The Use of Hypofractionated Whole Breast Irradiation in Treatment of Patients With Early-Stage Breast Cancer in the United States

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**Uptake and Costs of Hypofractionated vs Conventional Whole Breast Irradiation After Breast Conserving Surgery in the United States, 2008–2013**

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**IMPORTANCE** Based on randomized evidence, expert guidelines in 2011 endorsed shorter, hypofractionated whole breast irradiation (WBI) for selected patients with early-stage breast cancer and permitted hypofractionated WBI for other patients.

**OBJECTIVES** To examine the uptake and costs of hypofractionated WBI among commercially insured patients in the United States.

**DESIGN, SETTING, AND PARTICIPANTS** Retrospective, observational cohort study, using administrative claims data from 14 commercial health care plans covering 7.4% of US adult women in 2013, we classified patients with incident early-stage breast cancer treated with lumpectomy and WBI from 2008 and 2013 into 2 cohorts: (1) the hypofractionation-endorsed cohort \( n = 8924 \) included patients aged 50 years or older without prior chemotherapy or axillary lymph node involvement and (2) the hypofractionation-permitted cohort \( n = 6719 \) included patients younger than 50 years or those with prior chemotherapy or axillary lymph node involvement.

**EXPOSURES** Hypofractionated WBI (3-5 weeks of treatment) vs conventional WBI (5-7 weeks of treatment).

**MAIN OUTCOMES AND MEASURES** Use of hypofractionated and conventional WBI, total and radiotherapy-related health care expenditures, and patient out-of-pocket expenses. Patient and clinical characteristics included year of treatment, age, comorbid disease, prior chemotherapy, axillary lymph node involvement, intensity-modulated radiotherapy, practice setting, and other contextual variables.

**RESULTS** Hypofractionated WBI increased from 10.6% (95% CI, 8.8%-12.5%) in 2008 to 34.5% (95% CI, 32.2%-36.8%) in 2013 in the hypofractionation-endorsed cohort and from 8.1% (95% CI, 6.0%-10.2%) in 2008 to 21.2% (95% CI, 18.9%-23.6%) in 2013 in the hypofractionation-permitted cohort. Adjusted mean total health care expenditures in the 1 year after diagnosis were $28,747 for hypofractionated and $31,641 for conventional WBI in the hypofractionation-endorsed cohort (difference, $2894; 95% CI, $1610-$4234; \( P < .001 \)) and $64,273 for hypofractionated and $72,860 for conventional WBI in the hypofractionation-permitted cohort (difference, $8587; 95% CI, $5316-$12,017; \( P < .001 \)). Adjusted mean total 1-year patient out-of-pocket expenses were not significantly different between hypofractionated vs conventional WBI in either cohort.

**CONCLUSIONS AND RELEVANCE** Hypofractionated WBI after breast conserving surgery increased among women with early-stage breast cancer in 14 US commercial health care plans between 2008 and 2013. However, only 34.5% of patients with hypofractionation-endorsed and 21.2% with hypofractionation-permitted early-stage breast cancer received hypofractionated WBI in 2013.
therapy, and achievable homogenous radiation dose distribution. For patients who do not meet these criteria, the task force did not recommend for or against the use of HF-WBI.

In 2013, ASTRO launched the Choosing Wisely initiative, aimed at reducing health care costs, which encouraged physicians and patients to discuss HF-WBI. In a recent issue of JAMA, Bekelman et al.5 showed a trend of increased utilization of HF-WBI in the United States in recent years and the associated reduction in care expenditures. Using the administrative claims data from 14 commercial health plans that cover 7% of the US adult women, the authors showed that the proportion of patients receiving HF-WBI roughly tripled between 2008 and 2013. The percentage of women fitting the HF-endorsed category and actually receiving this regimen went from 11% to 35%, while the numbers in the HF-permitted category (patients who did not fit the HF-endorsed criteria) rose more conservatively, from 8% to 21%. Of mean total health care expenditures in the year after the diagnosis, adoption of HF-WBI was associated with roughly a 10% savings. The findings are in line with 2 recent analyses using the National Cancer Data Base (NCDB)6 and the Surveillance, Epidemiology, and End Results (SEER)-Medicare-linked database.7 Wang et al.8 showed that use of HF-WBI in the NCDB increased from 5.4% in 2004 to 22.8% in 2011, and was more commonly given in academic centers and areas with high median income. Jaggi et al.9 reported that the use of HF-WBI increased from 3.8% in 2006 to 13.6% in 2010 in the SEER-Medicare population. Older age, smaller tumors, increased comorbidity, higher education, and Western SEER regions were associated with the use of HF-WBI. However, even in women older than 80 years, utilization of HF-WBI was only 25%.

Both Bekelman et al.5 and Jaggi et al.9 also suggested that the use of a more expensive intensity-modulated radiotherapy (IMRT) technique may be slowly increasing, preventing a more profound reduction in health care costs. From Table 1 of the JAMA article one can calculate that IMRT was used in 8% of conventionally treated patients and in 12% of patients treated with HF-WBI. Could this percentage be slowly rising, despite the 2013 Choosing Wisely campaign recommending against the routine use of IMRT in whole breast radiation therapy, to offset the decline in reimbursements owing to the fewer treatment fractions patients receive with HF-WBI? The use of IMRT for the left breast cancer is frequently justified by the need to decrease the dose to the heart. There is an inherent concern about a higher fractional dose to the heart and a potential increase in late cardiac toxicity. Despite no difference in morbidity leading to hospitalization from cardiac causes among women with left-sided early-stage breast cancer treated with HF-WBI or CF-WBI after 15 years of followup,6 some physicians argue that hypofractionation needs a longer follow-up, as the cardiac toxicity increases with each decade after radiation. Instead of IMRT, many advocate for the use of breath-hold technique—a simple respiratory maneuver that increases the distance between the left chest wall and the heart—introduced in 1997 by the Harvard group of physicians.6 One might argue that this technique is even more important for patients receiving HF-WBI to the left breast. Prone treatment is another low-cost technique that can reduce the in-field heart volumes for large-breasted women,9 and could be considered for such patients undergoing HF-WBI. Not only could it reduce the risk of cardiac and pulmonary toxicity, but it could also lead to improved homogeneity of dose distribution by simply reducing the width of treated breast tissue, potentially translating into better long-term outcomes.

All 3 studies5-7 also highlighted significant differences in international practice patterns. For example, 70% of patients in Ontario, Canada, received HF-WBI in 2008, whereas in the United Kingdom, since 2009 most patients received HF-WBI since the release of the National Institute for Health and Clinical Excellence guidance.

How can we achieve a wider adoption of HF-WBI in the United States? In addition to utilizing techniques, such as breath-hold and prone radiation, to protect the heart and improve dose homogeneity, a greater concern is the high costs of treatments for breast cancer. While the evidence is compelling, the relative costs of treatment must be considered.

In summary, HF-WBI offers greater convenience, lower costs, and the same outcome for women with early-stage breast cancer. The publication by Bekelman et al.5 showed improved adoption over time, but the actual rate remains low compared with other countries. This is an opportunity for US radiation oncologists to reflect on their practices and implement HF-WBI responsibly. More data are needed to determine whether HF-WBI can be used in women who receive chemotherapy and/or targeted therapy and those who require regional nodal irradiation.

ARTICLE INFORMATION

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REFERENCES


