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Clinical Investigation

Patient Experiences and Clinician Views on the Role of Radiation Therapy for Ductal Carcinoma In Situ

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Summary

In a population-based survey of patients with DCIS, we observed that one quarter of patients omitted RT after BCS, with a twofold difference in the rate of RT

Purpose: To evaluate patient experiences with decisions regarding radiation therapy (RT) for ductal carcinoma in situ (DCIS), and to assess clinician views on the role of RT for DCIS with favorable features in the present era.

Methods and Materials: A sample of women with newly diagnosed breast cancer from the population-based Georgia and Los Angeles County Surveillance, Epidemiology, and End Results (SEER) registries were sent surveys approximately 2 months after undergoing breast-conserving surgery (BCS), with a 70% response rate. The analytic sample was limited to 538 respondents with unilateral DCIS. We also surveyed

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omission between the 2 SEER regions studied. In a corresponding survey of clinicians, we observed systematic differences in opinions between the 2 SEER regions regarding the role of RT.

761 surgeons and radiation oncologists treating breast cancer in those regions, of whom, 539 responded (71%).

Results: After BCS, 23% of patients omitted RT, with twice the rate of omission in Los Angeles County relative to Georgia (31% vs 16%; $P < .001$). The most common reasons for omitting RT were advice from a clinician that it was not needed (62%) and concern about side effects (24%). Cost and transportation were not reported as influential considerations. After covariate adjustment, low- and intermediate-grade disease (odds ratio [OR] 5.5, 95% confidence interval [CI] 2.5-12; and OR 3.2, 95% CI 1.7-6.1, respectively) and Los Angeles County SEER site (OR 4.3, 95% CI 2.3-8.2) were significantly associated with greater RT omission. Of the responding clinicians, 62% would discuss RT omission for a patient with DCIS with favorable features. Clinicians in Los Angeles County were more likely to discuss RT omission than were those in Georgia (67% vs 56%; $P = .01$). Approximately one third of clinicians would obtain the Oncotype DX DCIS score.

Conclusions: The heterogeneity in RT omission after BCS for DCIS continues to be substantial, with systematic differences in provider opinions across the 2 regions we studied. Enhanced precision of recurrence estimates, guidance from professional organizations, and better communication are needed to improve the consistency of treatment in this controversial area.

Introduction

Widespread concern exists about overtreatment of ductal carcinoma in situ (DCIS). Approximately 30% of patients undergo mastectomy (1, 2), of whom, about one third have a contraindication to breast conservation (3). Adjuvant radiation therapy (RT) is frequently administered to the remaining 70% of DCIS patients who undergo breast-conserving surgery (BCS) (1).

Although randomized trials have demonstrated that RT halves the rate of ipsilateral breast tumor recurrence after BCS for DCIS, it has not been shown to improve breast cancer-specific survival (4, 5). Among patients with in situ disease, the probability of death from other causes exceeds the probability of breast cancer death, regardless of the age at diagnosis (6). Increasing evidence demonstrates that survival after treatment of DCIS is >98% at 10 years, regardless of the intensity of locoregional therapy (2, 4, 7). Given the favorable prognosis of DCIS, concerns about overtreatment have led to efforts to identify patients who are suitable candidates for de-intensified therapy (8-12), including BCS without adjuvant RT. Previous studies have demonstrated regional variation in the use of adjuvant RT for DCIS (13); however, little is known about whether such differences persist now that data have emerged from large clinical trials in that setting.

Therefore, we conducted a survey of women recently diagnosed with DCIS from the population-based Georgia and Los Angeles Surveillance, Epidemiology, and End Results (SEER) registries, with a separate survey sent to their surgeons and radiation oncologists. Such a study is important for evaluating the patterns of care for DCIS, because SEER data alone are known to underascertain RT receipt (14). Additionally, given the age-related variability in patterns of care, restriction to the older SEER−Medicare cohort is suboptimal. Survey data also add explanatory details regarding decision-making for both patients and clinicians that cannot be obtained through registry data alone.

Our objectives were (*1*) to describe the current patterns of RT utilization for DCIS in a diverse contemporary sample treated in a variety of settings; (*2*) to evaluate, among the patients with DCIS, the reasons for omitting RT after BCS, their satisfaction with the decision-making process, and correlates of RT omission; and (*3*) to evaluate surgeons' and radiation oncologists' views on the management of DCIS with favorable prognostic features and the correlates of discussing RT omission as an option.

Methods and Materials

Patient sample and data collection

The iCanCare study identified women with a diagnosis of DCIS or early-stage invasive breast cancer aged 20 to 79 years who were reported to the SEER registries of Georgia and Los Angeles County, California. Surveys were sent between July 2013 and August 2015, with oversampling of racial minorities. The exclusion criteria included previous breast cancer, stage III to IV disease, tumors >5 cm, >3 involved lymph nodes, and an inability to complete the survey in English or Spanish. The survey was completed by 5080 eligible patients (69.6% of eligible patients surveyed; see Appendix E1; available online at www.redjournal.org) and linked to the SEER data. The median interval from diagnosis to survey completion was 6.8 ± 3.2 months. The analytic sample for the present

analysis consisted of only the subset of these patients with a diagnosis of unilateral DCIS.

We provided patients with a $20 cash incentive and used a modified Dillman method to improve the response rate (15). This study was approved by the University of Michigan, the University of Southern California, Emory University, and the public health departments of Georgia and California. All data were de-identified before research use.

Clinician sample and data collection

Attending surgeons and radiation oncologists were identified primarily through patient report on an open-ended survey question and from information available within the SEER database. We sent surveys to clinicians with a $50 to $100 cash incentive. From the 510 identified surgeons and 251 radiation oncologists, we obtained survey responses from 370 surgeons (73%) and 169 radiation oncologists (67%).

Measures

The questionnaires were developed using an iterative design process and standard techniques to assess content validity, including review by survey design experts and cognitive interviewing with patients and clinicians outside our target sample, as described in our previous report (16).

We determined the definitive surgical procedure by asking about the initial surgery after biopsy and whether additional procedures had been performed. RT receipt was measured by asking the patients, "Did you or are you planning to have radiation therapy to treat your breast cancer?" and whether RT was completed, ongoing, or planned. Among those who omitted or planned to omit RT, we asked patients to indicate their reasons. We asked about communication with clinicians, including to what extent the risk of recurrence was discussed and whether numeric estimates were used. We also asked about the distance to the nearest radiation oncology facility.

We assessed the values that influenced decision-making by asking, "When decisions were being made about your treatments, how important was it to you that your treatments…" followed by several prompts such as, "allowed you to avoid side effects of treatment," and "allowed you to avoid exposure to radiation," with responses on a 1- to 5-point scale, ranging from not at all important to very important. We also queried patient perceptions regarding the adequacy of information provided to make decisions about radiation and about decision satisfaction. Responses collected on 5-point scales were collapsed to higher (eg, somewhat, quite, and very satisfied) and lower (eg, not at all or a little satisfied) categories for analysis.

To evaluate clinician views, we presented a clinical vignette of a healthy 65-year-old woman with mammographically detected, intermediate-grade, estrogen receptor-positive DCIS with no necrosis that had been excised with lumpectomy with margins >1 cm; the patient planned to receive tamoxifen. After presenting this scenario, the surgeons and radiation oncologists were asked whether they would discuss omission of RT as an option. The response to this question was used as the dependent variable for a clinician-level multivariable logistic regression. Clinicians were also asked whether they would recommend whole breast radiation and whether they would order the Oncotype DX DCIS score. Responses were rated on a 4-point scale that was grouped as yes (probably yes or definitely yes) and no (probably no and definitely no) for analysis.

Statistical analysis

The results from the patient survey were weighted to account for sampling design and differential nonresponse. We calculated the proportions of patients who omitted RT when grouped by clinical and sociodemographic characteristics. Both unweighted and weighted proportions are presented. Univariate comparisons were performed using the χ^2 test. Variables with >5% missing used the "missing" category in calculating the χ^2 P value (for grade, magnetic resonance imaging, endocrine therapy, insurance, and income).

To account for item nonresponse in multivariable modeling, we multiply imputed data using the sequential regression multiple imputation method (17). We first generated 5 independently imputed data sets. For each imputed data set, we then fitted a weighted multivariable logistic regression model to examine the association between RT omission and patient clinical and sociodemographic covariates, including age, tumor grade, estrogen receptor status, use of RT, comorbidities, race, type of insurance, marital status, education, income, and SEER site. Finally, we combined the 5 sets of inferential statistics using Rubin's formula (18).

The results from the clinician survey were also weighted to account for differential survey nonresponse. We calculated the proportion of surgeons and radiation oncologists who reported they would discuss omission of RT as an option in a scenario of favorable prognosis DCIS (as described). Discussion of RT omission was the dependent variable in a clinician-level weighted multivariable logistic regression model, with specialty, SEER region, gender, and practice characteristics as covariates. The analyses were conducted using SAS statistical software, version 9.4, (SAS Institute, Inc, Cary, NC).

Results

Patient survey

Among the survey respondents, 538 patients with a diagnosis of unilateral DCIS treated with BCS were included in the present analysis (Table 1). Patients who had undergone mastectomy for DCIS were excluded (161 patients with

Table 1 Patient characteristics (n = 538)

Characteristics	Patients (n)	Weighted (%)	Omitting RT* (%)	*P* value†
Age (y)				.04
<49	87 (16.2)	15.7	16.4	
50-69	334 (62.1)	62.5	21.8	
≥70	117 (21.7)	21.8	31.1	
Grade				<.001
Low	67 (12.5)	12.2	39.8	
Intermediate	229 (42.6)	42.7	26.8	
High	205 (38.1)	38.9	10.3	
Other or unknown	37 (6.9)	6.2	43.3	
Estrogen receptor status				<.001
Positive	476 (88.5)	88.1	22.4	
Negative	42 (7.8)	8.4	14.1	
Unknown	20 (3.7)	3.4	61	
MRI				.14
Yes	271 (50.4)	51.9	19.9	
No	217 (40.3)	39.8	27.4	
Unknown	50 (9.3)	8.3	21.4	
Endocrine therapy				.01
Yes	191 (35.5)	36.4	17.6	
No	131 (24.3)	24.3	32.0	
Unknown	216 (40.1)	39.3	22.5	
Comorbidity				.08
None	361 (67.1)	67.7	25.2	
≥1	177 (32.9)	32.3	18.4	
Race				.13
White	251 (46.7)	53.3	22.9	
Black	118 (21.9)	23.2	17.8	
Latina	109 (20.3)	14.8	24.2	
Asian	51 (9.5)	7.2	33.4	
Other or unknown	9 (1.7)	1.5	45.5	
Type of insurance				.16
Medicaid/ other public	58 (10.8)	10.7	25.4	
Medicare	123 (22.9)	24.2	23.5	
Private	284 (52.8)	53.1	20.2	
None	8 (1.5)	1.2	10.8	
Unknown	65 (12.1)	10.8	34.7	
Marital status				.77
Married/partnered	307 (57.1)	56.4	23.0	
Not partnered	221 (41.1)	41.7	21.9	
Not reported	10 (1.9)	1.9	49.3	
Education				.09
Some college or less	317 (58.9)	58.8	20.3	
College graduate or more	207 (38.5)	38.9	26.9	
Not reported	14 (2.6)	2.3	26.9	
Income ($)				.24
<20,000	66 (12.3)	12.1	14.4	
20,000-90,000	246 (45.7)	45.8	22.9	
≥90,000	139 (25.8)	26.2	24.0	
Unknown	87 (16.2)	15.9	28.3	
Employment status				.33
Unemployed	108 (20.1)	18.8	26.1	
Part-time	56 (10.4)	10.8	28.8	
Full time	216 (40.1)	40.2	19.1	
Retired/not working	158 (29.4)	30.2	24.3	
Site				<.001
Georgia	221 (41.1)	53.8	16.2	
Los Angeles County	317 (58.9)	46.2	31	

Abbreviations: MRI = magnetic resonance imaging; RT = radiation therapy.

Data in parentheses are percentages; percentages do not sum to 100% because of rounding.

* Percentage omitting RT calculated within the weighted sample.

† *P* values for differences in the proportion of RT omission stratified by the categories shown; a separate category was included for unknown when the unknown values were >5% (eg, for insurance).

unilateral mastectomy and 199 patients with bilateral mastectomy).

The patient characteristics and rates of RT omission are listed in Table 1. Overall, 23% omitted RT after BCS. On univariate analysis, grade, age, estrogen receptor status, and SEER region were each significantly associated with RT omission. In the subset of 322 patients for whom we had data on endocrine therapy receipt, we observed that patients who did not receive or did not plan to take endocrine therapy were also more likely to omit RT. We observed markedly different rates of RT omission in the 2 SEER regions included in the present study, with nearly twice the rate of RT omission in Los Angeles County relative to Georgia (31% vs 16%; $P < .001$). In a patient-level logistic regression model that included the covariates from Table 1, lower grade and Los Angeles County SEER site were significantly associated with greater RT omission (Table 2).

A trend was found toward greater RT omission with increasing age, ranging from a 13% omission rate for age <50 years to a 28% omission rate for age ≥70 years. Similarly, the rates of RT omission were greater with lower grade disease in each age group, with the greatest rate of omission occurring in women aged ≥70 years with grade 1 disease (59%). No significant interactions were found among age, grade, and site (Table 3).

Among the women who did not receive RT, the most commonly reported reasons were that a clinician told them it was not needed (62% of women who omitted RT), that the decision was left to the patient and she chose not to receive RT (29%), and concern about side effects and complications (24%); the responses were not mutually exclusive. A small proportion of women who omitted RT reported that their clinicians did not discuss the role of RT with them (6%). Few women omitted RT because of concern for burdens the treatment would impose (3%) or cost (4%). Women who reported living ≥30 minutes from the nearest radiation oncology facility were no more likely to omit RT than women who lived closer. We did not

Table 2 Patient-level logistic regression model of characteristics associated with radiation therapy omission

Variable	OR	95% CI	*P* value
Grade			<.001
Low	5.49	2.51-12.03	
Intermediate	3.22	1.69-6.13	
High	1.00	Reference	
Age group (y)			.65
<50	1.00	Reference	
50-69	1.39	0.62-3.12	
≥70	1.50	0.51-4.45	
Estrogen receptor status			.66
Positive	1.53	0.39-5.94	
Negative	1.00	Reference	
Comorbidity			.08
None	1.65	0.92-2.95	
≥1	1.00	Reference	
Race			.63
White	1.00	Reference	
Asian	0.83	0.35-1.96	
Black	1.18	0.54-2.61	
Latina	0.66	0.29-1.48	
Education			.12
Some college or less	1.00	Reference	
College graduate	1.59	0.87-2.92	
Income ($)			.65
<20,000	1.00	Reference	
20,000-90,000	1.39	0.35-5.54	
≥90,000	1.19	0.23-6.16	
Marital status			.51
Not married/partnered	1.00	Reference	
Married/partnered	1.25	0.67-2.36	
Employment status			.67
Unemployed	0.99	0.44-2.19	
Part time	1.60	0.64-3.96	
Full time	0.82	0.40-1.70	
Retired/not working	1.00	Reference	
Type of insurance			.65
Medicare	1.34	0.61-2.94	
Medicaid/other public	1.38	0.42-4.52	
Private	1.00	Reference	
Site			<.001
Los Angeles County	4.33	2.28-8.18	
Georgia	1.00	Reference	

Abbreviations: CI = confidence interval; OR = odds ratio.
Median number = 540 from 5 independently imputed data sets.

Table 3 Omission of radiation therapy stratified by age and grade

Variable	Omitting RT (weighted %)
Age <50 (n = 79)	13.2
Grade 1	27.0
Grade 2	20.7
Grade 3	2.1
Age 50-70 (n = 317)	21.8
Grade 1	36.5
Grade 2	28.7
Grade 3	9.6
Age ≥70 (n = 105)	27.5
Grade 1	59.3
Grade 2	26.3
Grade 3	19.4

Abbreviation: RT = radiation therapy.

observe differences in the reasons for omitting RT between the 2 SEER sites sampled.

When asked about the considerations that influenced their treatment decisions, the women who omitted RT were more likely to value avoidance of side effects (81% vs 65%; $P = .002$), avoidance of radiation exposure (78% vs 36%; $P < .001$), and fewer trips for treatment visits (51% vs 38%; $P = .02$). Although we did not observe differences between the 2 geographic regions in these considerations, we found that women in Los Angeles County who omitted RT more often reported the importance of receiving the least extensive treatment possible. Overall, most women reported that it was very important that their treatments kept them from worrying about cancer recurrence (80.5%), had a low possibility of complications (80.9%), and allowed them to continue caring for their home and family (80.5%). Approximately one half of women (51.3%) reported that it was very important that their treatment decision allowed them to continue to work for pay, primarily patients aged <60 years.

Regarding communication about the risk of cancer recurrence, 34.9% of patients reported that their clinicians discussed the risk of cancer recurrence "not at all" or "a little bit," with no apparent differences between patients who received or omitted RT. A sizeable proportion of women (40.9%) overestimated their risk of local recurrence after all treatments were received as being >15% at 10 years. The risk of distant disease recurrence risk was similarly overestimated, with 43.8% of women approximating their risk of distant recurrence as >5% at 10 years. Relatively few women reported that they received inadequate information about the RT decision; this was slightly more common among women who omitted RT (14% vs 6% of women who had received RT; $P = .03$). No significant differences were found in satisfaction about the decisions regarding whether to have RT, regardless of whether the patient had received or omitted it. Women who had received RT were more likely to consult with a radiation oncologist before surgery than were women who omitted RT (54% vs 26%; $P < .001$).

Clinician survey

The clinician characteristics and reported rates of discussing RT omission as an option in a low-risk DCIS scenario are listed in Table 4. The mean clinician age was 52.8 ± 10.9 years, with an average of 21 years in practice for surgeons and 17 years for radiation oncologists. Although we did not observe differences between the 2

Table 4 Physician characteristics

Physician characteristics	Surgeon				Radiation oncologist			
	% (n = 348)*	Weighted %	Discussing RT omission† (%)	*P* value‡	% (n = 163)*	Weighted %	Discussing RT omission† (%)	*P* value‡
Mean overall practice duration (y)	20.9	21.2	NA	NA	17.3	17.3§		
Practice duration (y)				.31				.55
<30	74.4	72.7	54.1		82.2	82.0	74.1	
≥30	24.4	26.0	61.6		15.3	15.7	80.7	
Missing	1.2	1.3	43.5		2.5	2.4	23.6	
Site				.03				.18
Georgia	51.1	50.7	50.1		47.2	50.6	69.2	
LA	48.9	49.3	61.8		52.8	49.4	78.8	
Gender				.49				.42
Male	73.7	76.4	55.4		68.7	69.8	72.3	
Female	24.4	21.7	59.8		27.6	26.5	78.5	
Missing	1.9	1.9	29.1		3.7	3.8	72.0	
Residents and/or fellows				.06				.24
Yes	29.3	28.7	63.8		26.4	25.5	67.5	
No	69.5	70.3	52.3		71.2	72.1	77.0	
Missing	1.1	1.0	77.9		2.5	2.4	49.3	
Breast cancer volume within past 12 mo				.62				.39
≤50	67.8	70.9	54.8		38.7	38.1	68.1	
>50	29.9	26.9	57.8		54.0	54.4	78.1	
Missing	2.3	2.2	66.9		7.4	7.4	73.4	
Discussion in multidisciplinary tumor board				.16				.16
≤50%	57.5	59.2	52.5		57.1	57.5	79.4	
>50%	40.8	39.0	60.4		36.8	37.1	67.0	
Missing	1.7	1.8	69.7		6.1	5.4	63.2	

Abbreviation: RT = radiation therapy.

* A total of 22 surgeons and 6 radiation oncologists did not complete the question about RT omission.

† Weighted percentage.

‡ *P* values for differences in proportion of physicians discussing RT omission stratified by the categories shown; a separate category was included for unknown when unknown values were >5%.

§ Weighted mean.

SEER regions in the reported proportion of cases discussed in a multidisciplinary tumor board, clinicians in Los Angeles County were more likely to report teaching residents or fellows. When surgeons and radiation oncologists were presented with the same clinical scenario of a healthy, 65-year-old woman with favorable prognosis DCIS who had undergone lumpectomy (as described in the Methods and Materials section), most clinicians (69.6%) would recommend whole breast RT, without significant differences between specialties. However, radiation oncologists were more likely to discuss RT omission as an option in this scenario (73.9% vs 55.9%; $P < .001$; Fig. 1). No significant differences were found in the discussion of RT omission according to teaching status or multidisciplinary discussion. Among the surgeons, 39.3% reported that they would obtain the Oncotype DX DCIS score to assist with the decision regarding RT, and 61.2% of surgeons would defer the decision to obtain the Oncotype DX DCIS score to the radiation oncologist. Approximately one third of radiation oncologists reported that they would order the Oncotype DX DCIS score in the hypothetical case (35.3%), and 34.1% indicated that they had personally ordered the Oncotype DX DCIS score.

Univariate analysis of the clinician characteristics showed a trend for surgeons who work with trainees to be more likely to discuss omission of RT with their patients. In a clinician-level logistic regression model, we observed that radiation oncologists were more likely to discuss RT omission than were surgeons. Clinicians in the Los Angeles County SEER region were significantly more likely to discuss RT omission than were clinicians in Georgia (Table 5).

Discussion

In this contemporary survey study of a diverse sample of patients with DCIS identified through two US population-

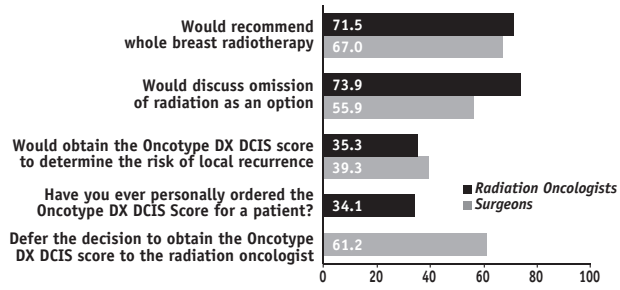

Fig. 1. Surgeon and radiation oncologist treatment recommendations in a scenario of a healthy 65-year-old patient with 9-mm, intermediate-grade DCIS who underwent lumpectomy with widely negative margins (surgeons, n = 370; radiation oncologists, n = 169; presented as percentage with affirmative response).

based registries, we observed omission of RT in one quarter of patients receiving BCS. Lower grade disease was the dominant clinical factor associated with RT omission. Patients in the Georgia SEER region were significantly less likely to omit RT (odds ratio [OR] 0.23, 95% confidence interval [CI] 0.12-0.44) than were patients in Los Angeles County. Similarly, clinicians in Georgia were also less likely to discuss RT omission (OR 0.61, 95% CI 0.40-0.93).

Table 5 Physician-level logistic regression model of discussion of radiation therapy omission as an option

Variable	OR	95% CI	*P* value
Specialty			.002
Surgeon	1.00	Reference	
Radiation oncologist	2.21	1.34-3.63	
Site			.02
Los Angeles County	1.00	Reference	
Georgia	0.61	0.40-0.93	
Gender			.42
Female	1.00	Reference	
Male	0.82	0.50-1.34	
Residents and/or fellows			.67
Yes	0.90	0.56-1.46	
No	1.00	Reference	
Practice duration (y)			.21
<30	1.00	Reference	
≥30	1.38	0.83-2.30	
Breast cancer volume within past 12 mo			.48
<50 cases	1.00	Reference	
≥50 cases	1.19	0.74-1.91	
Discussed in multidisciplinary tumor board			.60
None	1.00	Reference	
0%-9%	0.66	0.31-1.39	
10%-25%	1.05	0.50-2.20	
26%-50%	0.95	0.40-2.26	
>50%	1.03	0.52-2.02	

Abbreviations: CI = confidence interval; OR = odds ratio.

We observed a trend (although not significant) toward greater RT omission with increasing age, with the greatest rate of omission (28%) in women aged ≥70 years. This observation might reflect reports of a lower risk of recurrence with older age (7, 19, 20). Alternatively, the competing risks of morbidity and mortality in older women might make patients and their clinicians less likely to find the reduction in local recurrence seen with RT to be of meaningful benefit. These observations suggest that although age remains an influential consideration, grade is the dominant clinical factor affecting the decisions regarding RT for DCIS.

Although tumor grade has been associated with a risk of ipsilateral breast tumor recurrence, there is evidence to suggest that grade may be inadequate to identify a low-risk group of patients for RT omission. In prospective clinical trials designed to evaluate the omission of RT for patients with favorable characteristics, patients with small, low- and intermediate-grade tumors had a 12-year risk of local recurrence approaching 15% (11, 12), and long-term follow-up data have demonstrated the concerning finding of no plateau in the rate of ipsilateral breast events (11, 12). Additionally, much of the impetus for RT omission originated with the Van Nuys Prognostic Index (21), which has not been found to have meaningful discriminatory power in attempts at external validation with independent data sets (22, 23). Taken together, these findings have raised concerns that a low-risk cohort has not yet been identified, leading some to conclude that RT remains appropriate for most women after BCS (24). Nevertheless, the initial results from RTOG (Radiation Therapy Oncology Group) 9804 trial, in which patients with low-risk DCIS were randomized to observation or RT, showed an encouraging 6.7% local failure rate at 7 years without RT, although longer follow-up data are needed (10). However, even within this lower risk group, the use of RT reduced the risk of local failure to 0.8%, a benefit that is clinically meaningful to some patients.

The Oncotype DX DCIS score was designed to enhance the ability to identify patients who are most and least likely to benefit from RT by providing a more precise quantitation of the risk of local recurrence than can be obtained from conventional clinicopathologic variables. In our study, approximately one third of surgeons and radiation oncologists reported that they would obtain the Oncotype DX DCIS score to determine the risk of local recurrence, and only 34% of radiation oncologists had ordered the test. This tepid uptake of the Oncotype DX DCIS score may partially relate to the present study's accrual of patients from 2013 to 2015, shortly after the Oncotype DX DCIS score was released commercially in 2012. It may also reflect clinicians' view that prospective clinical trials with long-term follow-up are needed to determine the clinical applicability of the Oncotype DX DCIS score (25, 26), or it might indicate that because the risk of local recurrence in the Oncotype DCIS low-risk group is similar to that of patients with small, non–high-grade DCIS, clinicians do not find

the test to provide sufficiently influential prognostic information. Finally, it has not been shown to have predictive value in determining who will benefit from RT. At present, it appears that the Oncotype DX DCIS score has not widely influenced decisions regarding RT use in the same way that the 21-gene assay has influenced chemotherapy decisions (27, 28). Updating trends in use of the Oncotype DX DCIS score will be an important subject for future research to consider, especially as studies begin to identify methods to combine the score with other clinicopathologic criteria to define a group at very low risk of recurrence even without RT (29).

In the present study, the geographic region was strongly associated with RT omission in both the patient-level and the clinician-level multivariable models. Given that we did not observe significant differences in the clinical characteristics of patients between the 2 SEER regions included in the present study, these regional differences likely reflect variation attributable to clinician and practice factors. These findings are consistent with the observation that similar patients may receive different treatments depending on their clinician (30) and that clinician recommendations are an important correlate of RT receipt (31). The most commonly reported reason for omission of RT was clinician advice that it was not needed. However, we observed that 26% of radiation oncologists and 44% of surgeons would not discuss RT omission as an option for a healthy 65-year-old patient with favorable risk DCIS treated with BCS. These observations highlight the importance of radiation oncologists as the primary source for information regarding RT and also suggest wide variation in clinician views regarding what constitutes a meaningful benefit for the use of RT. The observed regional differences are consistent with those from previous studies (1, 13) and might also reflect the influence of regional thought leaders involved in development of the University of Southern California/Van Nuys Prognostic Index (32, 33). Ultimately, our findings reflect the notion that even in the modern era, after publication of considerable evidence specifically investigating the risks and benefits of RT in this setting, the treatment a patient receives for favorable-risk DCIS continues to be heavily influenced by nonclinical factors, including something as arbitrary as the region of the country one inhabits.

Although omission of RT for patients with favorable prognostic features does not appear to compromise survival (7), many women choose to receive RT because of a strong desire to avoid any recurrence (3). Fear of recurrence might have an oversized influence on treatment decisions (34, 35), particularly in the setting of suboptimal knowledge about the recurrence and survival rates associated with different treatments (36). We observed the concerning finding that approximately one third of patients perceived that their clinicians did not adequately discuss the risk of cancer recurrence. This finding highlights the critical need to improve communication with patients about the risk of cancer recurrence when patients have the option of pursuing less aggressive therapy.

This study has strengths, including a large, racially diverse sample with a high response rate from patients and from clinicians. In the patient survey, the primary endpoint of RT omission was by patient self-report because SEER data are known to underascertain RT receipt (14). Weighting and multiple imputation were used to ensure that the results represented the entire population and to account for potential bias due to missing data. Several limitations also merit comment. A primary limitation of our data was the lack of information on margin status as an important factor in the decisions regarding surgery and RT. Our data were limited to 2 SEER regions and might not reflect the population as a whole. Although we did not observe systematic differences in patient values and preferences related to treatment decisions between the 2 SEER regions evaluated, we could not exclude the possibility that the observed regional differences in RT omission might relate to unmeasured differences in patient preferences. Clinicians were asked about the treatment of patients with favorable features only, and the results of the clinician survey might not be applicable to scenarios of DCIS with less favorable characteristics or advanced comorbidities. For example, the differences observed in the responses to that scenario might be smaller or larger if key clinical features, such as a less widely negative margin, had been included. Additionally, the patient survey was necessarily retrospective, and recollection can change with the passage of time. Nevertheless, our data provide a detailed, contemporary view of decision-making for DCIS from both patient and clinician perspectives.

Conclusions

Our findings have important implications. We observed substantial heterogeneity in RT receipt after BCS for DCIS, along with systematic differences in provider opinions across the two regions we studied. We also observed indications that patient−clinician communication is suboptimal. The limited omission of RT observed in our data raises important questions about patient and clinician willingness to consider even less aggressive approaches, such as non-surgical management of DCIS, which is currently being examined in clinical trials. The heterogeneity documented in the present study suggests a need for ongoing investigation to provide clarity on identifying a low-risk group of patients with DCIS who may forego RT. Future studies, using different approaches, such as qualitative analysis of interviews with patients or more detailed instruments administered in single-institution settings, would be valuable to delve more deeply into the issues identified by the present investigation, including the persistent regional variation in RT receipt. Most notably, the present findings suggest a compelling need for consensus guidelines from professional organizations to improve the consistency of treatment recommendations in this controversial area.

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