VOLUME 27 · NUMBER 7 · MARCH 1 2009

JOURNAL OF CLINICAL ONCOLOGY

ORIGINAL REPORT

Prevention, Screening, and Surveillance Care for Breast Cancer Survivors Compared With Controls: Changes from 1998 to 2002

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Submitted May 23, 2008; accepted October 29, 2008; published online ahead of print at www.jco.org on January 21, 2009.

Supported by an institutional research grant from the American Cancer Society.

Presented at the 44th Annual Meeting of the American Society of Clinical Oncology, May 30-June 3, 2008, Chicago, IL.

Authors' disclosures of potential conflicts of interest and author contributions are found at the end of this article.

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The Appendix is included in the full-text version of this article, available online at www.jco.org. It is not included in the PDF version (via Adobe® Reader®).

0732-183X/09/2707-1054/$20.00

DOI: 10.1200/JCO.2008.18.0950

ABSTRACT

Purpose
To examine how care for breast cancer survivors compares with controls.

Patients and Methods
Using the Surveillance, Epidemiology, and End Results–Medicare database, we examined five cohorts of stages 1 to 3 breast cancer survivors diagnosed from 1998 to 2002. For each survivor cohort (defined by diagnosis year), we calculated the number of visits to oncology specialists, primary care providers (PCPs), and other physicians and the percentage who received influenza vaccination, cholesterol screening, colorectal cancer screening, bone densitometry, and mammography during survivorship year 1 (days 366 to 730 postdiagnosis). We compared survivors' care to that of five cohorts of screening controls who were matched to survivors on age, ethnicity, sex, and region and who had a mammogram in the survivor's year of diagnosis and to that of five cohorts of comorbidity controls who were matched on age, ethnicity, sex, region, and comorbidity. We examined whether survivors' care was associated with the mix of physician specialties that were visited.

Results
A total of 23,731 survivors were matched with 23,731 screening controls and 23,396 comorbidity controls. There was no difference in trends over time in PCP visits between survivors and either control group. The survivors' rate of increase in other physician visits was greater than screening controls ($P = .002$) but was no different from comorbidity controls. Survivors were less likely to receive preventive care than screening controls but were more likely than comorbidity controls. Trends over time in survivors' care tended to be better than screening controls but were no different than comorbidity controls. Survivors who visited both a PCP and oncology specialist were most likely to receive recommended care.

Conclusion
Involvement by both PCPs and oncology specialists can facilitate appropriate care for survivors.

J Clin Oncol 27:1054-1061. © 2009 by American Society of Clinical Oncology

INTRODUCTION

As a result of progress in breast cancer diagnosis and treatment, more women are surviving the disease.[1] In 2008, approximately 182,460 women will be diagnosed with breast cancer in the United States,[2] approximately 42% of whom are aged 65 years or older.[3] The 5-year survival rate is 98% for localized disease and is 84% for regional disease.[2] Survivors who have completed their initial treatments require surveillance for recurrence, general screening and preventive care, and care for comorbid conditions.[4]

The American Society of Clinical Oncology (ASCO) recommends that breast cancer survivors who have completed initial treatment undergo a history and physical every 3 to 6 months for years 1 through 3, every 6 to 12 months for years 4 and 5, and annually thereafter.[5] In addition, ASCO suggests that women obtain an annual mammogram, unless otherwise indicated. The guidelines also address coordination of care and note that survivors require follow-up by a physician knowledgeable and experienced in survivor care. In some specific instances (eg, patients who receive adjuvant endocrine therapy), involvement of a cancer specialist is still recommended. However, survivors may be observed by their primary care provider (PCP), in general, as research has shown that outcomes may be equivalent for survivors observed by a PCP and those observed by an oncology specialist.[6]

Previous research supports the importance of care coordination for breast cancer survivors. Earle et al[7] examined the care received in 1997 to 1998 for breast cancer survivors diagnosed in 1991 to 1992. They demonstrated that survivors who visited oncology specialists were more likely to receive mammograms, but survivors who visited PCPs were more likely to receive noncancer preventive care. Survivors who were observed by both a PCP and oncology specialist were most likely to receive appropriate care.

This study builds on the study by Earle et al[7] to investigate care in the first year of survivorship and whether that care changed for survivors diagnosed between 1998 and 2002. Specifically, we compared patterns of physician visits and care for breast cancer survivors to noncancer controls and examined trends in these patterns over time.

PATIENTS AND METHODS

Research Design

This was a retrospective, cross-sectional study of five cohorts of breast cancer survivors; five cohorts of noncancer controls matched to survivors on age, ethnicity, sex, geographic region, and history of mammogram in the year of diagnosis (ie, screening controls); and five cohorts of noncancer controls matched to survivors on age, ethnicity, sex, geographic region, and comorbidity (ie, comorbidity controls). This study aimed to examine patterns of physician visits and care for cancer survivors; compare patterns of physician visits and care between cancer survivors and noncancer controls; explore how patterns of physician visits and care have changed over time; and evaluate whether care for survivors is associated with the mix of physician specialties visited. Survivors of stages 1 to 3 breast cancer diagnosed between 1998 and 2002 were identified and were split into five cohorts on the basis of year of diagnosis. Survivor and control cohorts were observed for the first year of survivorship, defined as days 366 to 730 postdiagnosis. Controls were assigned a diagnosis date of July 1 of the survivor's diagnosis year. We began this study period at day 366, as we expected that most women would have completed surgery, radiation, and chemotherapy in the first 365 days postdiagnosis.

Data Source

We used the Surveillance, Epidemiology and End Results (SEER)–Medicare database, which links the SEER registry data with claims data from the Medicare fee-for-service program.[8] In 1998 to 1999, the SEER program included 13 registries that covered approximately 14% of the US population.[9] Four registries were added in 2000, which expanded the SEER coverage to approximately 26% of the US population. The linked SEER-Medicare database provides a combination of clinical information and health services utilization data on cancer patients. Data on controls with no history of cancer from a 5% random sample of Medicare beneficiaries who live in a SEER region can be requested when the SEER-Medicare data is ordered.

Study Participants

Survivors who met the following criteria were eligible for this study: diagnosis of stages 1 to 3 breast cancer between 1998 and 2002 while residing in a SEER region, age 65 years or older at diagnosis, continuous enrollment in the fee-for-service Medicare program during the study period, survival for 730 days from the date of diagnosis without additional malignant diagnosis, no receipt of chemotherapy or radiation therapy during the study period, and no enrollment in hospice. Survivors were assigned to a cohort on the basis of the year of diagnosis, which produced five different cohorts. For each cohort of survivors, we identified two cohorts of noncancer controls.

Controls had to meet the same eligibility criteria as survivors, with the exception of a cancer diagnosis. Screening controls were matched one-to-one to patient cases on age, sex, ethnicity (ie, white, black, other), and SEER region, and each control was required to have had a mammogram in the matched survivor's diagnosis year. We included this requirement because prior screening practices may influence future screening practices, and because we know that our survivors each received a mammogram. We also matched patient

Table 1. Characteristics of Breast Cancer Survivors and Controls

Group by Year	Total No. of Patients	Characteristic: Age (years) Mean	SD	Ethnicity: White No.	%	Black No.	%	Other No.	%	Comorbidity Index* 0 No.	%	1 No.	%	2+ No.	%	Stage 1 No.	%	2 No.	%	3 No.	%
1998																					
Survivors	2,526	75.7	6.4	2,272	89.9	114	4.5	140	5.5	1,811	71.7	520	20.6	195	7.7	1,718	68.0	753	29.8	55	2.2
Screening controls	2,526	75.7	6.4	2,272	89.9	114	4.5	140	5.5	1,850	73.2	519	20.6	157	6.2	NA		NA		NA	
Comorbidity controls	2,486	75.7	6.4	2,242	90.2	111	4.5	133	5.3	1,786	71.8	532	21.4	168	6.8	NA		NA		NA	
1999																					
Survivors	2,695	75.7	6.2	2,419	89.8	119	4.4	157	5.8	1,885	69.9	587	21.8	223	8.3	1,891	70.2	756	28.1	48	1.8
Screening controls	2,695	75.7	6.2	2,419	89.8	119	4.4	157	5.8	1,958	72.6	537	19.9	200	7.4	NA		NA		NA	
Comorbidity controls	2,640	75.6	6.2	2,380	90.2	110	4.2	150	5.7	1,862	70.5	558	21.1	220	8.3	NA		NA		NA	
2000																					
Survivors	5,663	75.8	6.4	5,110	90.2	304	5.4	249	4.4	3,864	68.2	1,274	22.5	525	9.3	3,824	67.5	1,720	30.4	119	2.1
Screening controls	5,663	75.8	6.4	5,110	90.2	304	5.4	249	4.4	4,012	70.9	1,246	22.0	405	7.2	NA		NA		NA	
Comorbidity controls	5,579	75.8	6.3	5,055	90.6	286	5.1	238	4.3	3,735	66.9	1,285	23.0	559	10.0	NA		NA		NA	
2001																					
Survivors	6,226	75.8	6.4	5,653	90.8	299	4.8	274	4.4	4,232	68.0	1,442	23.2	552	8.9	4,091	65.7	1,996	32.1	139	2.2
Screening controls	6,226	75.8	6.4	5,653	90.8	299	4.8	274	4.4	4,315	69.3	1,406	22.6	505	8.1	NA		NA		NA	
Comorbidity controls	6,130	75.8	6.4	5,592	91.2	276	4.5	262	4.3	4,026	65.7	1,426	23.3	678	11.1	NA		NA		NA	
2002																					
Survivors	6,621	75.7	6.3	5,950	89.9	370	5.6	301	4.6	5,302	80.1	1,031	15.6	288	4.4	4,328	65.4	2,132	32.2	161	2.4
Screening controls	6,621	75.7	6.3	5,950	89.9	370	5.6	301	4.6	5,248	79.3	1,093	16.5	280	4.2	NA		NA		NA	
Comorbidity controls	6,561	75.6	6.3	5,911	90.1	352	5.4	298	4.5	5,259	80.2	1,021	15.6	281	4.3	NA		NA		NA	

Abbreviations: SD, standard deviation; NA, not applicable.
*Comorbidity index calculated excluding cancer and metastatic disease.

cases to comorbidity controls on the basis of age, sex, ethnicity, SEER region, and the three most common comorbidities (ie, chronic obstructive pulmonary disease, congestive heart failure, diabetes). Each of these comorbidity controls was not required to have had a mammogram in the matched survivor's diagnosis year, as not all survivors underwent mammography for screening purposes. That is, even though all patient cases had a mammogram, the test may not have been conducted for screening purposes. Thus, requiring the screening controls to have had a mammogram provides a worst-case estimate of how patient cases compare with controls. Elimination of the mammography requirement provided an alternative basis for comparison and produced a larger pool of controls, which enabled almost all patient cases to be matched to a control on comorbidities.

Variables

We assessed age, ethnicity, comorbidity index, SEER region, and stage of disease (in survivors only). The comorbidity index was calculated as a categoric variable (0, 1, 2+) on the basis of the claims data by using the Charlson score,[10] as implemented by Deyo et al[11] and as modified by Klabunde et al.[12] Cancer and metastatic disease were not included in the comorbidity index, because survivors had cancer but controls did not, and participants with metastatic disease were excluded.

The study period was defined as days 366 to 730 postdiagnosis. Types of physicians visited and care received were defined similarly to Earle et al.[7] We used the Medicare physician specialty code to categorize physician visits. PCPs included general practice, internal medicine, family practice, obstetrics, gynecology, geriatrics, and multispecialty group practice. Oncology specialists included medical oncology, hematology-oncology, general surgery, surgical oncology, and radiation oncology. Visits to physician specialties not listed as PCPs or oncology specialists were categorized as other physician visits. We also categorized the mix of physician specialties visited: PCP only (ie, visits to a PCP but not an oncology specialist), oncology specialist only (ie, visits to an oncology specialist but not a PCP), both (ie, visits to both a PCP and oncology specialist), and neither (ie, no visits to a PCP nor an oncology specialist). We refer to this variable as the physician mix visited. Finally, we evaluated five care services: influenza vaccination, cholesterol screening, colorectal cancer screening, bone densitometry, and mammography (Appendix Table A1, online only, for specific codes.) Women with a history of bilateral mastectomy were excluded from the mammography indicator.

Analyses

We described participant age, ethnicity, comorbidity index, SEER region, and disease stage (for survivors). We calculated the mean number of physician visits to oncology specialists (survivors only), PCPs, and other physicians, and we adjusted for age, ethnicity, comorbidity, SEER region, and stage (for survivors). To test for trends over time in the number of physician visits, we used Poisson regression, and we modeled the number of visits as a function of diagnostic year after adjustment for the variables noted above. We assessed differences in trends over time between survivors and controls by adding a diagnosis year-by-group interaction term.

We calculated the percentage of survivors and controls in each cohort who received each care service. To test trends over time, we used logistic regression with receipt of each service modeled as a function of diagnostic year after adjustment for clinical and sociodemographic variables. We added an interaction term for diagnosis year-by-group to test for differences in trends between groups.

Table 2. SEER Regions of Breast Cancer Survivors and Controls

Group by Year	SEER Region																													
	SF		CT		DE		HI		IA		NM		SE		UT		AT		SJ		LAn		GA		CA		KT		LA		NJ	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
1998																																
Survivors	213	8.4	348	13.8	368	14.6	70	2.8	382	15.1	91	3.6	313	12.4	112	4.4	155	6.1	110	4.4	359	14.2	5	0.2	0	0.0	0	0.0	0	0.0	0	0.0
Screening controls	213	8.4	348	13.8	368	14.6	70	2.8	382	15.1	91	3.6	313	12.4	112	4.4	155	6.1	110	4.4	359	14.2	5	0.2	0	0.0	0	0.0	0	0.0	0	0.0
Comorbidity controls	206	8.3	345	13.9	365	14.7	66	2.7	382	15.4	87	3.5	309	12.4	109	4.4	151	6.1	104	4.2	358	14.4	4	0.2	0	0.0	0	0.0	0	0.0	0	0.0
1999																																
Survivors	220	8.2	373	13.8	373	13.8	71	2.6	399	14.8	117	4.3	325	12.1	152	5.6	151	5.6	120	4.5	389	14.4	5	0.2	0	0.0	0	0.0	0	0.0	0	0.0
Screening controls	220	8.2	373	13.8	373	13.8	71	2.6	399	14.8	117	4.3	325	12.1	152	5.6	151	5.6	120	4.5	389	14.4	5	0.2	0	0.0	0	0.0	0	0.0	0	0.0
Comorbidity controls	213	8.1	369	14.0	368	13.9	67	2.5	396	15.0	116	4.4	322	12.2	142	5.4	146	5.5	115	4.4	383	14.5	3	0.1	0	0.0	0	0.0	0	0.0	0	0.0
2000																																
Survivors	218	3.9	326	5.8	411	7.3	61	1.1	382	6.8	125	2.2	334	5.9	155	2.7	130	2.3	120	2.1	403	7.1	10	0.2	1,232	21.8	487	8.6	432	7.6	837	14.8
Screening controls	218	3.9	326	5.8	411	7.3	61	1.1	382	6.8	125	2.2	334	5.9	155	2.7	130	2.3	120	2.1	403	7.1	10	0.2	1,232	21.8	487	8.6	432	7.6	837	14.8
Comorbidity controls	212	3.8	320	5.7	403	7.2	59	1.1	371	6.6	120	2.2	328	5.9	148	2.7	130	2.3	117	2.1	399	7.2	8	0.1	1,227	22.0	480	8.6	429	7.7	828	14.8
2001																																
Survivors	196	3.2	426	6.8	418	6.7	86	1.4	405	6.5	137	2.2	367	5.9	197	3.2	167	2.7	144	2.3	421	6.8	11	0.2	1,263	20.3	529	8.5	497	8.0	962	15.5
Screening controls	196	3.2	426	6.8	418	6.7	86	1.4	405	6.5	137	2.2	367	5.9	197	3.2	167	2.7	144	2.3	421	6.8	11	0.2	1,263	20.3	529	8.5	497	8.0	962	15.5
Comorbidity controls	185	3.0	418	6.8	414	6.8	85	1.4	399	6.5	134	2.2	363	5.9	193	3.1	162	2.6	135	2.2	414	6.8	9	0.1	1,254	20.5	523	8.5	489	8.0	953	15.5
2002																																
Survivors	257	3.9	443	6.7	470	7.1	82	1.2	406	6.1	150	2.3	431	6.5	172	2.6	161	2.4	126	1.9	465	7.0	12	0.2	1,414	21.4	539	8.1	495	7.5	998	15.1
Screening controls	257	3.9	443	6.7	470	4.1	82	1.2	406	6.1	150	2.3	431	6.5	172	2.6	161	2.4	126	1.9	465	7.0	12	0.2	1,414	21.4	539	8.1	495	7.5	998	15.1
Comorbidity controls	249	3.8	438	6.7	465	7.1	80	1.2	401	6.1	150	2.3	429	6.5	169	2.6	157	2.4	122	1.9	462	7.0	12	0.2	1,408	21.5	532	8.1	490	7.5	997	15.2

Abbreviations: SF, San Francisco; CT, Connecticut; DE, Detroit; HI, Hawaii; IA, Iowa; NM, New Mexico; SE, Seattle; UT, Utah; AT, Atlanta; SJ, San Jose; LAn, Los Angeles; GA, rural Georgia; CA, greater California; KT, Kentucky; LA, Louisiana; NJ, New Jersey.

For the survivors only, we categorized the physician mix visited as described above: PCP only, oncology specialist only, both, and neither. We calculated the percentage of survivors in each cohort who visited each physician mix category. Then, we conducted logistic regression for each physician mix category versus the other three to determine whether there were significant changes in physician mix seen over time.

We calculated the proportion of survivors who received each service by physician mix seen by combining the five diagnostic cohorts, and we tested for differences in care receipt by using χ^2 tests. We conducted logistic regression, again by combining the five cohorts, and we modeled the receipt of each service as a function of the physician mix seen after adjustment for total number of visits, age at diagnosis, ethnicity, stage, comorbidity index, socioeconomic status on the basis of census-tract median income (continuous as quintiles), urban/rural location, diagnostic cohort, and SEER region.

Because four registries were added in 2000, we also performed the analyses of the patterns of physician visits and care receipt by physician mix seen with only the subset of survivors who were from registries included in all five years. These results were similar to the overall analysis and are not reported.

RESULTS

Our sample included 23,731 survivors matched to 23,731 screening controls and 23,396 comorbidity controls. Three hundred thirty-five survivors (1.4%) could not be matched with comorbidity controls. The characteristics of the survivors and controls were generally stable across the five cohorts (Tables 1 and 2). The addition of the four registries in 2000 approximately doubled the sample size compared with that of 1998 and 1999. The average age was about 76 years, approximately 90% of the sample was white, and between 65% and 70% of survivors had stage 1 disease.

For both survivors and controls, visits to all physician types changed over time (all $P < .05$; Table 3). Some of these changes were statistically significant because of the large sample sizes but were small in absolute terms and were inconsistent from year to year in terms of increases or decreases. For example, the number of visits to PCPs only ranged from 4.2 to 4.3 for survivors and from 3.4 to 3.6 for comorbidity controls. However, increases in other physician visits were larger and more consistent in direction (eg, increases from 3.2 to 3.8 for survivors and from 2.8 to 3.3 for comorbidity controls). There was no difference in trends over time in PCP visits between survivors and either control group. The rate of increase in other physician visits for survivors was greater than screening controls ($P = .002$) but was no different from comorbidity controls ($P = .39$).

Survivors were generally less likely to receive recommended care than screening controls but were more likely than comorbidity controls. Trends over time in survivors' care receipt tended to be better than screening controls but not different than comorbidity controls. Specifically, survivors were less likely than screening controls to receive each of the screening and prevention measures (except bone densitometry in the 2002 cohort) but were more likely than comorbidity controls (except cholesterol screening for the 1999 and 2000 cohorts; Table 4). Survivors were more likely to receive mammograms

Table 3. Adjusted Mean Number of Physician Visits to Each Provider Type for Breast Cancer Survivors and Controls

Group by Physician Type	Cohort Year					Adjusted *P*	
	1998	1999	2000	2001	2002	Trend Over Time*	Difference†
Oncology specialist							
Survivors						< .0001	NA
Mean	2.2	2.2	2.5	2.5	2.5		
SD	0.5	0.5	0.6	0.6	0.6		
Primary care provider							
Survivors						< .0001	
Mean	4.2	4.3	4.2	4.2	4.3		
SD	1.2	1.3	1.1	1.2	1.1		
Screening controls						< .0001	.12
Mean	3.8	4.0	3.7	3.6	3.9		
SD	1.0	1.1	1.0	1.0	1.0		
Comorbidity controls						< .0001	.08
Mean	3.5	3.6	3.4	3.5	3.4		
SD	1.2	1.3	1.2	1.2	1.0		
Other physician							
Survivors						< .0001	
Mean	3.2	3.4	3.7	3.6	3.8		
SD	1.3	1.4	1.3	1.3	1.2		
Screening controls						.02	.002
Mean	3.6	3.5	4.0	3.8	3.7		
SD	1.5	1.5	1.5	1.4	1.3		
Comorbidity controls						.002	.39
Mean	2.8	3.0	3.3	3.3	3.2		
SD	1.2	1.3	1.3	1.4	.12		

Abbreviations: SD, standard deviation; NA, not applicable.
*P for trend over time, adjusted for age, ethnicity, stage, comorbidity, and Surveillance, Epidemiology, and End Results region (stage not included as covariate for controls).
†P for difference in trend over time between controls and survivors, adjusted for age, ethnicity, comorbidity, and Surveillance, Epidemiology, and End Results region.

Table 4. Care Received for Breast Cancer Survivors and Controls

Type of Care	% Receiving Care per Cohort Year					Adjusted *P*	
	1998	1999	2000	2001	2002	Trend Over Time*	Difference in Trend Over Time†
Influenza vaccination							
Survivors	51.7	54.0	53.5	56.7	55.4	< .0001	
Screening controls	61.0	55.6	58.3	61.3	62.7	< .0001	.55
Comorbidity controls	49.7	47.1	49.5	52.8	53.9	< .0001	.02
Cholesterol screening							
Survivors	31.0	32.4	35.1	36.3	38.6	< .0001	
Screening controls	38.6	37.8	42.4	43.4	43.7	.0006	.02
Comorbidity controls	30.4	33.6	36.6	35.9	37.6	< .0001	.16
Colorectal cancer screening							
Survivors	29.3	29.8	29.5	27.9	26.9	.03	
Screening controls	35.4	34.0	32.9	29.5	28.4	< .0001	.003
Comorbidity controls	24.1	25.2	23.9	22.4	21.2	< .0001	.24
Bone densitometry							
Survivors	14.1	14.3	14.8	16.2	18.2	<.0001	
Screening controls	17.7	18.0	18.3	20.5	17.5	.37	< .0001
Comorbidity controls	12.2	13.4	13.7	15.7	14.5	.002	.09
Mammogram‡							
Survivors	75.0	77.4	74.6	73.5	72.9	.17	
Screening controls	66.2	60.1	63.8	59.4	58.8	< .0001	.007
Comorbidity controls	38.7	40.0	38.4	38.6	38.2	.76	.39

*Difference is between controls and survivors. Adjusted for age, race, stage, comorbidity, and Surveillance, Epidemiology, and End Results region (stage not included as covariate for controls).
†Adjusted for age, ethnicity, comorbidity, and Surveillance, Epidemiology, and End Results region.
‡Excludes women with history of bilateral mastectomy.

than both control groups. Trends over time were statistically significant for all groups, except for bone densitometry for screening controls and mammography for survivors and comorbidity controls. Again, some of the differences were small in absolute terms. Compared with the screening controls, survivors' rates increased faster for cholesterol screening ($P = .02$) and bone densitometry ($P < .0001$) and decreased slower for colorectal cancer screening ($P = .003$) and mammograms ($P = .007$). The only difference between survivors and comorbidity controls was influenza vaccination ($P = .02$).

Looking only at the survivor cohorts and the physician mix visited, we find that survivors in the first year are most likely to be managed by both a PCP and oncology specialist (Table 5). Survivors who visited a PCP only decreased from 24.6% to 21.1% from the 1998 cohort to the 2002 cohort ($P < .0001$), and survivors who visited an oncology specialist only increased from 13.3% to 15.2% ($P = .006$). Although small in absolute terms, these trends indicate a potential shift to greater oncology specialist involvement.

In unadjusted analyses, survivors who visited both a PCP and oncology specialist were most likely to receive each care service (all $P < .0001$; Table 6). After analysis was adjusted for total number of visits, diagnostic cohort, age, ethnicity, stage of disease, comorbidity index, socioeconomic status, urban/rural location, and SEER region, survivors who visited both a PCP and oncology specialist were still most likely to receive each care service (Table 7). However, the difference between survivors who were observed by both types versus survivors who were observed by an oncology specialist only was not significant for cholesterol screening or bone densitometry. Compared with survivors who visited neither a PCP nor oncology specialist, survivors who visited an oncology specialist only were more likely to receive each care service. Compared with survivors who visited neither a PCP nor an oncology specialist, survivors who visited a PCP only were more likely to receive each care service except cholesterol screening. Survivors who visited an oncology specialist only were more likely to receive mammograms versus survivors who saw a PCP only.

Table 5. Mix of Physician Specialties Visited in the First Year of Survivorship for Each Breast Cancer Survivor Cohort

Specialty	% in Each Survivor Cohort Year					*P**
	1998 (n = 2,526)	1999 (n = 2,695)	2000 (n = 5,663)	2001 (n = 6,226)	2002 (n = 6,621)	
Both PCP and OS	54.5	55.5	57.7	56.9	56.6	.11
PCP Only	24.6	24.5	20.5	21.3	21.1	< .0001
OS Only	13.3	12.9	15.3	14.7	15.2	.006
Neither PCP nor OS	7.6	7.1	6.5	7.1	7.1	.79

Abbreviations: PCP, primary care provider; OS, oncology specialist.
*P values are from logistic regressions that model each physician specialty separately as a function of time. $P < .01$ was considered statistically significant to account for multiple comparisons, because the four categories are dependent.

Table 6. Care Received by Physician Mix Seen in the First Year of Survivorship: 1998 to 2002 Breast Cancer Survivor Cohorts Combined

Type of Care	Percentage of Patients by Type of Physician				
	Both PCP and OS (n = 13,436)	PCP Only (n = 5,161)	OS Only (n = 3,473)	Neither PCP nor OS (n = 1,661)	χ^2 *P*
Influenza vaccination	60.0	51.4	49.5	33.2	< .0001
Cholesterol screening	39.4	32.7	32.6	21.4	< .0001
Colorectal cancer screening	33.5	23.4	23.0	13.1	< .0001
Bone densitometry	18.7	13.0	14.3	6.9	< .0001
Mammogram*	82.2	60.3	79.0	42.9	< .0001

Abbreviations: PCP, primary care provider; OS, oncology specialist.
*Excludes women with history of bilateral mastectomy.

Survivors were more likely to receive each care service as the number of visits increased. Age of 75 to 84 years at diagnosis was associated with increased odds of influenza vaccination, but older age was associated with decreased odds of the other services. Black ethnicity was associated with decreased odds of receiving each care service, and other race was associated with decreased odds of mammography. Higher-stage disease was associated with decreased odds of receiving each care service. Survivors with more comorbidities were more likely

Table 7. Adjusted Odds Ratios for Care Receipt: 1998 to 2002 Breast Cancer Survivor Cohorts Combined

Characteristic	Type of Care									
	Influenza Vaccination		Cholesterol Screening		Colorectal Cancer Screening		Bone Densitometry		Mammogram*	
	Odds Ratio	95% CI	Odds Ratio	95% CI	Odds Ratio	95% CI	Odds Ratio	95% CI	Odds Ratio	95% CI
Provider type										
Both†										
PCP only	**0.84**‡	**0.77 to 0.91**	**0.90**	**0.82 to 0.99**	**0.75**‡	**0.68 to 0.82**	**0.84**‡	**0.74 to 0.95**	**0.36**‡	**0.33 to 0.40**
OS only	**0.76**§	**0.68 to 0.85**	0.97§	0.86 to 1.10	**0.72**§	**0.63 to 0.82**	0.92§	0.78 to 1.07	**0.85**§‖	**0.74 to 0.97**
Neither	**0.51**	**0.43 to 0.60**	**0.78**	**0.65 to 0.94**	**0.43**	**0.35 to 0.54**	**0.55**	**0.41 to 0.72**	**0.19**	**0.16 to 0.23**
Total No. of visits										
0-4†										
5-7	**1.31**	**1.17 to 1.47**	**1.69**	**1.48 to 1.92**	**1.46**	**1.28 to 1.66**	**1.33**	**1.12 to 1.57**	**1.42**	**1.25 to 1.62**
8-12	**1.64**	**1.47 to 1.83**	**2.21**	**1.95 to 2.51**	**1.75**	**1.54 to 1.99**	**1.72**	**1.46 to 2.02**	**1.46**	**1.29 to 1.66**
≥ 13	**1.89**	**1.69 to 2.12**	**2.39**	**2.10 to 2.71**	**1.92**	**1.68 to 2.19**	**1.92**	**1.63 to 2.27**	**1.40**	**1.23 to 1.60**
Age, years										
65-74†										
75-84	**1.21**	**1.14 to 1.28**	**0.93**	**0.87 to 0.98**	**0.81**	**0.76 to 0.86**	**0.76**	**0.71 to 0.82**	**0.78**	**0.73 to 0.83**
≥ 85	1.07	0.97 to 1.17	**0.57**	**0.51 to 0.63**	**0.51**	**0.46 to 0.58**	**0.44**	**0.38 to 0.52**	**0.45**	**0.40 to 0.49**
Ethnicity										
White†										
Black	**0.47**	**0.41 to 0.53**	**0.86**	**0.75 to 0.98**	**0.81**	**0.70 to 0.94**	**0.47**	**0.38 to 0.59**	**0.74**	**0.65 to 0.85**
Other	0.94	0.73 to 1.20	1.06	0.82 to 1.37	1.16	0.90 to 1.50	0.89	0.65 to 1.23	**0.69**	**0.53 to 0.92**
Stage										
1†										
2	**0.83**	**0.78 to 0.88**	**0.81**	**0.76 to 0.86**	**0.81**	**0.76 to 0.86**	**0.83**	**0.77 to 0.90**	**0.77**	**0.72 to 0.82**
3	**0.67**	**0.56 to 0.81**	**0.64**	**0.52 to 0.78**	**0.42**	**0.33 to 0.55**	0.77	0.59 to 1.01	**0.48**	**0.40 to 0.58**
Comorbidity index										
0†										
1	**1.18**	**1.10 to 1.26**	**1.40**	**1.30 to 1.50**	**0.86**	**0.80 to 0.93**	**0.87**	**0.79 to 0.95**	**0.86**	**0.80 to 0.93**
≥ 2	**1.12**	**1.01 to 1.24**	**1.57**	**1.42 to 1.74**	**0.81**	**0.72 to 0.91**	**0.68**	**0.58 to 0.79**	**0.66**	**0.59 to 0.74**
Socioeconomic status	**1.08**	**1.06 to 1.11**	**1.03**	**1.01 to 1.05**	**1.08**	**1.05 to 1.10**	**1.12**	**1.09 to 1.15**	**1.03**	**1.01 to 1.06**
Urban or rural status										
Rural†										
Urban	1.00	0.89 to 1.11	1.04	0.92 to 1.17	1.00	0.88 to 1.13	0.98	0.84 to 1.15	**0.82**	**0.73 to 0.94**

NOTE. Odds ratios also adjusted for diagnostic cohort and Surveillance, Epidemiology, and End Results region. Bold text indicates $P < .05$ *v* reference category.
Abbreviations: PCP, primary care provider; OS, oncology specialist.
*Excludes women with bilateral mastectomy.
†Reference category.
‡$P < .05$ for primary care provider only *v* neither.
§$P < .05$ for oncology specialist only *v* neither.
‖$P < .05$ for primary care provider only *v* oncology specialist only.

to receive influenza vaccination and cholesterol screening but were less likely to receive colorectal cancer screening, bone densitometry, or mammograms. Higher socioeconomic status was associated with increased odds of receiving each care service. Urban/rural location had little impact on care receipt.

DISCUSSION

This study goes beyond previous research, to our knowledge, by investigating both how patterns of physician visits and care receipt have changed over time for breast cancer survivors and how survivors' care compares to noncancer controls. Earle et al[7] looked at only a single cohort of breast cancer survivors at 5 years postdiagnosis. A previous study in colorectal cancer examined how care has changed over time but had no control group.[13] A control group facilitates comparison of changes to secular trends. This study used two control groups. The screening control group was required to have had a mammogram in the year of patient case diagnosis. We included this requirement because prior screening practices may influence later screening practices, and we know that our patient cases had mammograms. However, mammograms for patient cases may not have been performed for screening purposes, so requiring the controls to have a mammogram provides a worst-case estimate of how patient cases compare with controls. Thus, we also included a second control group, of which the participants were not required to have had a mammogram in the year the patient case was diagnosed, but with whom survivors were matched on common comorbidities.

Trends in physician visits were similar for survivors and controls, except that other physician visits increased faster for survivors than for screening controls. Survivors were generally less likely to receive recommended care than screening controls but were more likely than comorbidity controls. As expected, survivors were more likely to receive mammograms than both control groups. Screening rates were relatively low for both survivors and controls, but—because this study examined 1 year of care receipt—we would not expect all participants to receive all services (eg, colorectal cancer screening is not required annually). Survivors who were observed by both a PCP and oncology specialist were most likely to receive recommended care.

Because breast cancer affects a large population of women, even small differences can have important impacts at the population level. Although many of the differences we found were statistically significant, the differences were small in absolute terms; this is important to consider when results are interpreted. Other study limitations reflect the use of secondary data. Only care that is covered and billed for is included in the SEER-Medicare database, so care that was provided but not billed for would not be captured. However, we would expect billing practices to be similar for survivors and controls. More importantly, these data provide no information on why care was not provided. The care services assessed here are based on validated quality measures used in other studies,[7] but physicians may be making judgments regarding which services are appropriate for a given patient. It is also possible that services were offered but refused by survivors. However, differences in care receipt by ethnicity and socioeconomic status suggest important disparities in care.

Another limitation of the SEER-Medicare database is that it only includes enrollees in the fee-for-service Medicare program; thus, we do not know whether care for survivors in managed care differs from controls or has changed over time. In addition, our sample included only survivors aged 65 years or older at diagnosis, so we do not have data on younger breast cancer survivors. One might expect the patterns seen in the population younger than 65 years to be similar, and, as noted previously, 42% of breast cancers are diagnosed in women aged 65 years or older.

Despite these limitations, our finding that survivors were less likely than screening controls to receive preventive care suggests that there is room for improvement. Similar to previous studies, we found that survivors observed by both a PCP and oncology specialist are most likely to receive appropriate care.[7,13,14] For survivors managed by both a PCP and oncology specialist, it is critical that all involved physicians understand what follow-up care is necessary and which physician is responsible for providing it. In 2008, ASCO released treatment summary and survivorship care plan templates to facilitate this care coordination.[15] These forms can be used to document the treatments the patient received and the surveillance and follow-up care required, although they do not address general primary and preventive care. Whether these templates will be effective in improving the care received by cancer survivors is an important area for additional research. The findings from our study suggest that these recent efforts, and others, will be critical to ensure appropriate care for cancer survivors.

AUTHORS' DISCLOSURES OF POTENTIAL CONFLICTS OF INTEREST

The author(s) indicated no potential conflicts of interest.

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Acknowledgment

We thank Bridget A. Neville, MPH, for assembling the appendix of codes used to identify the screening, prevention, and surveillance services.

