

Delayed Radiotherapy for Breast Cancer Patients in Integrated Delivery Systems

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Breast cancer, diagnosed in 180,000 women in the United States in 2008,¹ usually is treated with mastectomy or breast-conserving surgery (BCS) with or without radiotherapy (RT).² Treatment characteristics vary by race/ethnicity, socioeconomic status, geographic region, healthcare access, and insurance status.³⁻⁸ Quality of care, including timing and completeness of RT and chemotherapy, can affect recurrence and survival rates.⁷⁻¹³ The start of RT is time sensitive, yet many factors can affect whether a patient experiences a delayed start. If she has positive nodes, she may be more likely to have longer discussions about treatment options because more options are available.² As breast cancer treatment requires extensive coordination of care across multiple providers and specialties, patients may experience difficulties navigating the healthcare system.¹⁴ Typical treatment starts with surgery and lymph node assessment, followed by recovery time after surgery, subsequent RT to the whole breast for 5 to 6 weeks, and a 1-week RT boost to the tumor bed.² Positive lymph nodes are an indication for chemotherapy to be part of the treatment.²

There is conflicting evidence regarding the optimal timing of RT following BCS.^{11,15-19} One study suggests that RT delay does not negatively affect breast cancer–related health outcomes,¹⁹ but most have found a negative impact.^{11,15-18} A systematic review concluded that RT delay was associated with higher rates of local recurrence.¹⁷ Delay also may be associated with psychological distress and anxiety, which can negatively impact the care process and outcomes.²⁰

This study assesses patient-level predictors of delayed RT in an insured population of older women with early-stage breast cancer treated in integrated healthcare delivery systems, a group that has not been studied for timeliness in receiving RT.

DATA AND METHODS

This study is nested in the Breast Cancer Treatment Effectiveness in Older Women Study cohort.²¹ We included 541 women age ≥ 65 years diagnosed with unilateral, early-stage breast cancer (American Joint Commission on Cancer stage I or II²²) enrolled in 5 integrated delivery systems in the Cancer Research Network, a collaborative group of research programs, enrolled populations, and data systems of 14 health systems nationwide.²³ Women diagnosed from 1990

Objective: To identify factors associated with delayed radiotherapy (RT) in older women with early-stage breast cancer.

Methods: We studied 541 women age ≥ 65 years diagnosed with early-stage breast cancer in 1990-1994 at 5 integrated healthcare delivery systems and treated with breast-conserving surgery and RT, but not chemotherapy. We examined whether demographic, tumor, or treatment characteristics were associated with RT delays of >8 weeks postsurgery using χ^2 tests and multivariable logistic regression.

Results: Seventy-six women (14%) had delayed RT, with a median delay of 14 weeks. Even though they had insurance and access to care, nonwhite and Hispanic women were much more likely than white women to have delayed RT (odds ratio = 3.3; 95% confidence interval = 1.7, 10) in multivariable analyses that controlled for demographic and clinical variables.

Conclusions: Timely RT should be facilitated through physician and patient education, navigation, and notification programs to improve quality of care. Queues for RT appointments should be evaluated on an ongoing basis to ensure adequate access. Future research should examine modifiable barriers to RT timeliness and whether delays impact long-term outcomes.

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Take-Away Points

This study identified factors associated with delayed radiotherapy (RT) for women age ≥65 years with breast cancer in 5 integrated healthcare delivery systems.

- Delayed RT was experienced by 14% of the study subjects, even though they had insurance and access to care.
- Women receiving delayed care were more likely to be nonwhite or Hispanic.
- Queues for RT appointments should be evaluated on an ongoing basis to ensure adequate access.

through 1994 were followed for 10 years. All subjects in this nested cohort received BCS with a full course of whole breast RT, but no chemotherapy. Subjects from the original cohort receiving BCS without RT (23%) or mastectomy (53%) were excluded.²¹ We restricted the sample to women not receiving chemotherapy to eliminate variations in RT timing related to chemotherapy sequencing. We used automated administrative databases, medical record review, and tumor registries to ascertain age, race/ethnicity, Charlson Comorbidity Index score,²⁴ lymph node status, tumor size, histology, estrogen receptor (ER) or progesterone receptor (PR) status, and any use of tamoxifen. To calculate the Charlson Comorbidity Index score, information on comorbid conditions was collected from medical records for all healthcare services provided in the year before diagnosis. This index includes 18 conditions weighted to predict mortality. We excluded cancer diagnoses from the index and categorized the remaining score as 0, 1, or 2+. Because others have shown that an 8-week delay can impact health outcomes, we defined RT delay as starting RT more than 8 weeks following BCS, based on medical record data.^{11,17} All research was conducted following approval from local institutional review boards and in accor-

dance with the ethical standards of those boards.

We calculated the percentage of women with delayed RT and the percentage with timely RT by demographic and clinical characteristics. We used χ^2 tests and fit multivariable logistic regression models to identify factors associated with delayed RT, controlling for integrated delivery system site.

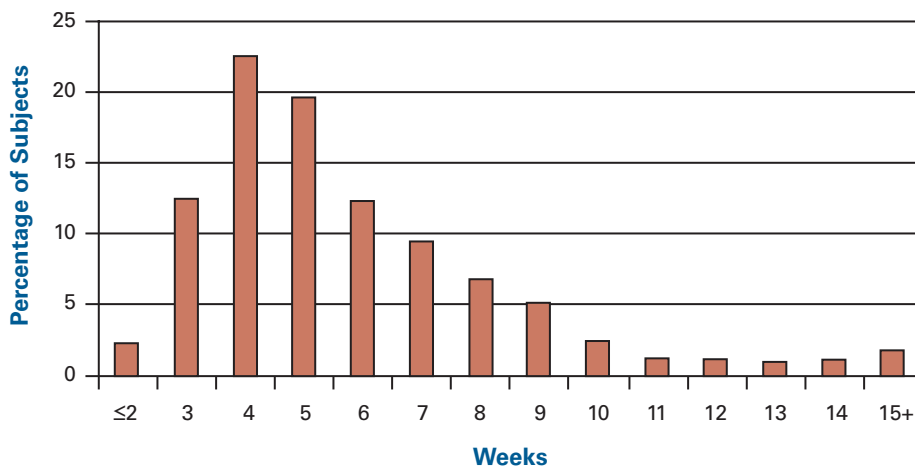
RESULTS

The sample included 541 women, of whom 76 (14%) had a delay of more than 8 weeks (Figure). Among women with RT delayed more than 8 weeks, the median delay was 14 weeks, and 21 subjects (4%) had delays of more than 12 weeks. More than two-thirds of the sample was younger than age 75 years, and few (3.3%) scored more than 1 on the Charlson Comorbidity Index. Almost 7% were ER-/PR-, and 13% of subjects had positive nodes (Table 1). In multivariable analyses (Table 2), women of nonwhite race or Hispanic ethnicity had significantly higher odds of delayed RT (odds ratio [OR] = 3.3, 95% confidence interval [CI] = 1.7, 10). We had limited precision in general, as indicated by some wide CIs (eg, tumor size >2 cm [OR = 1.9, 95% CI = 0.9, 4.1] and ER-/PR- status [OR = 1.8, 95% CI = 0.7, 4.9]).

DISCUSSION

In this fully insured population of older women with

■ **Figure.** Distribution of Radiotherapy Timing After Breast-Conserving Surgery (N = 541)^a



^aSubjects were all women receiving breast-conserving surgery and any radiotherapy. The median time to start of radiotherapy was 4.8 weeks; the mean time was 5.7 weeks.

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breast cancer who had access to integrated delivery systems, about 1 in 7 women experienced delayed RT following BCS, a rate similar to that reported in other studies.^{11,17} Surprisingly, in this population, the proportion with RT delays of more than 8 weeks was about the same as that found in a fee-for-service Medicare population (14% vs 16%, respectively).¹¹ One might expect better coordinated, and therefore less delayed, care in integrated healthcare delivery systems, yet delays of more than 8 weeks may be due to healthcare access issues such as transportation problems, language concordance or communication issues, or limited patient knowledge about the importance of timely RT—all barriers that are not mediated by insurance status. Alternatively, delays may be caused by poor care coordination by clinicians and the healthcare system or patient-related barriers, concerns, or anxiety regarding decision making and treatment itself.^{20,25,26}

The only predictor of delayed RT was nonwhite or Hispanic race/ethnicity, consistent with previous research.^{11,18} Indeed, delayed RT, which may represent uncoordinated care (among other possible factors), was not affected significantly by other included clinical or demographic factors. Whether these delays in turn affect mortality for patients in integrated delivery systems could not be shown because of limited statistical power.

All eligible women were included in our study population, and we had no loss to follow-up in the treatment period. This design advantage substantially limited the potential for selection bias. Another strength of this study is that all subjects in the cohort had equal access to complete treatment by having access to care in an integrated healthcare delivery system. In addition to sociodemographic information (beyond age), we had important information about the tumors themselves that helped explain treatment receipt and reduced confounding in our analyses. Nonetheless, we did not have information on characteristics such as patient educational attainment, income, transportation availability, radiation oncologist availability, language barriers, or prefer-

Table 1. Characteristics of Study Patients (N = 541)

Characteristic	No. (Row %)	
	Timely RT	Delayed RT ^a
Age at breast cancer diagnosis, y		
65-69	173 (87)	26 (13)
70-74	156 (85)	27 (15)
75-79	78 (83)	16 (17)
≥80	58 (89)	7 (11)
Race/ethnicity^b		
White, non-Hispanic	416 (88)	56 (12)
Nonwhite or Hispanic	49 (71)	20 (29)
Charlson Comorbidity Index score		
0	335 (86)	53 (14)
1	113 (84)	22 (16)
2+	17 (94)	1 (6)
Node status		
Negative	407 (87)	63 (13)
Positive		
1-3 nodes	52 (81)	12 (19)
≥4 nodes	6 (86)	1 (14)
Tumor size		
<1 cm	199 (88)	27 (12)
1-2 cm	210 (86)	34 (14)
>2 cm	56 (79)	15 (21)
Histology		
Well differentiated	94 (89)	12 (11)
Intermediate/moderately differentiated	192 (85)	33 (15)
Poorly differentiated/undifferentiated/anaplastic	86 (85)	15 (15)
Unknown	93 (85)	16 (15)
ER/PR status		
ER+ or PR+	386 (87)	59 (13)
ER- and PR-	29 (81)	7 (19)
Other	50 (83)	10 (17)
Tamoxifen		
Not used	186 (87)	27 (13)
Used	279 (85)	49 (15)

ER indicates estrogen receptor; PR, progesterone receptor; RT, radiotherapy.

^aA total of 76 patients (14%) had delayed RT. Radiotherapy was considered to be delayed when radiation treatment started more than 8 weeks postlumpectomy.

^bNonwhite and Hispanic women were significantly more likely ($P < .05$ by the χ^2 test) to receive delayed RT.

ences for care; doctor-patient communication; or healthcare system programs such as care coordination—all of which may be greater barriers to or facilitators of care for older women diagnosed with breast cancer.^{14,25} These characteristics may directly or indirectly influence care-seeking behavior and care receipt among nonwhite and Hispanic women, who are more

Table 2. Odds of RT Being Delayed More Than 8 Weeks After Definitive Breast-Conserving Surgery, Multivariable

Characteristic	Odds Ratio	95% Confidence Interval
Age at breast cancer diagnosis, y		
65-69	Reference	
70-74	1.3	0.7, 2.5
75-79	1.6	0.8, 3.3
≥80	1.2	0.5, 3.2
Race/ethnicity		
White, non-Hispanic	Reference	
Nonwhite and/or Hispanic	3.3	1.7, 10
Charlson Comorbidity Index score		
0	Reference	
1	1.1	0.6, 2.0
2+	0.3	0.03, 2.3
Node status		
Negative	Reference	
Positive		
1-3 nodes	1.3	0.6, 2.9
≥4 nodes	1.0	0.1, 9.5
Tumor size		
<1 cm	Reference	
1-2 cm	1.2	0.6, 2.1
>2 cm	1.9	0.9, 4.1
Histology		
Well differentiated	Reference	
Intermediate/moderately differentiated	1.0	0.5, 2.1
Poorly differentiated	0.6	0.2, 1.5
Unknown	1.0	0.4, 2.3
ER/PR status		
ER+ or PR+	Reference	
ER- and PR-	1.8	0.7, 4.9
ER or PR unknown	1.4	0.6, 3.2
Tamoxifen		
Not used	Reference	
Used	1.2	0.6, 2.4

ER indicates estrogen receptor; PR, progesterone receptor; RT, radiotherapy.

likely to be of lower socioeconomic status.²⁷ All subjects had Medicare coverage in these healthcare systems with the same benefits for RT and Medicare paying for RT in inpatient, outpatient, and freestanding clinics. Outpatient RT requires a set copayment, which was usually lower than fee-for-service copayments, thereby reducing barriers to care even more. It is

unlikely that coverage levels affected timeliness of RT.

We have shown that access to healthcare, as reflected by a patient's membership in an integrated healthcare delivery system, does not in itself ensure timely therapy. Rates of RT delay were similar between integrated delivery systems and the fee-for-service sector¹¹ and appear to be affected by race/ethnicity. Healthcare delivery systems and providers should consider targeting care coordination efforts to traditionally underserved patients to improve timeliness of RT.

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