The Patient’s Perspective on Breast Radiotherapy: Initial Fears and Expectations Versus Reality

Narek Shaverdian, MD; Xiaoyan Wang, PhD; John V. Hegde, MD; Criselda Aledia, RN; Joanne B. Weidhaas, MD, PhD, MSM; Michael L. Steinberg, MD; and Susan A. McCloskey, MD, MSHS

BACKGROUND: Although the efficacy and toxicity of breast radiotherapy (RT) has been studied extensively, to the authors’ knowledge little is known regarding the patient’s perspective on the modern breast RT experience. To better inform future patients and providers, the authors explored patient perceptions of their RT experience.

METHODS: Consecutive patients who were free of disease recurrence and who had been treated between 2012 and 2016 were surveyed regarding their original fears, how short-term and long-term toxicities compared with initial expectations, and how pretreatment beliefs concerning RT compared with the actual experience.

RESULTS: A total of 502 patients were surveyed, with a response rate of 65% (327 patients). The median patient age and posttreatment follow-up was 59 years and 31 months, respectively. Approximately 83% of patients (269 patients) underwent breast conservation therapy. Although approximately 68% of patients (221 patients) endorsed that they initially had little to no knowledge regarding RT, approximately 47% (152 patients) reported that they had heard frightening stories. Approximately 2% of patients (6 patients) agreed that the negative stories they previously heard about RT were actually true. Approximately 92% of patients treated with breast conservation (247 patients) and 81% of patients who underwent mastectomy (47 patients) agreed with the statement “If future patients knew the real truth about RT, they would be less scared about treatment.” Approximately 83% (272 patients) and 84% (274 patients), respectively, of all patients reported the overall severity of short-term and long-term side effects to be better than or as expected.

CONCLUSIONS: Breast RT is associated with misconceptions and fears. Patients’ experiences with modern breast RT appear to be superior to expectations, and the majority of patients in the current study agreed that their initial negative impressions were unfounded.

INTRODUCTION

Radiotherapy (RT) plays an integral role in the definitive treatment of breast cancer by reducing the risk of locoregional disease recurrence and breast cancer death.1,2 Numerous randomized phase 3 trials have established the equivalence of breast conservation therapy, defined as lumpectomy and RT, to mastectomy,3-5 and more recent data have suggested a breast cancer-specific survival benefit with breast conservation therapy.6-8 However, despite this literature, recent trends have indicated that the percentage of women who elect to undergo mastectomy continues to rise.9,10 Furthermore, registry data indicate that adjuvant RT is underused after mastectomy in populations with established benefit.11

Fears and misconceptions regarding RT have been identified by both breast surgeons and patients as factors influencing why a patient would choose mastectomy over breast conservation therapy.12,13 In fact, interviews of women regarding their initial feelings regarding RT commonly found descriptions involving fear and anxiety.14 The majority of patients also have been found to have little or no baseline understanding of RT, regardless of sociodemographic factors.15 Furthermore, only a minority of patients identify RT as a “modern” cancer treatment, suggesting that perceptions of RT have not kept up with the significant advances in the field.16 Indeed, prior studies have postulated that fears and misconceptions regarding RT contribute to its underuse.17,18 However, in reality, significant advances in breast RT over the last 2 decades have resulted in increased accuracy, reduced toxicities, and improved treatment convenience.19-25

Despite the wealth of published literature evaluating the efficacy and toxicity outcomes of breast RT,26-30 to our knowledge there is relatively little known regarding the patient’s perspective concerning their experience with breast RT. Given the documented misconceptions and fears regarding breast RT, we sought to explore the treatment experience from the patient’s perspective to better inform future patients and providers. Therefore, we evaluated original fears, compared...
patient perceptions of actual short-term and long-term toxicities with baseline expectations, and investigated how pretreatment beliefs regarding RT compared with the actual experience among a large cohort of women treated with modern breast RT.

MATERIALS AND METHODS

Patients and Treatments

Consecutive patients who were free of disease recurrence with nonmetastatic, noninflammatory invasive, or preinvasive breast cancer and who were treated with RT from 2012 through March 1, 2016, were included. Patients were at least 6 months out from the completion of RT. Patients aged > 90 years and those with dementia were excluded. Patients were treated in the setting of a previously described multidisciplinary breast cancer clinic.31 As a standard, patients were seen by radiation oncology, medical oncology, and breast surgery clinicians at the time of their initial diagnosis before any therapeutic intervention. Patients again were seen by radiation oncology clinicians after their primary surgery to further discuss RT recommendations. Treatment recommendations were in accordance with current National Comprehensive Cancer Network guidelines as previously reported.32 All patients underwent computed tomography-based radiation planning with field-in-field, forward planned, intensity-modulated RT. Patients receiving standard fractionated whole-breast irradiation received 50.4 gray (Gy) in 1.8-Gy fractions, patients receiving hypofractionated whole-breast irradiation received 42.56 Gy in 2.06-Gy fractions, and patients receiving postmastectomy irradiation to the chest wall/reconstructed breast and regional lymph nodes received 50.4 Gy in 1.8-Gy fractions. Accelerated partial breast RT was delivered using external beam and patients received 38.5 Gy in 3.85-Gy fractions. Radiation boosts were an additional 10 to 16 Gy in 2-Gy to 2.5-Gy fractions. Patients were routinely seen in follow-up 2 weeks after the completion of treatment and biannually thereafter.

Instruments and Measures

The questionnaire initially was developed through literature review and input from nursing and physician staff, and relied on previously validated measures (see Supporting Information Questionnaires 1 and 2). Patients then trialed the questionnaire and provided feedback regarding wording, length, and applicability. The questionnaire elicited baseline knowledge and fears regarding RT. In addition, patients were asked to compare their actual short-term and long-term side effect experience with their expectations by selecting whether their actual experience was as expected or better than or worse than expected. The overall short-term and long-term toxicity experience was evaluated as well as specific toxicities including pain; skin changes; fatigue; time felt ill; limitations on work and recreational activities; anxiety; sadness; disruptions to family; and long-term changes to breast size, appearance, and texture. These measures were adapted from validated patient-reported questionnaires including the Breast Cancer Treatment Outcome Scale,27 the European Organization for Research and Treatment of Cancer-Specific Quality-of-Life questionnaire (EORTC QLQ-BR23),33 and the National Surgical Adjuvant Breast and Bowel Project-B39 quality of life-treatment assessment. Finally, patients selected how true or false they found statements exploring how their pretreatment beliefs and fears regarding RT compared with the actual experience. Additional variables evaluated included sociodemographic factors and disease and treatment characteristics.

The current study was approved by the institutional review board at the study institution. The survey was administered for a 4-month period starting on July 1, 2016. Eligible patients, as described above, who were seen at a regularly scheduled follow-up appointment during the study period were asked to complete the questionnaire by their treating physician. Patients then completed the questionnaire during their scheduled appointment in private examination rooms. All other patients were mailed the questionnaire. No incentives were offered to patients to complete the questionnaire.

Statistical Analysis

Baseline characteristics of responders and nonresponders were compared using the chi-square or Fisher exact test. Disease and treatment characteristics between patients treated with breast conservation therapy and those treated with mastectomy and analysis of patients treated with standard fractionated versus hypofractionated whole-breast irradiation were compared using chi-square analysis. Frequencies of these patient-reported outcomes then were evaluated and analyzed. Analyses were performed using SAS statistical software (version 9.4; SAS Institute Inc, Cary, North Carolina). A P value < .05 was considered to be statistically significant.

RESULTS

Patient Clinical Characteristics

A total of 502 patients were eligible, representing all patients treated at the study institution from 2012 through March 1, 2016, who had nonmetastatic, noninflammatory,
invasive or preinvasive breast cancer and who were alive, free of disease recurrence, and aged <90 years with no diagnosis of dementia at the time of the survey initiation on July 1, 2016. In total, 42 living patients were excluded, which included 26 patients who had recurrent disease, 9 patients who were aged ≥90 years, and 7 patients who were diagnosed with dementia. A total of 327 of 502 eligible women (65%) completed the questionnaire. The majority of respondents (299 of 327; 91%) returned the completed questionnaire via mail. No statistical differences were found with regard to the distribution of age, ethnicity, marital status, or disease stage between responders and nonresponders (P = .20, P = .45, P = .07, and P = .07, respectively). Responders completed the questionnaire a median of 31 months (range, 6-61 months) after the completion of RT. The majority of responders were white (76%), married (77%), and college graduates (77%), and had a median age of 59 years. Of the 327 respondents, 267 (82%) were treated for an invasive breast cancer and 269 (83%) were treated with breast-conserving therapy. Among patients who underwent mastectomy, 85% (49 patients) underwent reconstruction. Approximately 42% of patients (138 patients) underwent standard fractionated whole-breast irradiation, 28% (92 patients) underwent hypofractionated whole-breast irradiation, 22% (71 patients) underwent comprehensive regional lymph node irradiation, and 78% (254 patients) received a radiation boost. Approximately 37% of patients (120 patients) received chemotherapy, and 70% (230 patients) received adjuvant endocrine therapy. Compared with patients treated with breast conservation, more patients who underwent mastectomy were diagnosed with AJCC 7th edition (2010) stage II or III disease (P<.001), and were more likely to receive comprehensive regional lymph node irradiation (P<.001) and chemotherapy (P<.001). Baseline patient characteristics are shown in Table 1.

### TABLE 1. Baseline Patient Characteristics

<table>
<thead>
<tr>
<th>Factor</th>
<th>All Patients N = 327</th>
<th>Patients Treated With Breast Conservation N = 269</th>
<th>Patients Treated With Mastectomy N = 58</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age, y</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Median</td>
<td>59</td>
<td>61</td>
<td>50</td>
</tr>
<tr>
<td>Range</td>
<td>28-89</td>
<td>30-89</td>
<td>28-84</td>
</tr>
<tr>
<td><strong>Race/ethnicity, % (no.)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>76% (250)</td>
<td>75% (203)</td>
<td>81% (47)</td>
</tr>
<tr>
<td>Asian American</td>
<td>11% (36)</td>
<td>11% (29)</td>
<td>12% (7)</td>
</tr>
<tr>
<td>Latino</td>
<td>10% (32)</td>
<td>11% (29)</td>
<td>5% (3)</td>
</tr>
<tr>
<td>African American</td>
<td>3% (9)</td>
<td>3% (8)</td>
<td>2% (1)</td>
</tr>
<tr>
<td><strong>Marital status, % (no.)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>75% (246)</td>
<td>76% (205)</td>
<td>71% (41)</td>
</tr>
<tr>
<td>No</td>
<td>23% (74)</td>
<td>22% (60)</td>
<td>24% (14)</td>
</tr>
<tr>
<td>Unknown</td>
<td>2% (7)</td>
<td>2% (4)</td>
<td>5% (3)</td>
</tr>
<tr>
<td><strong>AJCC 7th edition Stage of disease, % (no.)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>18% (60)</td>
<td>22% (59)</td>
<td>2% (1)</td>
</tr>
<tr>
<td>I</td>
<td>39% (126)</td>
<td>46% (123)</td>
<td>5% (3)</td>
</tr>
<tr>
<td>II</td>
<td>34% (111)</td>
<td>30% (82)</td>
<td>50% (29)</td>
</tr>
<tr>
<td>III</td>
<td>9% (30)</td>
<td>2% (5)</td>
<td>43% (25)</td>
</tr>
<tr>
<td><strong>Breast conservation, % (no.)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>82% (269)</td>
<td>100% (269)</td>
<td>-</td>
</tr>
<tr>
<td>No</td>
<td>18% (58)</td>
<td>-</td>
<td>100% (58)</td>
</tr>
<tr>
<td><strong>Lymph node evaluation, % (no.)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Axillary dissection</td>
<td>13% (42)</td>
<td>4% (11)</td>
<td>53% (31)</td>
</tr>
<tr>
<td>Sentinel lymph node dissection</td>
<td>82% (268)</td>
<td>96% (257)</td>
<td>100% (58)</td>
</tr>
<tr>
<td><strong>Radiotherapy, % (no.)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>APBI</td>
<td>6% (19)</td>
<td>7% (19)</td>
<td>-</td>
</tr>
<tr>
<td>Standard whole breast</td>
<td>42% (139)</td>
<td>52% (139)</td>
<td>-</td>
</tr>
<tr>
<td>Hypofractionated whole breast</td>
<td>28% (92)</td>
<td>34% (92)</td>
<td>-</td>
</tr>
<tr>
<td>Standard chest wall</td>
<td>2% (6)</td>
<td>-</td>
<td>10% (6)</td>
</tr>
<tr>
<td>Comprehensive regional lymph node</td>
<td>22% (71)</td>
<td>7% (19)</td>
<td>90% (52)</td>
</tr>
<tr>
<td><strong>Radiation boost treatment, % (no.)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>78% (254)</td>
<td>81% (219)</td>
<td>60% (35)</td>
</tr>
<tr>
<td>No</td>
<td>22% (73)</td>
<td>19% (50)</td>
<td>40% (23)</td>
</tr>
<tr>
<td><strong>Chemotherapy, % (no.)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Any chemotherapy</td>
<td>37% (120)</td>
<td>27% (73)</td>
<td>81% (47)</td>
</tr>
<tr>
<td>Neoadjuvant chemotherapy</td>
<td>15% (47)</td>
<td>8% (21)</td>
<td>45% (26)</td>
</tr>
<tr>
<td><strong>Endocrine therapy</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>70% (230)</td>
<td>69% (186)</td>
<td>76% (44)</td>
</tr>
</tbody>
</table>

Abbreviation: APBI, accelerated partial breast irradiation.
All general medical characteristics (comorbid conditions and medications) were based at the time of treatment.
Baseline Perceptions and Knowledge of RT

Approximately 68% of patients (221 patients) responded that they had little or no prior knowledge of RT at the time of diagnosis, and 4% (14 patients) responded that they had a great deal of baseline knowledge. Among patients who reported some or a great deal of baseline knowledge regarding RT, the most common source of information was friends and family (86 patients). Nearly one-half of patients (152 patients; 47%) shared that they had previously read or heard frightening stories of serious radiation side effects. The most commonly ranked top initial fears of RT included damage to internal organs (129 patients; 40%), skin burning (79 patients; 24%), being radioactive (24 patients; 7%), and an inability to perform daily functions (19 patients; 6%). In addition, ranked fears included feeling tired and weak (17 patients; 5%), damage to the immune system (17 patients; 5%), pain (10 patients; 3%), changes in appearance (3 patients; 1%), and cost (3 patients; 1%). It is interesting to note that approximately 6% of patients (19 patients) responded that they were not fearful of receiving RT.

Comparison of Pretreatment Beliefs Regarding RT Versus Actual Treatment Experience

Among all patients, 3% (8 patients) found the negative stories they previously read about RT to actually be true based on their treatment experience. Similarly, 2% of patients (6 patients) found the negative stories regarding RT that they heard from family and friends to actually be true. Approximately 85% of patients (281 patients) found their actual RT experience to be “less scary” than originally expected. Approximately 90% of patients treated with breast conservation (240 patients) and 78% of patients treated with mastectomy (45 patients) found the statement “after treatment, I now realize that radiation therapy is not as bad as they say it is” to be true. Approximately 4% of patients treated with breast conservation (10 patients) and 10% of patients treated with

Figure 1. Comparison of baseline beliefs regarding radiotherapy (RT) versus the actual treatment experience. Results show responses among all patients and those patients treated with breast conservation or mastectomy.
mamectomy (6 patients) found their overall RT experience to be harder than expected. It is important to note that 92% of patients treated with breast conservation (247 patients) and 81% of patients treated with mastectomy (47 patients) found the statement “If future patients knew the real truth about radiation therapy, they would be less scared about treatment” to be true (Fig. 1).

**Perceptions of Acute RT Toxicity**

Among all patients, 84% (275 patients) reported that the overall severity of their short-term radiation side effects was less than or as expected. Only 4% of patients treated with breast conservation (11 patients) and 5% of patients treated with mastectomy (3 patients) found the overall severity of their short-term side effects to be significantly more than expected. Approximately 75% of all patients (243 patients) found the severity of breast pain and sensitivity experienced during RT to be less than or as expected. The severity of short-term radiation-induced skin changes was found to be less than or as expected by 66% of patients treated with breast conservation (176 patients) and 41% of patients treated with mastectomy (24 patients). In addition, 81% of patients treated with breast conservation (217 patients) and 69% of patients treated with mastectomy (40 patients) found the changes to their energy level during treatment to be less than or as expected. Limitations to work activities while undergoing RT were found to be less than or as expected by 86% of all patients (282 patients), with approximately 60% of patients (194 patients) reporting less work disruptions than anticipated. Similarly, short-term limitations on recreational activities were found to be less than or as expected by 84% of all patients (274 patients). The majority of all patients, 91% (298 patients), found the amount of time they felt ill to be less than or as expected. The amount of anxiety and worry felt during RT was reported to be less than or as expected by 89% of patients treated with breast conservation (238 patients) and 79% of patients treated with mastectomy (46 patients). In addition, 91% of patients treated with breast conservation (244 patients) and 85% of patients treated with mastectomy (49 patients) found the disruptions to their families during RT to be less than or as expected (Fig. 2).

**Long-Term RT Toxicity Perceptions**

Approximately 84% of all patients (274 patients) reported that the overall severity of their actual long-term RT side effects was less than or as expected. Only 3% of patients treated with breast conservation (7 patients) and 4% of patients treated with mastectomy (2 patients) reported that their overall long-term side effects were significantly more severe than expected. Among patients who underwent breast conservation, 75% (201 patients) reported that the actual long-term changes to their breast size were less than or as expected and, similarly, 74% (200 patients) found the actual long-term texture changes of their treated breast to be less than or as expected. Approximately 96% of patients treated with breast conservation (256 patients) and 81% of patients treated with mastectomy (47 patients) found long-term arm swelling to be less than or as expected. Approximately 89% of patients treated with breast conservation (238 patients) found the appearance of their radiated breast to be better than or as originally expected, with only 2% (5 patients) finding these changes...
in appearance to be significantly worse than expected. Furthermore, 89% of patients treated with breast conservation (238 patients) reported less than or as expected dissatisfaction with their body as a result of treatment, with only 3% (9 patients) reporting significantly more dissatisfaction than expected. Among patients who underwent mastectomy, 67% (39 patients) found the appearance of the area treated with RT to be better than or as expected and, similarly, 64% (37 patients) reported the dissatisfaction with their body as a result of treatment to be less than or as expected (Fig. 3).

Comparison of Perceptions Across Different RT Modalities After Breast Conservation

Subgroup analyses of women treated with either standard fractionated whole-breast, hypofractionated whole-breast, or accelerated partial breast irradiation after breast conservation surgery confirmed that the majority of patients reported a better than or as expected treatment experience regardless of RT modality (see Supporting Information Figs. 1-3). Further comparison of women treated with hypofractionation versus standard fractionated whole-breast RT found patients treated with hypofractionated regimens to be of less advanced disease stage ($P = .006$), less likely to receive chemotherapy ($P = .0005$), and less likely to receive a radiation boost ($P < .0001$) (see Supporting Information Table 1). Although minimal differences in treatment perceptions between these 2 cohorts of women were found, significantly fewer women treated with hypofractionation responded that short-term limitations on recreational activities were worse than expected ($P = .016$) (see Supporting Information Tables 2 and 3). In addition, there was a trend toward significantly fewer patients treated with hypofractionated RT to respond that disruptions to family ($P = .076$) and limitations on work activities ($P = .063$) were worse than expected compared with patients treated with standard fractionated whole-breast irradiation (see Supporting Information Table 2).
DISCUSSION
The results of the current study highlight the pervasive nature of the fears and misconceptions regarding breast RT, and demonstrated that patients’ actual treatment experiences are mostly superior to their initial expectations. It is interesting to note that the vast majority of patients agreed that their initial negative impressions and fears regarding breast RT were unfounded. These patient-centered data can play a critical role in counseling future patients and providers regarding the actualities of the modern breast RT experience.

Prior studies have documented the initial fears women have regarding breast RT and the impact these fears have on treatment decisions. Specifically, it has been found among women undergoing mastectomy that concerns regarding RT were among the most influential factors when deciding between mastectomy versus breast conservation,13 and a prior study evaluating treatment decision making in a cohort of 272 women with early-stage breast cancer found that approximately 72% of patients shared significant concerns regarding the receipt of RT.12 Although breast conservation therapy has been associated with an improved body image versus mastectomy29 and equivalent4,5 if not superior cancer control and survival outcomes,6,8 its use among eligible patients is on the decline,9,10 thereby motivating our interest to evaluate the RT experience from the patient’s perspective. Indeed, although we found that greater than two-thirds of all patients reported having had little to no baseline knowledge of RT, nearly one-half of all patients shared that they had heard or read frightening stories of serious RT side effects. However, we found that among patients treated with breast conservation therapy, only 2% found the prior negative stories that they read or heard to actually be true, approximately 89% found their overall RT experience to be less scary that originally imagined, approximately 90% agreed that RT is not as “bad as they say it is,” and, most notably, approximately 93% of patients treated with breast conservation agreed that if future patients knew the “real truth” about RT, they would be less scared about potential treatment. Clearly, these data indicate that RT in the setting of breast conservation actually is a far superior treatment experience than perceived by the public, and should be appreciated by future women weighing treatment options.

Even among patients treated with mastectomy with strong indications for adjuvant RT, there is an underuse of RT11 despite evidence finding that adjuvant RT improves overall survival.2 Patients in the current study cohort who were treated with mastectomy were of more advanced disease stage, and nearly all patients treated with postmastectomy RT received comprehensive regional lymph node irradiation. Despite their more aggressive disease features and treatments, the majority of patients treated with RT after mastectomy similarly found their actual RT experience to be superior to original expectations across multiple domains. Specifically, approximately 76% of patients who underwent mastectomy found their overall RT experience to be less scary than expected and, importantly, approximately 81% of these patients agreed that if future patients knew the “real truth” about RT, they would be less scared about treatment.

Although there is a wealth of literature regarding both physician-reported and patient-reported toxicities associated with breast RT, it recently has been suggested that how actual side effects compare with expectations may be more important than the absolute severity.34 It is interesting to note that the results of the current study found that among women treated with breast conservation therapy, the majority found the severity of both short-term and long-term side effects to actually be less than expected. Breast pain after breast conservation has been found to be an important correlate of quality of life27 and, importantly, the majority of patients treated with breast conservation in the current study noted less long-term breast pain than expected. Fewer patients who were treated with mastectomy found the overall severity of short-term and long-term toxicities to be less than expected compared with patients treated with breast conservation. However, similar to patients treated with breast conservation, only 5% of patients who underwent mastectomy reported finding the overall severity of their toxicities to be significantly more than expected. In addition, the results of the current study are comparable to prior findings suggesting that patients treated with breast conservation have an improved body image,29 because approximately 11% of patients treated with breast conservation reported more dissatisfaction than expected with their body after treatment versus 36% of patients treated with mastectomy.

It is interesting to note that advances in breast RT over the last 20 years have specifically focused on improving the top initial fears regarding RT named by the women in the current study cohort, namely damage to internal organs and skin burning, thereby supporting the belief that public perceptions of RT have not kept up with the advances in the field.16,35 Specifically, computed tomography-based advanced planning has allowed for the delivery of a personalized and more homogenous dose of radiation, thereby reducing acute skin toxicities.20,21 In
addition, hypofractionated radiation schedules have not only reduced treatment length and increased convenience, but also have been associated with reduced short-term toxicities, including acute dermatitis and breast pain.\textsuperscript{23,26} Finally, accelerated partial breast irradiation, a technique that allows for localized radiation delivery, has had an expanding scope of practice,\textsuperscript{36} and has similarly been associated with less acute toxicity.\textsuperscript{24} Furthermore, advances in radiation planning have continually allowed for more sparing of the heart and lungs, with recent reports indicating that the heart and lung doses currently achieved in practice are even superior to what is reported in the modern literature,\textsuperscript{23} and that the absolute risk of lung cancer or cardiac mortality as a result of breast RT is estimated to be $<1\%$ among nonsmokers.\textsuperscript{30} Therefore, given these significant advances in RT that have improved convenience and reduced toxicities, the current study finding that patients perceive a better than expected treatment experience with modern breast RT, although novel, is not unexpected given the significant degree of baseline fears and misconceptions held by the general public.

Although the current study shared the experiences of $>300$ women treated with modern RT and provided vital information regarding the patient’s perspective on modern breast RT, there are several limitations. Although diverse, the population in the current study was limited to patients from a single institution and therefore may be biased by geographic and socioeconomic influences. In addition, recall bias may have influenced the current study findings. However, the relative agreement in responses across this large sample of patients suggests a minimal impact of this potential bias. Furthermore, the current study was cross-sectional in nature, and therefore only allowed for a snapshot assessment of these outcomes. However, there was a wide range noted in the lengths of follow-up, thereby allowing for the inclusion of perceptions from women with follow-up that ranged from 6 to 61 months since the completion of treatment. In addition, although we conducted subgroup analyses comparing the perceptions of those treated with hypofractionated and standard fractionated whole-breast irradiation, the small cohort of patients treated with accelerated partial breast irradiation limited our ability to perform further analyses. Future trials comparing RT modalities also should evaluate patient perceptions of the treatment experience.

Despite advances in technology and treatment options, there is significant misinformation and fear regarding breast RT. However, the actual experiences of patients were overwhelmingly superior to initial expectations, and the majority of patients agreed that their initial fears and negative impressions regarding breast RT were unfounded. These data can play a critical role in counseling future patients and providers concerning the actualities of modern breast RT.

**FUNDING SUPPORT**

Supported in part by a STOP CANCER grant awarded to Dr. Susan A. McCloskey.

**CONFLICT OF INTEREST DISCLOSURES**

The authors made no disclosures.

**AUTHOR CONTRIBUTIONS**


**REFERENCES**


