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Patient Demographic and Tumor Characteristics Influencing Oncologist Follow-up Frequency in Older Breast Cancer Survivors

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Abstract

Background—Although recommendations for breast cancer follow-up frequency exist, current follow-up guidelines are standardized, without consideration of individual patient characteristics. Some studies suggest oncologists are using these characteristics to tailor follow-up recommendations, but it is unclear how this is translating into practice. The objective was to examine current patterns of oncologist breast cancer follow-up and determine the association between patient and tumor characteristics and follow-up frequency.

Methods—The Surveillance, Epidemiology and End Results (SEER)-Medicare database was used to identify stage I-III breast cancer patients diagnosed 2000-2007 (n=39,241). Oncologist follow-up visits were defined using Medicare specialty provider codes and the linked AMA Masterfile. Multinomial logistic regression determined the association between patient and tumor characteristics and oncologist follow-up visit frequency.

Results—Younger age (p<0.001), positive nodes (p<0.001), ER/PR positivity (p<0.001), and increasing treatment intensity (p<0.001) were most strongly associated with more frequent follow-up. However, after accounting for these characteristics, significant variation in follow-up frequency was observed. In addition to patient factors, the number and types of oncologists involved in follow-up was associated with follow-up frequency (p<0.001). Types of oncologists providing follow-up varied, with medical oncologists the sole providers of follow-up for 19-51% of breast cancer survivors. Overall, 58% of patients received surgical oncology and 51% undergoing radiation received radiation oncology follow-up, usually in combination with medical oncology.

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Conclusions—Significant variation in breast cancer follow-up frequency exists. Developing follow-up guidelines tailored for patient, tumor, and treatment characteristics, while also providing guidance on *who* should provide follow-up, has the potential to increase clinical efficiency.

Introduction

Follow-up every 3-6 months is recommended for the 3 million current U.S. breast cancer survivors.¹⁻³ Goals of follow-up include early detection of new cancers, local-regional recurrence, distant metastases, and treatment toxicity. Both the American Society of Clinical Oncology and the National Comprehensive Cancer Network provide recommendations for follow-up frequency.^{2,3} However, these follow-up guidelines are standardized, without consideration of individual patient characteristics. This is significant given that both patient and tumor characteristics can dramatically affect the risk and timing of recurrence.⁴⁻⁸ Some studies suggest oncologists are using these characteristics (such as tumor size, nodal status, and molecular tumor subtype) to tailor follow-up recommendations,⁹⁻¹¹ but it is unclear how this is translating into practice. Understanding patient factors driving current patterns of follow-up is a first step towards the development of more efficient, tailored breast cancer follow-up. Our objective was to examine current patterns of oncologist breast cancer follow-up and determine the association between patient and tumor characteristics and follow-up frequency. We hypothesized that significant drivers of the frequency of follow-up patients receive would include nodal status (increased frequency if node positive) and estrogen/progesterone receptor (ER/PR) status (decreased frequency if positive).

Methods

This study was reviewed by the University of Wisconsin Institutional Review Board and granted a waiver of consent.

Data source

The linked Surveillance, Epidemiology and End Results (SEER)-Medicare database was used to identify patients diagnosed with breast cancer from 2000-2007. The SEER-Medicare data resource has been previously described by our group¹²⁻¹⁴ and others,^{15,16} and is an established resource for studying longitudinal cancer in elderly patients.

Patient selection

All female, Medicare-enrolled patients aged 66 years and older diagnosed with stage I-III invasive breast cancer within any SEER region between 2000 and 2007 were eligible (Figure 1). SEER anatomic site (C50.0-50.6, 50.8-50.9), and histology (8000-8005, 8010-8015, 8020-8022, 8030-8035, 8041, 8043, 8050-8052, 8140-8141, 8143, 8190, 8200, 8201, 8211, 8230-8231, 8251, 8255, 8260-8261, 8310, 8314, 8315, 8320, 8323, 8401, 8440, 8480, 8481, 8490, 8500-8504, 8507-8508, 8510, 8512-8514, 8520-8525, 8530, 8540-8541, 8543, 8550, 8551, 8560, 8562, 8570-8575, 8980-8982, 9020) codes were used to identify breast cancer patients. Patients were included in the study if they underwent definitive breast surgery (Appendix). Continuous enrollment in Medicare Part A and B was required for 1-year preceding diagnosis to allow ascertainment of comorbidities through a minimum of 2-years after diagnosis, death, or December 31, 2009 (whichever came first) to assess follow-up received. Patients were excluded if they were enrolled in a Health Maintenance Organization (HMO) during the same time period. Patients were also excluded if they were diagnosed with another malignancy five years before or after the date of breast cancer diagnosis.

Primary outcome variable

The primary outcome was frequency of oncologist follow-up visits. Any visit with a surgical, medical, or radiation oncologist was considered to be an “oncologist visit”; in this context, general surgeons who provided breast cancer care were considered to be surgical oncologists. To ensure only follow-up (rather than active treatment) visits were captured, the evaluable follow-up window began 12 months after diagnosis or a minimum of 3 months after last treatment (excluding endocrine therapy and reconstructive surgery).¹⁷ A minimum of 1 year of follow-up was required. Our evaluable follow-up window ended at the earliest of these events: 1) 4 years after diagnosis; 2) death; 3) 12/31/2009 (end of available data); or 4) 3 months prior to a new ICD-9 diagnosis code for secondary cancer [excluding breast and unspecified site¹⁸], a 2nd SEER breast cancer diagnosis, or resumption of treatment after a 90-day gap.¹⁸⁻²⁰ Our follow-up window ended three months prior to these events to minimize bias associated with inappropriately capturing clinic visits for work-up of recurrence or ongoing treatment (which would overestimate the number of follow-up visits occurring).

All clinic visits with an appropriate Evaluation and Management code (ICD-9 codes: 99058, 99201-99205, 99211-99215, 99241-99245, 99271-99275, 99354, 99355, 99381-99387, 99391-99397, 99401-99404, 99411, 99412, 99420, 99429, 99431, 99432, G0101, G0245-G0250, G0344, G0375, G0376) were assessed. We defined oncologist visits using the Medicare specialty provider code and linked AMA Masterfile.^{21,22} In cases where both the AMA Masterfile and Medicare specialty provider code were missing or did not indicate an oncology specialty, we evaluated physicians’ claims to determine whether their clinical practice was consistent with being an oncologist;²¹ a breast cancer ICD-9 diagnosis code was required for any oncologist visits identified by these claims-based definitions.²¹

Patient-related variables

Basic demographics, including date of birth, gender, race/ethnicity, and marital status, were obtained from SEER data. Socioeconomic status was assessed using census tract median level of household income and median level of education. Residence location was assessed using the Rural Urban Commuting Area codes. The Deyo implementation²³ of the Charlson Comorbidity Index²⁴ was used to assess patient comorbidities. The 6th edition American Joint Committee on Cancer (AJCC) staging²⁵ was used to assign stage based on SEER tumor size and number of nodes positive. ER/PR status and tumor grade were also assessed using SEER. Definitions for treatment received are included in the appendix. Endocrine therapy was not able to be assessed, as oral medications are not included in Medicare part A and B. Therefore, ER/PR status was used as a surrogate for receipt of endocrine therapy.

Analysis

Summary statistics were used to describe patient demographic and disease characteristics for the entire cohort. Each patient was categorized as having <2, 2-4, and >4 visits/year to approximate the 25th, 25th-75th, and 75th percentiles in our data. Multinomial logistic regression identified patient characteristics associated with receipt of more frequent follow-up (compared to a baseline of <2 visits/year), adjusting for sociodemographics, tumor characteristics and treatment, and using robust estimates of the variance to account for clustering. Primary tumor size and number of positive lymph nodes were included in the model rather than AJCC stage to allow assessment of how each component influenced follow-up frequency. A series of bar graphs representing the frequency of follow-up were created to better explore the relationship between treatment received and follow-up frequency. Additional bar graphs were generated representing the types of oncologists involved in follow-up care.

Results

Demographic and tumor characteristics for the 39,421 patients meeting inclusion criteria for the study are presented in Table 1. The majority of patients were AJCC Stage I (59%), with 36% Stage II and 5% Stage III. Patients had a median 2.67 follow-up visits/year. Younger age, positive nodes, ER/PR positivity, and increasing intensity of treatment were most strongly associated with receipt of more frequent follow-up on multivariate modeling (Table 2). For example, the odds ratio (OR) of having >4 visits/year when compared to <2 visits/year was 1.5 (confidence interval [C.I.] 1.4-1.6) with positive nodes, 1.2 (C.I. 1.1-1.3) if ER/PR positive, and 3.3 (C.I. 3.0-3.6) if chemotherapy was received. The likelihood of more frequent follow-up also increased with intensity of primary local therapy (using lumpectomy alone as the reference): mastectomy alone OR 1.6 (C.I. 1.4-1.9), lumpectomy with radiation OR 3.9 (C.I. 3.4-4.5), and mastectomy with radiation OR 4.7 (C.I. 3.9-5.7).

Given the strong relationship between treatment received and follow-up frequency, treatment received was examined in more detail (Figure 2). As was demonstrated in our multivariable risk-adjusted model, a trend towards increased visit frequency with increased intensity of treatment was observed. For example, >43% of patients who underwent lumpectomy and were treated with both chemotherapy and radiation received >4 follow-up visits per year vs. 24% of patients undergoing lumpectomy and radiation alone. However, significant variation in frequency of follow-up received was observed. This is most clearly appreciated in the lumpectomy, radiation and no chemotherapy cohort (Figure 2). 48% of these patients received 2-4 follow-up visits per year. However, the remaining patients were as likely to receive <2 visits per year as they were >4 visits per year. This variation persisted after controlling for other patient sociodemographic and tumor characteristics (i.e. ER/PR receptor and nodal status).

Increasing treatment modalities employed means that multiple oncologists are involved in patients' active treatment and have the potential to be involved in follow-up care. As expected, an increasing number of oncologists involved in follow-up was associated with increased follow-up frequency ($p<0.001$ on univariate analysis). Figure 3 demonstrates the proportion of patients receiving follow-up with a given oncologist type, based on treatment. Medical oncologists are sole providers of follow-up for 19-51% of breast cancer survivors. Conversely, radiation and surgical oncologists are unlikely to provide sole follow-up. Overall, >90% of patients receiving chemotherapy and 60-84% who do not receive chemotherapy have a medical oncologist involved in their follow-up. 58% of patients undergoing surgery have surgical oncology follow-up and 51% treated with radiation have radiation oncology follow-up, usually in combination with medical oncology. ER/PR status (a surrogate for endocrine therapy) did not influence the likelihood of receiving follow-up by a given oncologist type.

Discussion

We identified significant variation in frequency of oncologist follow-up visits, influenced by patient demographics (i.e. age), tumor characteristics (nodal status, ER/PR status), and treatment received. This suggests that oncologists may be using these patient factors to tailor follow-up recommendations for a given patient. We had hypothesized that ER/PR and nodal status would have the strongest association with follow-up frequency. Both of these factors were associated with frequency of follow-up visits, although ER/PR positivity was associated with more rather than less frequent follow-up (opposite what had been hypothesized *a priori*). However, although both of these factors were associated with frequency of follow-up visits, the types of treatment a patient received appeared to have a stronger overall influence.

An obvious possible explanation for the association between treatment received and frequency of follow-up visits is that patients with “higher risk” tumors are also those most likely to receive multiple treatment modalities (making treatment a surrogate for tumor characteristics). However, as both tumor characteristics and treatment received were associated with follow-up frequency on multivariable modeling, this suggests that the association with treatment received cannot be explained by tumor characteristics alone. Another explanation is that risk of treatment toxicity is being considered in follow-up recommendations. This argument is indirectly supported by the observation that ER/PR positivity (a surrogate for endocrine therapy) was associated with more frequent follow-up than ER/PR negative; this increased follow-up frequency could be explained by ongoing monitoring for treatment toxicity. Finally, the types and number of oncologists involved in a patient’s follow-up care may influence follow-up frequency. Current guidelines do not provide guidance on what types of oncologists should provide follow-up, or what the responsibilities of each should be. Consequently, challenges associated with coordinating multidisciplinary care may lead to more frequent follow-up for patients who receive care from multiple oncologists. Given the inconsistency we observed in the number and types of oncologists providing follow-up care for breast cancer survivors, *who* provides follow-up may be a critical factor driving the frequency of follow-up breast cancer survivors receive. This suggests that coordinating care amongst different oncology specialties may hold the greatest potential for increasing efficiency.

Limitations to our study exist. First, we are unable to directly assess use of oral medications (specifically endocrine therapy) in the SEER-Medicare database. To address this, we utilized ER/PR positivity as a surrogate for receipt of oral endocrine therapy in our analyses. This assumption is somewhat limited by issues related to compliance with recommended endocrine therapy.²⁶ Additionally, as our study was limited to Medicare patients, findings cannot be generalized to younger women; however, given that over 50% of breast cancer patients are >65 years of age,²⁷ our results are applicable to the majority of women. Finally, we are unable to assess intent of the follow-up visits, i.e. was a visit truly for surveillance versus evaluation of a symptom. By categorizing our frequency of follow-up into 3 categories, we were able to adjust for some of this uncertainty.

In summary, we determined that significant variation exists in the frequency of oncologist follow-up visits received by older breast cancer survivors. Some variation may be “appropriate,” and attributed to tailoring of follow-up based on patient demographics, tumor characteristics and/or treatment received. As we begin to think about increasing the efficiency of breast cancer follow-up, treatment received is an appealing factor to guide tailored follow-up, as it indirectly accounts for tumor characteristics as well as directly accounting for treatment toxicity, and could easily be incorporated into current clinical practice guideline algorithms.

We also determined that the types of oncologists providing follow-up is another potentially important cause for the observed variation. Given the lack of guidance on who should provide follow-up and challenges associated with care coordination, identification of *who* should provide follow-up with delineation of specific responsibilities during follow-up has the potential to increase clinical efficiency, decrease cost, and ease some of the burden on the oncology work force.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Synopsis: Significant variation in breast cancer follow-up frequency, as well as types of oncologists providing follow-up, exists. Developing follow-up guidelines tailored for patient, tumor, and treatment characteristics, while also providing guidance on *who* should provide follow-up, may increase clinical efficiency.

Figure 1.
Selection of study cohort

Figure 2.
Frequency of follow-up visits with an oncologist by treatment received

Figure 3.
Proportion of breast cancer survivors receiving follow-up from: (A) a medical oncologist, (B) a surgical oncologist, and (C) a radiation oncologist.

Table 1
Patient Demographic, Tumor and Treatment Characteristics

Characteristic	N=39,421	%
<i>Demographics</i>		
Age		
66-70	11,694	27%
71-75	11,408	27%
76-80	10,490	25%
81+	9,105	21%
Race ^a		
White	38,100	90%
Black	2,359	6%
Other	2,110	5%
Marital Status ^b		
Married	20,001	47%
Widowed	15,391	36%
Unmarried	6,002	14%
Charlson Comorbidity index ^c		
0	28,096	66%
1	9,622	23%
2	4,799	11%
Residence location		
Urban	29,116	92%
Rural	3,581	8%
Median household income in census tract	53,256 (SD 25,074)	
Median proportion with less than 12 years education (census tract)	16.8% (SD 12.1)	
<i>Tumor Characteristics</i>		
Primary tumor size ^d		
0-2 cm	28,449	67%
2-5 cm	12,378	29%
>5 cm or diffuse/inflammatory	1,813	4%
Nodal status		
Negative	28,876	68%
Positive	9,610	23%
Unstaged	4,211	10%

Characteristic	N=39,421	%
Estrogen/Progesterone Receptor		
Positive	27,120	64%
Negative	10,825	25%
Unknown	4,752	11%
Grade ^e		
Well Differentiated	10,797	25%
Moderately Differentiated	18,582	44%
Poorly or Undifferentiated	10,333	24%
<i>Treatment Received</i>		
Primary Treatment of the Breast		
Lumpectomy	3,170	7%
Mastectomy	13,610	32%
Lumpectomy with radiation	22,541	53%
Mastectomy with radiation	3,376	8%
Definitive Axillary Surgery		
Axillary Lymph Node Dissection	10,397	24%
Sentinel Lymph Node Biopsy	28,655	67%
None	3,645	9%
Systemic Chemotherapy	8,859	21%

^a race unknown in 26 patients

^b marital status unknown in 1,213 patients

^c Deyo implementation used, Charlson comorbidity index unknown in 160 patients

^d primary tumor size unknown in 44 patients

^e grade unknown in 2 790 patients' analysis adjusted for SEER region

Table 2
Multinomial Risk-Adjusted Analysis of Frequency of Follow-up Visits

	2-4 visits vs. <2 visits/year OR (95% CI)	>4 visits vs. <2 visits/yea OR(95% CI)
Demographics		
Age		
>81 or older	Reference *	Reference *
76-80	1.5 (1.4-1.6)	1.5 (1.4-1.6)
71-75	1.6 (1.5-1.7)	1.7 (1.6-1.9)
66-70	1.8 (1.7-2.0)	2.0 (1.8-2.2)
Race		
White	Reference	Reference
Black	0.9 (0.8-1.0)	1.0 (0.8-1.1)
Other	0.9 (0.8-1.1)	1.0 (0.8-1.1)
Marital Status		
Married	Reference *	Reference **
Widowed	0.9 (0.9-1.0)	0.9 (0.8-0.9)
Unmarried	0.8 (0.8-0.9)	0.9 (0.8-1.0)
Charlson Comorbidity index [†]		
0	Reference *	Reference
1	0.9 (0.9-1.0)	1.1 (1.0-1.1)
2	0.8 (0.8-0.9)	1.0 (0.9-1.1)
Residence Location		
Rural	Reference **	Reference *
Urban	1.2 (1.1-1.3)	1.4 (1.2-1.6)
Income (by quartile)		
1 st (\$36,159)	Reference	Reference
2 nd (\$36,160-\$47,739)	1.1 (1.0-1.2)	1.0 (0.9-1.1)
3 rd (\$47,740-\$64,854)	1.0 (0.9-1.1)	1.0 (0.9-1.1)
4 th (\$64,585)	1.1 (0.9-1.2)	1.1 (0.9-1.2)
% non-High School graduates		
1 st (7%)	Reference	Reference
2 nd (7%-13%)	0.9 (0.9-1.0)	0.9 (0.8-1.0)
3 rd (13-22%)	1.0 (0.9-1.1)	1.0 (0.9-1.2)
4 th (22%)	1.0 (0.9-1.1)	1.0 (0.9-1.2)
Tumor Characteristics		
Primary tumor size		
0-2 cm	Reference ***	Reference
2-5 cm	1.0 (0.9-1.1)	1.0 (0.9-1.0)
>5 cm or diffuse/inflammatory	0.8 (0.7-0.9))	0.9 (0.9-1.1)

	2-4 visits vs. <2 visits/year OR (95% CI)	>4 visits vs. <2 visits/yea OR(95% CI)
Nodal status		
Negative	Reference *	Reference *
Positive	1.3 (1.2-1.4)	1.5 (1.4-1.6)
ER or PR status		
Negative	Reference *	Reference *
Positive	1.1(1.1-1.2)	1.2 (1.1-1.3)
Unknown	0.9 (0.9-1.0)	1.0 (0.9-1.1)
Tumor Grade		
1	Reference	Reference
2	1.0 (1.0-1.1)	1.1 (1.0-1.1)
3	1.0 (0.9-1.1)	1.0 (0.9-1.1)
Treatment Received		
Local Treatment		
Lumpectomy alone	Reference *	Reference *
Mastectomy alone	1.7 (1.5-1.8)	1.6 (1.4-1.9)
Lumpectomy + Radiation	2.2 (2.0-2.4)	3.9 (3.4-4.5)
Mastectomy + Radiation	2.6 (2.2-3.0)	4.7 (3.9-5.7)
Receipt of chemotherapy		
No chemotherapy	Reference *	Reference *
Chemotherapy	1.9 (1.7-2.0)	3.3 (3.0-3.6)

* p value <0.001

** p value <0.01

*** p value <0.05

[†] Analysis controlled for SEER registry region

[‡] Deyo implementation of Charlson Comorbidity Index was utilized