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Clinical Investigation

The Impact of Radiation Oncologists on the Early Adoption of Hypofractionated Radiation Therapy for Early-Stage Breast Cancer



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Summary

This study evaluated the impact of radiation oncologists on the early adoption of hypofractionated radiation therapy for early-stage breast cancer. Using SEER-Medicare data and multilevel, multivariable logistic models, we assessed the impact of radiation oncologist and geographic practice area on the likelihood of receiving hypofractionated radiation therapy. The key finding of our study was that the individual radiation oncologist heavily influenced the decision to pursue hypofractionation.

Purpose: Despite multiple randomized trials showing the efficacy of hypofractionated radiation therapy in early-stage breast cancer, the United States has been slow to adopt this treatment. The goal of this study was to evaluate the impact of individual radiation oncologists on the early adoption of hypofractionated radiation therapy for early-stage breast cancer.

Methods: We identified 22,233 Medicare beneficiaries with localized breast cancer that was diagnosed from 2004 to 2011 who underwent breast-conserving surgery with adjuvant radiation. Multilevel, multivariable logistic models clustered by radiation oncologist and geographic practice area were used to determine the impact of the provider and geographic region on the likelihood of receiving hypofractionated compared with standard fractionated radiation therapy while controlling for a patient's clinical and demographic covariates. Odds ratios (OR) describe the impact of demographic or clinical covariates, and the median OR (MOR) describes the relative impact of the individual radiation oncologist and geographic region on the likelihood of undergoing hypofractionated radiation therapy.

Results: Among the entire cohort, 2333 women (10.4%) were treated with hypofractionated radiation therapy, with unadjusted rates ranging from 0.0% in the bottom quintile of radiation oncologists to 30.4% in the top quintile. Multivariable analysis found that the individual radiation oncologist (MOR 3.08) had a greater impact on the use of hypofractionation than did geographic region (MOR 2.10) or clinical and demographic variables. The impact of the provider increased from the year 2004 to 2005 (MOR 2.82) to the year 2010 to 2011 (MOR 3.16) despite the publication of

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long-term randomized trial results in early 2010. Male physician and radiation oncologists treating the highest volume of breast cancer patients were less likely to perform hypofractionation ($P < .05$).

Conclusions: The individual radiation oncologist strongly influenced the likelihood of a patient's receiving hypofractionated radiation therapy, and this trend increased despite the publication of long-term data showing equivalence to standard fractionation. Future research should focus on physician-related factors that influence this decision. © 2016 Elsevier Inc. All rights reserved.

Introduction

Breast conservation therapy involving lumpectomy and adjuvant radiation therapy is the treatment of choice for many women with early-stage breast cancer (1). Early clinical data established whole breast radiation delivered over 5 to 7 weeks of daily treatment as the standard to reduce the risk of long-term toxicity (2-5). In the 1990s, data became available showing that shorter courses (3-4 weeks) of treatment might be as effective without increasing toxicity (6). Owing to wide variations in the patterns of care surrounding fractionation (7, 8), multiple randomized trials directly comparing hypofractionation with standard radiation were initiated, with recent long-term results confirming equivalence (9-13). However, despite the development of clinical guidelines by the American Society for Radiation Oncology in 2011 (14) followed by the American Board of Internal Medicine's Choosing Wisely campaign in 2013 (7), the uptake of hypofractionation in the United States has been slow (15, 16), with evidence that practice patterns vary widely based on geography (15, 17).

Although some variation in patterns of care is expected, resulting from differences in disease presentation and patient preference, wide variations can indicate inefficiency in overall health care delivery (18-20). Quantifying and understanding the drivers of this variability can identify barriers to more equitable health care delivery.

Data suggest that tumor-related factors such as tumor size, histologic grade, and laterality do not affect the receipt of hypofractionation, although several patient-related factors do increase the likelihood of receiving hypofractionation, namely, older age, greater comorbidity, lower median household income (16), and lower level of education (15). Limited practice-related factors have also been investigated, with treatment in a hospital-based clinic and higher density of radiation oncologists increasing the likelihood of receiving hypofractionation (16, 17), whereas overall population density had no impact (15). The impact of provider-specific data, however, is limited to data from a single-state multi-institution study (21). The purpose of this study was to evaluate the relative impact of the individual provider on the early adoption of hypofractionated radiation therapy in a large representative cohort of elderly women with early-stage breast cancer.

Methods

Data source

We identified female breast cancer patients from the Surveillance, Epidemiology, and End Results (SEER)-Medicare linked database. The SEER program is managed by the National Cancer Institute, which pools data from individual cancer registries from across the United States, covering 28% of the population. Medicare provides federally funded health insurance programs for individuals in the United States over the age of 65. The SEER-Medicare linkage provides Medicare claims for Medicare beneficiaries within SEER. Given that these claims capture information about a patient's cancer treatment, including the treating provider, we can study the influence of providers on patterns of care in breast cancer. The Institutional Review Board of University of California San Diego deemed this study exempt from review.

Study population

An initial query of the SEER-Medicare database identified 67,059 patients at least 66 years old who received diagnoses between 2004 and 2011 of histologically confirmed, nonmetastatic breast cancer who underwent breast-conserving surgery. Patients were required to have continuous parts A and B coverage from 1 year before diagnosis until death or the end of the study period (December 2012) to allow for the ascertainment of comorbidities before diagnosis, the identification of the treating radiation oncologist, and the determination of radiation regimen received. Patients with part C coverage were excluded from the study because managed care organizations do not routinely submit claims information, resulting in incomplete claims data. Additional patient selection criteria are described below, and the final study cohort included 22,233 patients. The complete patient selection schema is shown in Figure 1.

Study covariates

The SEER database was used to identify patient characteristics such as age at diagnosis, race, marital status, year of diagnosis, primary tumor size and grade, laterality,

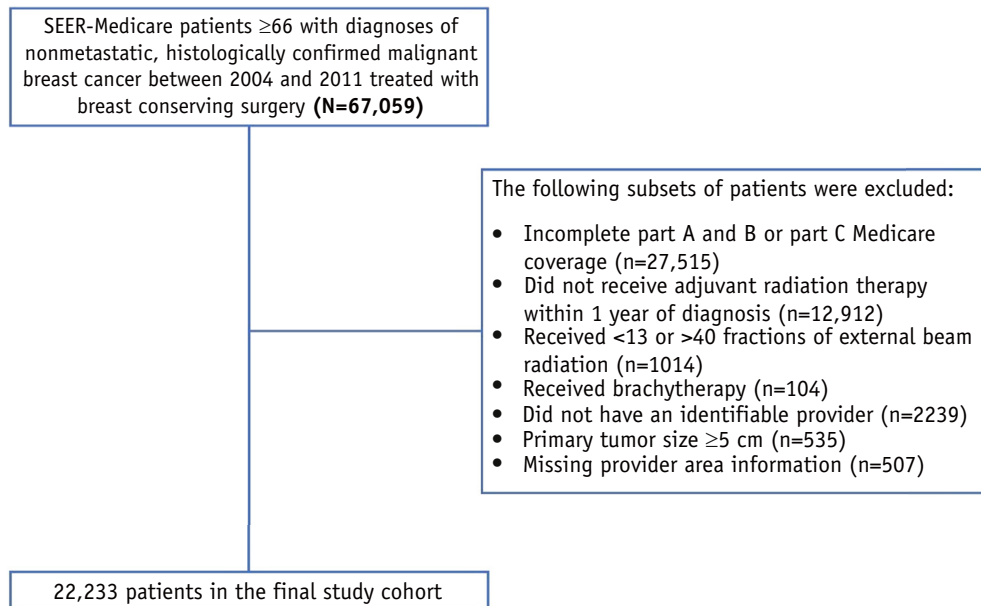


Fig. 1. Schema for patient selection.

number of positive nodes, and a census tract indicator of poverty status. Patients with a primary tumor greater than 5 centimeters were excluded from further analysis because tumors of this size are a relative contraindication to breast-conserving surgery (13). Inpatient and outpatient Medicare claims from the year before diagnosis were used to assess pre-existing comorbidity using the Deyo adaptation of the Charlson comorbidity index (22). The administration of chemotherapy was ascertained by identifying chemotherapy administration codes and specific drug codes from within a patient's Medicare files (23). Care at a teaching hospital was defined as any indirect medical education payment during a hospitalization after the patient's diagnosis of cancer. The use of magnetic resonance imaging of the breast after diagnosis to account for possible stage migration was identified using Healthcare Common Procedure Coding System (HCPCS) codes (Table E1; available online at www.redjournal.org). Patient characteristics for the entire cohort stratified by those receiving hypofractionated and standard fractionated radiation therapy are presented in Table 1.

Radiation therapy and provider

Radiation therapy was identified in the carrier claims and outpatient files using HCPCS codes (Table E1; available online at www.redjournal.org) (24). A course of radiation therapy was defined as a cluster of claims with breaks of 30 days or more between codes assumed to be indicative of a separate course of radiation therapy. Among women with multiple courses of radiation, only the first course was considered. Patients who received brachytherapy were also excluded. Only patients with records of 13 and 24 days (hypofractionated) and 25 to 40 days (standard) of radiation

(15) within 1 year of breast cancer diagnosis were included to reduce the likelihood of including patients receiving palliative courses or otherwise atypical courses of radiation therapy.

We identified the treating radiation oncologist (provider) using previously described methods (25). Briefly, we identified the specific provider using the Unique Physician Identification Number (UPIN) or National Physician Identifier (NPI) associated with the provider-specific weekly management code 77247. A crosswalk was used to link UPI to NPI after the 2007 transition. We identified physician characteristics from a tertiary linkage with the American Medical Association (AMA) Masterfile and UPINs/NPIs. Physician characteristics evaluated included sex, medical school year of graduation, primary employment arrangement, training outside the United States, and the annual completion of 50 hours of continuing medical education. To assess the impact of the volume of breast cancer patients treated, providers were ranked in quartiles according to the relative volume of breast cancer patients treated within the study cohort. We did not use absolute volume cutoffs because SEER-Medicare does not include all patients treated by a provider. We used the Federal Information Processing Standards county code associated with a provider's preferred mailing address as a surrogate for practice area to control for geographic effects. We excluded the small fraction of patients treated by providers without a known county.

Statistical analysis

This study sought to understand the impact of individual providers on the likelihood of a patient's receiving hypofractionated radiation therapy. We used a χ^2 test to evaluate

Table 1 Characteristics of patients in the entire cohort and those treated with hypofractionated radiation therapy

Characteristics	Entire cohort (%)	Hypofractionated cohort (%)	Standard fractionation cohort (%)	P value*
Total	22,233	2333	19,900	
Patient characteristics				
Age at diagnosis, y				
66-74	11,883 (53.5)	925 (39.6)	10,958 (54.9)	<.001
75-79	5550 (24.7)	580 (24.9)	4970 (24.9)	
≥80	4850 (21.8)	828 (35.5)	4022 (20.2)	
Race				
White	19,960 (89.8)	2084 (89.3)	17,876 (89.8)	.003
Black	1198 (5.4)	107 (4.6)	1091 (5.5)	
Other	1075 (4.8)	142 (6.1)	933 (4.7)	
Marital status				
Married	11,362 (51.1)	1083 (46.4)	10,279 (51.7)	<.001
Divorced	1823 (8.2)	192 (8.2)	1632 (8.2)	
Single	1467 (6.6)	161 (6.9)	1306 (6.6)	
Other	7581 (34.1)	897 (38.5)	6684 (33.6)	
Charlson comorbidity index				
0	14,735 (66.3)	1476 (63.3)	13,259 (66.6)	<.001
1	4969 (22.4)	547 (23.5)	4422 (22.2)	
2	1566 (7.0)	169 (7.2)	1397 (7.0)	
≥3	963 (4.3)	141 (6.0)	822 (4.1)	
Census tract poverty indicator, %				
<5	7251 (32.6)	749 (32.1)	6502 (32.7)	.03
5-10	6401 (28.8)	692 (29.7)	5709 (28.7)	
10-<20	5436 (24.5)	603 (25.8)	4833 (24.3)	
≥20	3145 (14.1)	289 (12.4)	2856 (14.4)	
Primary tumor size, cm				
0-2	17,591 (79.1)	1911 (81.9)	15,680 (78.8)	<.001
>2-5	4642 (20.9)	422 (18.1)	4220 (21.2)	
Nodes positive				
None	16,731 (75.6)	1833 (78.6)	14,898 (74.9)	<.001
1-3	3257 (14.6)	206 (8.8)	3051 (15.3)	
≥4	711 (3.2)	27 (1.2)	684 (3.4)	
Unknown	1534 (6.9)	267 (11.4)	1267 (6.4)	
Grade				
Well or moderately differentiated	16,100 (72.4)	1797 (77.0)	1403 (71.9)	<.001
Poor or undifferentiated	5191 (23.4)	450 (19.3)	4741 (23.8)	
Unknown	942 (4.2)	86 (3.7)	856 (4.3)	
Laterality				
Left	11,300 (50.8)	1173 (50.3)	10,127 (50.9)	.58
Right	10,933 (49.2)	1160 (49.7)	9773 (49.1)	
Year of diagnosis				
2004-2005	4884 (22.0)	196 (8.4)	4688 (23.6)	<.001
2006-2007	5163 (23.2)	293 (12.6)	4870 (24.5)	
2008-2009	5877 (26.4)	653 (28.0)	5224 (26.3)	
2010-2011	6309 (38.4)	1191 (51.0)	5118 (25.7)	
Teaching hospital	6524 (29.4)	622 (26.7)	5902 (29.7)	.003
Breast MRI	5043 (22.7)	567 (24.3)	4476 (22.5)	.05
Chemotherapy	4508 (20.3)	286 (12.3)	4222 (21.2)	<.001
Provider characteristics [†]				
Gender				
Male	15,706 (70.6)	1462 (62.7)	14,244 (71.6)	<.001
Female	6527 (29.4)	871 (37.3)	5565 (28.4)	

(continued on next page)

Table 1 (continued)

Characteristics	Entire cohort (%)	Hypofractionated cohort (%)	Standard fractionation cohort (%)	P value*
Medical school year of graduation				
<1970	1561 (7.0)	117 (5.0)	1444 (7.3)	<.001
1970-1980	3994 (18.0)	427 (18.3)	3567 (17.9)	
1981-1990	8361 (37.6)	794 (34.0)	7567 (38.0)	
>1991	8317 (37.4)	995 (42.7)	7322 (36.8)	
Present employment				
Solo practice	1649 (7.4)	112 (4.8)	1537 (7.7)	<.001
Group practice	12,393 (55.7)	1331 (57.0)	11,062 (55.6)	
Government	4953 (22.3)	494 (21.2)	4459 (22.4)	
Other	3238 (14.6)	396 (17.0)	2842 (14.3)	
Provider experience				
Lowest quartile	5416 (24.4)	645 (27.6)	4771 (24.0)	<.001
2nd quartile	5715 (25.7)	578 (24.8)	5137 (25.8)	
3rd quartile	5442 (24.5)	589 (25.3)	4853 (24.4)	
Top quartile	5660 (25.4)	521 (22.3)	5139 (25.8)	
US trained	19,370 (87.1)	2092 (89.7)	17,278 (86.8)	<.001
Completed at least 50 hours of continuing medical education annually	2359 (10.6)	211 (9.0)	2148 (10.8)	.009

Abbreviations: MRI = magnetic resonance imaging; US = United States.

* χ^2 test comparing patients receiving hypofractionation with those receiving standard radiation therapy.

† Expressed in terms of number of patients treated by a specific type of provider.

the unadjusted differences between patients receiving hypofractionation and those treated with standard fractionated radiation therapy. We then used hierarchic multi-variable logistic regression models with patients (level 1) nested within providers (level 2) and then clustered by provider county (level 3) to understand the role of physicians and their practice area (26, 27). All patient-level and

physician-level covariates were selected a priori based on factors that could influence the likelihood of hypofractionation. These fixed effects were categoric; the subgroups are presented in Table 1. To graphically display the variability in hypofractionation, we plotted the observed and adjusted rates while grouping providers into quintiles based on observed hypofractionation rate (Fig. 2). With the

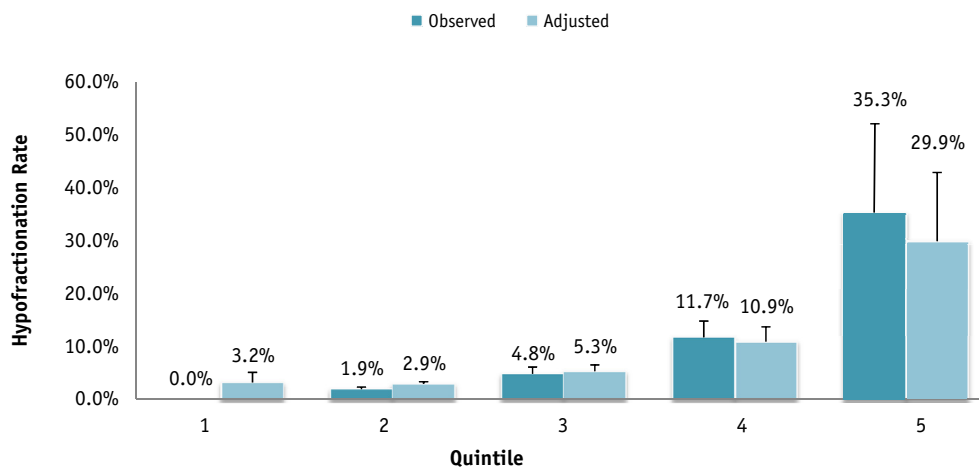


Fig. 2. Observed (dark blue) and adjusted (light blue) mean rates of hypofractionated radiation therapy stratified by provider quintile of hypofractionation usage (1 = lowest rate of hypofractionation; 5 = highest rate of hypofractionation). Adjusted rates of hypofractionation were determined using a hierarchic logistic model controlling for patient, tumor, and provider characteristics. Rates of hypofractionation and 95% confidence intervals are presented above each column. (A color version of this figure is available at www.redjournal.org.)

adjusted rates we calculated the predicted likelihood of hypofractionation for each patient and then determined the adjusted rate of hypofractionation per provider (28, 29). We then presented the observed and adjusted mean rates of hypofractionation per provider quintile.

We calculated the residual intraclass correlation (ICC) and median odds ratio (MOR) for the provider and practice area separately to determine their association with use of hypofractionation (30). Briefly, the ICC can be used to measure the correlation between patients treated by different providers within a single county and then between those treated by the same provider (30) to assess the strength of the cluster relationships. The MOR, conversely, can be used to translate both the provider and area level variations to the scale of odds ratios (ORs), facilitating a direct comparison with the model's fixed effects (31, 32). The MOR also expresses the likelihood of a patient's receiving a different outcome if the patient were to change providers or county. For example, if the MOR for providers were to equal 1, then there would be no difference in the likelihood of hypofractionation between providers; however, if this MOR were equal to 1.5, then a patient would have 50% greater odds of hypofractionation if treated by 1 randomly selected provider as opposed to another. We calculated the confidence interval (CI) for the MOR using bootstrapping and Delta's method with 1000 resampling datasets (33). We also partitioned the explained variance in the use of hypofractionation using a conditional R^2 for generalized linear mixed models (34). We used PROC GLIMMIX in SAS version 9.4 (SAS Institute Inc, Cary, NC) to perform our multilevel analyses with the residual pseudolikelihood estimation technique (35). All statistical tests performed were 2-sided, with a P value $<.05$ considered statistically significant.

Results

Our final cohort included 22,233 women, treated by 1437 providers, of whom 2333 (10.4%) received hypofractionated radiation therapy. The majority of patients were between 66 and 74 years old with tumors ≤ 2 centimeters and negative lymph nodes. Most were treated by male radiation oncologists trained in the United States who graduated from medical school after 1981 and were part of a group practice. The proportion of patients receiving hypofractionation increased over the study period. In general, patients who received hypofractionation were older (≥ 80 years), with locally confined tumors, and were more likely to be treated by female providers (Table 1).

Observed rates of hypofractionated radiation therapy for breast cancer demonstrated marked variation among providers, ranging from 0.0% in the bottom quintile of radiation oncologists to 30.4% in the top quintile. After multivariable adjustment, the rates attenuated slightly, although substantial variation persisted, with adjusted rates

ranging from 2.3% in the lowest quintile to 27.0% in the highest quintile (Fig. 2).

Predictors of hypofractionated radiation therapy identified through multivariable analysis controlling for patient-related and provider-related factors included older age, having no nodal exploration, diagnosis occurring after 2005, or being treated by a female physician. Conversely, being black, having positive lymph nodes, receiving chemotherapy or magnetic resonance imaging of the breast, or being treated by a provider in the highest quartile of breast cancer case volume significantly reduced the likelihood of receiving hypofractionated radiation therapy.

The ICC for geographic region was 0.11. By contrast, the correlation between patients treated by the same provider was 0.38, indicating that there was greater homogeneity in treatment pattern for patients treated by the same provider than for patients in the same area. We then assessed the impact of provider and geography on the likelihood of hypofractionated radiation therapy, using the MOR. The MOR for provider was 3.08 (95% CI: 2.52, 3.76), indicating that if a patient had seen another provider, she would have had triple the odds of receiving a different therapy recommendation. The impact of geography was more moderate: patients only had double the odds of a different therapy recommendation if they were in a different county (MOR 2.10; 95% CI: 1.78, 2.47). Inasmuch as the MOR can be directly compared with the ORs of fixed effects, we found that other than the year of diagnosis, the provider was the strongest predictor of the receipt of hypofractionated radiation therapy. The complete multivariable analysis, including the ORs for fixed effects and MORs for random effects, is presented in Figure 3. Partitioning the explained variance of the model yielded 19.0% attributable to the provider area, 44.2% attributable to the provider, and 36.8% attributable to the patient and provider characteristics.

In evaluating how changing practice patterns affected the impact of the provider and county on the likelihood of hypofractionation, we found that overall the MOR for provider and county increased from 2004 to 2005 (2.82 and 2.02, respectively) to 2010 to 2011 (3.16 and 2.23, respectively). Complete results for the MOR stratified by diagnosis year are presented in Table 2.

Discussion

This study highlights the influential role of the individual provider on shaping patterns of health care delivery in radiation oncology. The key finding of this study was that the individual radiation oncologist heavily influenced the early adoption of hypofractionated radiation in early-stage breast cancer. The likelihood of a patient's receiving hypofractionated radiation increased markedly between 2010 and 2011, coinciding with the first publication of long-term results comparing hypofractionation with standard fractionation in March 2010 (9). However, the relative

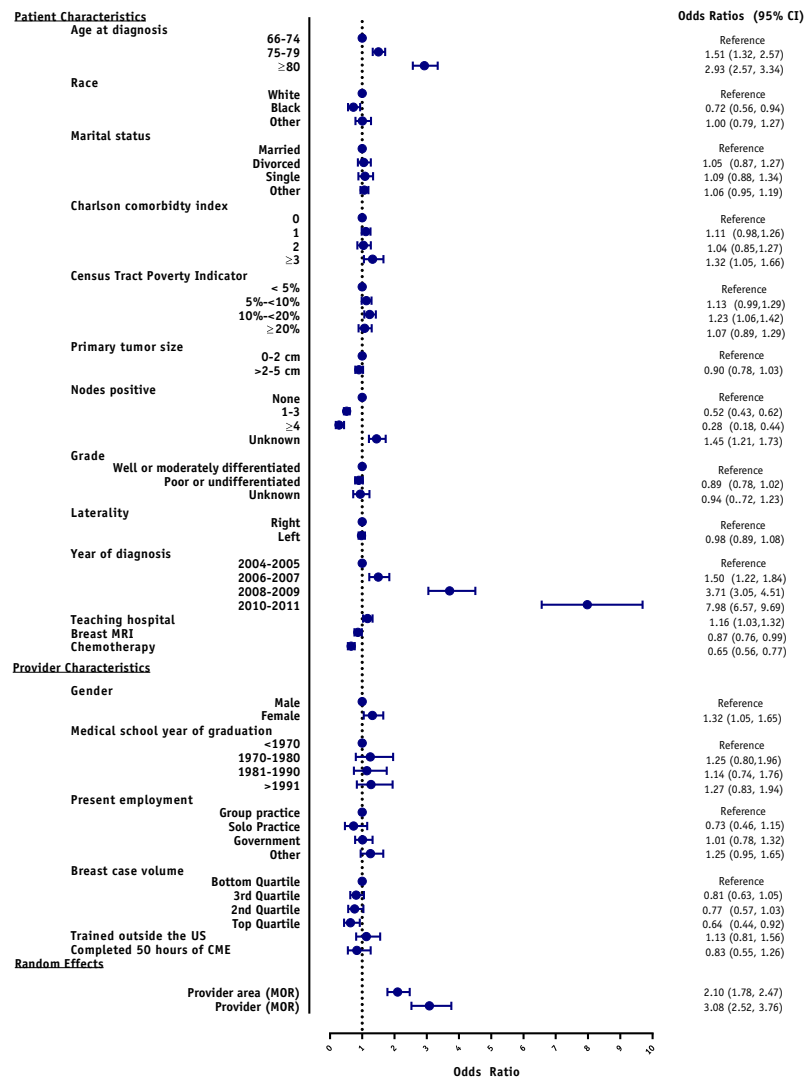


Fig. 3. Forest plot for the adjusted odds ratios for patient and provider characteristics (fixed effects) showing the likelihood of hypofractionated radiation therapy. Exact odds ratios and median odds ratios (MOR) with 95% confidence intervals (CI) are also presented. An odds ratio greater than 1 favors hypofractionation, whereas an odds ratio less than 1 favors standard radiation therapy. The MOR for the model’s random effects, the provider, and the associated area are directly comparable to the model’s fixed effects. *Abbreviation:* MRI = magnetic resonance imaging.

influence of the provider also increased between 2004 and 2005 and between 2010 and 2011, suggesting that as the evidence and recommendations more strongly favor hypofractionation as a standard of care, the influence of the individual provider will become more important in the promulgation of these new practice patterns.

Shorter radiation treatment courses with hypofractionated radiation in appropriately selected patients produce equivalent outcomes with reduced burden to patients, and they result in reduced resource utilization and costs (36). However, questions do remain regarding the use of this therapy in the post-mastectomy or post-chemotherapy setting or in node-positive women. Our study did include a small subset of cautionary patients for hypofractionation (node-positive women, those treated with chemotherapy, or

both), but a sensitivity analysis showed similar results when these populations were excluded. The high degree of provider-associated variation observed in this study for women eligible for hypofractionation suggests inefficiency in health care delivery without clinical benefit to patients.

To date, our study represents the first population-based analysis studying the impact of individual radiation oncologists on the likelihood of receiving hypofractionated radiation therapy after breast-conserving surgery. Our research builds on previous efforts that focused on understanding sources of variation ascribed by patient factors and geography. Jagsi et al (15) found little correlation between hypofractionated radiation therapy and tumor-specific characteristics including stage, grade, and breast laterality. More recently, Gillespie et al (17) reported substantial

Table 2 The median odds ratio (MOR) for provider and associated county (geographic region) stratified by year of diagnosis

Year of diagnosis	MOR provider	MOR provider area
2004-2005	2.82	2.02
2006-2007	2.75	2.13
2008-2009	2.99	2.38
2010-2011	3.16	2.23

The MOR characterizes the heterogeneity contributed by the model's random effects adjusted for patient and provider level covariates. If all providers or counties were the same, the MOR would be 1. Conversely, strong provider or county level differences result in a larger MOR. The MOR for provider and county was seen to increase between 2004 and 2005 and between 2010 and 2011, demonstrating increased heterogeneity between providers and regions.

geographic heterogeneity in the use of hypofractionated radiation therapy across the United States, suggesting that the health care environment plays a role in shaping the patterns of radiation therapy.

The role of radiation oncologists has recently been investigated within the Michigan Radiation Oncology Quality Consortium (21). Among the 13 practices studied, hypofractionation use ranged from 2% to 80%, with 51% of the variation in the rate of hypofractionation attributable to the practice, 21% to the provider, and 28% to the patient. Our analysis builds on the Michigan study by providing a population-based perspective of the influence of the provider. We also found that the non-patient-related factors play a significant role in the selection of hypofractionated radiation therapy. Our study favored the impact of the provider; however, we cannot comment on the impact of the institution with the available AMA data. Together, these studies suggest that the evolution of hypofractionation in the United States has been a less than efficient process, strongly influenced by factors other than a patient's disease.

To date, there has been limited research quantifying the impact of the radiation oncologist on radiation treatment decisions. Hoffman et al (37), in a subset analysis, commented that of patients who met with radiation oncologists, 19.0% of the variation in management was due to the radiation oncologist and 2% was ascribable to patient characteristics. The importance of the radiation oncologist is similarly reflected in this article. Most previous work has focused on assessing the impact of surgeons on treatment patterns such as mastectomy for breast cancer (38-41) or active surveillance in prostate cancer (37, 42), or primary treatment of vestibular schwannoma (43). Therefore, both this article and the previous report by Jagsi et al (15) represent a novel approach in understanding treatment decisions—by assessing the impact of the radiation oncologist—and they suggest an increasing need for research, especially because the relative increase in nationwide health care expenditures in radiation oncology far outpaces that in other medical specialties (44).

The main provider-related factor driving receipt of hypofractionated radiation therapy was the gender of the provider, with women more likely to prescribe hypofractionation than men even when year of training was controlled for. Female physicians may be more empathetic to the time constraints of female patients, which is supported by evidence that gender-concordant visits exhibit higher scores on understanding the whole person compared with gender-discordant visits (45). Additionally, female physicians are more likely to engage in conversations about social issues (46) and to participate in shared decision making (47), which has been shown to influence treatment decisions in breast cancer (48).

Our study suggests that strategies to address the slow uptake of breast hypofractionation need to consider factors beyond the individual patient and her interaction with the health care system. These strategies must also consider the individual providers and their beliefs and biases. Efforts to reduce provider bias could potentially include improved patient or physician education (49) and implementation of shared decision-making tools (50, 51). Reimbursement reform represents a clear but complex measure that has the capacity to influence patterns of care. The current fee-for-service reimbursement paradigm in radiation oncology misaligns incentives by rewarding longer courses of radiation. Konksi et al (52) showed that if a radiation therapy department treated 40% of its breast cancer patients with hypofractionated therapy, annual revenue would decrease by over \$500,000. Alternate reimbursement models that incentivize greater adherence to evidence-based recommendations could help reduce both physician-based and practice-based variability while improving quality of care.

This study has limitations that must be acknowledged. Because our cohort was limited to Medicare beneficiaries over the age of 65, a limited subset of breast cancer patients, these results may not be generalizable to younger women or those with private insurance. SEER is also an observational dataset subject to selection bias. In addition, this dataset does not include data on several potentially confounding covariates such as patient anatomy, surgical margins, the presence of multicentric disease, or radiation planning information such as dose inhomogeneity. Finally, with the administrative data available in this project we cannot comment on factors such as patient choice, psychosocial factors, health behaviors, or patient-physician communication, all of which are critical in this decision-making process.

Despite these limitations, this study marks the first population-based analysis evaluating the impact of individual radiation oncologists on the early adoption of hypofractionated radiation therapy in elderly women with early-stage breast cancer. This work suggests that providers play a significant role in the treatment decision, resulting in greater than expected variation in its use. Reduction in this variability will require not only concerted efforts to ensure that well-informed patients are the principal drivers of

treatment decisions but also further initiatives to address the impact of the individual physician.

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