3 | |
| >30 minutes | 126 | | 11.3 | |

| | No. N=999) | Weighted % | % Omitting RT* | *P*† |
|---|---|---|---|---|
| Not reported | 34 | | 54.8 | |

*Percent omitting RT calculated within the weighted sample

†*P* values for differences in the proportion of RT omission; the 'not reported' category (if present) was excluded from the calculation.

‡Not all patients were asked to provide this information due to differences in survey versions