The Effect of Medicare Health Care Delivery Systems on Survival for Patients with Breast and Colorectal Cancer

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Abstract

Background: **Two of the most common types of health care delivery systems in the U.S. are fee-for-service (FFS) and managed care systems such as health maintenance organizations (HMO). Differences may exist in patient outcomes depending on the health care delivery system in which they are enrolled. We evaluated differences in the survival of patients with breast and colorectal cancer at diagnosis between the two Medicare health care delivery systems (FFS and HMO).**
Methods: **We used a linkage of two national databases, the Medicare database from the Centers for Medicare and Medicaid Services, and the National Cancer Institute's Surveillance, Epidemiology, and End Results program database, to evaluate differences in demographic data, stage at diagnosis, and survival between breast and colorectal cancer over the period 1985 to 2001.**
Results: **Medicare patients enrolled in HMOs were diagnosed at an earlier stage of diagnosis than FFS patients. HMO patients diagnosed with breast and colorectal cancer had improved survival, and these differences remained even after controlling for potential confounders (such as stage at diagnosis, age, race, socioeconomic status, and marital status). Specifically, patients enrolled in HMOs had 9% greater survival in hazards ratio if they had breast cancer, and 6% if they had colorectal cancer.**
Conclusions: **Differences exist in survival among patients in HMOs compared with FFS. This is likely due to a combination of factors, including but not limited to, earlier stage at the time of diagnoses.** (Cancer Epidemiol Biomarkers Prev 2006;15(4):769–73)

Introduction

Two of the most common types of health care delivery systems in the U.S. are fee-for-service (FFS) and managed care systems (which include the health maintenance organizations, HMO). Medicare's HMO program has grown rapidly in recent years; as of 1999, >6.5 million persons were enrolled, which accounted for 17% of the beneficiary population (1, 2). An important issue is whether, and how, the health care delivery system in which patients participate may affect patient outcomes. Managed care systems have been developed to contain health care costs, but their effect on quality of care has not been clearly established (3, 4). It has been reported that some differences in patient outcomes are associated with the type of health care delivery system in which they are enrolled (5-9).

Breast and colorectal cancer represent two of the most common cancer sites and screening tests exist. Breast cancer is the most common non–skin cancer among women in the U.S., and is second only to lung cancer as a cause of cancer-related death. In 2004, an estimated 216,000 new cases of breast cancer were diagnosed in American women, and >40,000 women died of the disease (10). Forty-one of every 1,000 women die of breast cancer (11). Colorectal cancer is the second leading cause of cancer-related deaths in the U.S. for men and women combined; examined by gender, it is the third leading cause of cancer-related mortality for both women (after lung and breast cancers), and for men (after lung and prostate cancers; refs. 10, 12). An individual's lifetime risk of dying of colorectal cancer in the U.S. has been estimated to be 2.6%.

The finding that persons with early stage colorectal, as well as breast cancer, at the time of diagnosis have longer survival than persons with advanced disease suggests the potential need for screening and early detection. Regular screening may reduce breast cancer incidence and mortality (13-15), and recent systematic reviews have confirmed breast cancer screening to be a cost-effective strategy (15). Randomized controlled trials have shown a reduction in colorectal cancer incidence and mortality with annual and biannual fecal occult blood testing; case-control studies have shown a reduction in colorectal cancer mortality associated with the use of sigmoidoscopy (16-21).

Using national health care databases, the current study evaluated differences in the survival of breast and colorectal cancer after diagnosis between the two Medicare health care delivery systems (FFS and HMO) over the period 1985 to 2001.

Materials and Methods

This study represents an analysis of the linkage of two national databases: the Medicare database from the Centers for Medicare and Medicaid Services (formerly the Health Care Financing Administration), and the National Cancer Institute's Surveillance, Epidemiology, and End Results (SEER) program database (2). The linked database combining the SEER and Medicare data represents a large population-based source of information for cancer-related epidemiologic and health services research.

SEER Data. The SEER program is an epidemiologic surveillance system sponsored by the National Cancer Institute consisting of population-based tumor registries that routinely collect information on all newly diagnosed cancer (incident) cases that occur in persons residing in SEER areas (22). The information collected about each incident cancer diagnosis includes the patient's demographic characteristics, date of

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diagnosis, tumor data (e.g., histology, stage, and grade), type of treatment recommended or provided within 4 months of diagnosis, follow-up of vital status, and cause of death, if applicable.

Although SEER data do not constitute a national probability sample, they are the primary source of national information on cancer incidence and survival (2, 22). SEER areas were initially concentrated in western states, encompassing a lower proportion of blacks and a higher proportion of ''other'' races than the average U.S. population. Reported information include month and year of diagnosis, stage at diagnosis, date of death, and county and census tract of residence.

Medicare Data. Medicare enrollment files contain entitlement dates to part A and part B, zip code of residence, health care delivery type, and months in which the beneficiary was enrolled in a Medicare HMO. Medicare is the primary health insurer for 97% of the U.S. population 65 years and older (2). All Medicare beneficiaries receive part A benefits, which cover inpatient care in short- and long-stay hospitals, skilled nursing facilities, home health, and hospice care. Ninety-five percent of beneficiaries also subscribe to part B of Medicare to obtain benefits that cover physician services, outpatient care, durable medical equipment, and home health in some cases. Medicare, in a master enrollment file known as the ''Enrollment Database,'' maintains information about each beneficiary's enrollment and entitlement, demographics, and HMO membership.

Data Linkage. The linkage of the SEER and Medicare data is the result of the collaborative effort of the National Cancer Institute, the SEER registries, and the Centers for Medicare and Medicaid Services (2). It reflects the linkage of two large population-based sources of data that provide detailed information about Medicare-aged persons with cancer. The linkage of these two data sources results in a unique population-based source of information that can be used for an array of epidemiologic and health services research. For example, this combined data set may have use for studying patterns of care for persons with cancer before a cancer diagnosis, over the period of initial diagnosis and treatment, and during long-term follow-up. Additional examination of cancer tests and procedures and the costs of cancer treatment is possible.

For each linked data set, among persons in the SEER data who were 65 years or older, 94% were matched to the Medicare enrollment database (2). We choose to use this link data set as it provides information on Medicare-managed care patients as opposed to the SEER-Medicare database, which does not. Use of this linked data, however, lacks access to claims data, limiting the further assessment of comorbidities.

Patient Selection. We first selected all SEER incident cases of either breast or colorectal cancers in women ages 65 years or older for breast cancer, and for all patients with colorectal cancer diagnosed between 1985 and 2001 that were entitled to Medicare part A and part B (Medicare HMO) at the time of diagnosis, and who were matched to the Medicare enrollment files. Demographic (age, race, and marital status) and cancer diagnostic information was obtained through SEER and information on Medicare entitlement and utilization through Medicare enrollment records. Because of the lack of information on individual income and educational level, 1990 U.S. census data were used as proxy measures.

The HMO indicators determined HMO status at the time of diagnosis. If a patient was indicated as not being a member of HMO and the claim was processed by the Centers for Medicare and Medicaid Services, then he/she was classified as Medicare FFS.

Cancer Staging and Survival. For the staging of the breast and colorectal cancer cases, the SEER summary staging system was used, which is based on the extent of disease at diagnosis as reported by the individual SEER registries (22). These registries abstract information from a variety of sources, including inpatient hospital records, outpatient records, and pathology reports. The histologic staging system consists of five tumor stages: *in situ*, local, regional, distant, and unknown stage. Cancer cases with an unknown stage were excluded from the present analysis. Of note, there was a greater percentage of unstaged cancers for HMO patients for both breast cancer [2,337 (11.0%) HMO patients compared with 11,149 (10.2%) FFS patients ($P < 0.01$)], as well as for colon

Table 1. Study population characteristics for patients with primary breast and colorectal cancer

	Breast cancer			Colorectal cancer		
	HMO (n = 21,336)	FFS (n = 109,000)	P	HMO (n = 16,343)	FFS (n = 89,047)	P
Age (mean + SD)	74.5 ± 6.5	74.9 ± 7.3	<0.01	76.4 ± 7.0	76.9 ± 7.6	<0.01
Gender						
Male	n/a	n/a		7,790 (47.7)	40,253 (45.2)	<0.01
Female	21,336 (100%)	109,900 (100%)		8,553 (52.3)	48,794 (54.8)	
Race (%)						
White	17,718 (83.4)	95,762 (88.5)	<0.01	12,786 (78.8)	75,468 (85.7)	<0.01
Black	1,423 (6.7)	6,881 (6.4)		1,355 (8.4)	6,924 (7.9)	
Hispanic	450 (2.1)	1,127 (1.0)		324 (2.0)	750 (0.9)	
Other	1,653 (7.8)	4,428 (4.1)		1,760 (10.8)	4,890 (5.5)	
Census tract median income						
<$20,000	1,062 (5.1)	8,996 (8.7)	<0.01	988 (6.2)	8,678 (10.4)	<0.01
≥$20,000	19,887 (94.9)	94,462 (91.3)		14,986 (93.8)	75,175 (89.6)	
Census tract % of some college						
<30	14,112 (67.4)	72,520 (70.2)	<0.01	11,134 (69.8)	61,975 (74.0)	<0.01
≥30	6,827 (32.6)	30,829 (29.8)		4,829 (30.2)	21,776 (26.0)	
Marital status						
Married	9,651 (46.6)	44,781 (42.4)	<0.01	7,054 (44.7)	42,554 (49.3)	<0.01
Other	11,053 (53.4)	60786 (57.6)		8,734 (55.3)	43,812 (50.7)	
Stage at diagnosis						
In situ	2,489 (13.1)	10,515 (10.8)	<0.01	770 (5.6)	4,254 (5.5)	<0.01
Local	11,958 (62.9)	58,176 (59.5)		5,252 (38.0)	28,549 (36.7)	
Regional	3,765 (19.8)	23,460 (24.0)		5,312 (38.4)	29,712 (38.2)	
Distant	787 (4.2)	5,670 (5.7)		2,503 (18.0)	15,201 (19.6)	

NOTE: Column totals may not add up due to missing data.

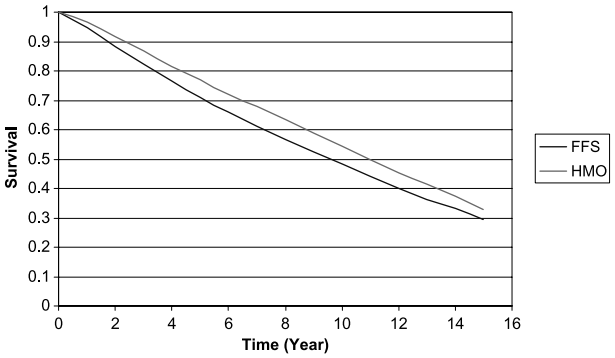

Figure 1. Kaplan-Meier survival curve for breast cancer by HMO status.

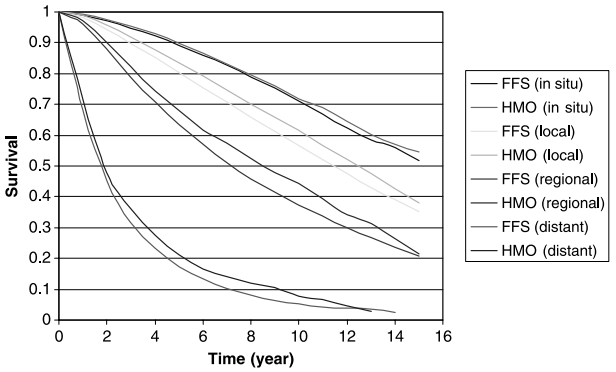

Figure 3. Kaplan-Meier survival curves for breast cancer patients by stage at diagnosis and HMO status.

cancer [2,505 (15.3%) unstaged cancers for HMO patients compared with 11,331 (12.7%) for FFS patients ($P < 0.01$)].

Data Analysis. Student's t tests for continuous variables and χ^2 test for discrete variables were used to compare the demographic data, as well as the stage at the diagnosis for breast or colorectal cancer by HMO status. Kaplan-Meier survival analysis was done to evaluate the overall survival, as well as stage-specific survival, between HMO and FFS patients with breast or colorectal cancer. We then did multivariate analysis using Cox proportional hazards models to assess whether the HMO patients had better survival than the FFS patients. In the multivariate models, we adjusted for the stage at diagnosis, as well as a range of potential confounding factors including age, race, marital status, census tract median income and educational level (proxy measures for socioeconomic status), and gender (for colorectal cancer only).

Results

As shown in Table 1, both FFS breast and colorectal cancer patients were slightly older than HMO patients [breast (mean ± SD), 74.9 ± 7.3 versus 74.5 ± 6.5 ($P < 0.01$); colorectal, 76.9 ± 7.6 versus 76.4 ± 7.0 ($P < 0.01$)]. There were slightly different distributions of gender in HMO compared with FFS ($P < 0.01$); in both groups, female patients represented a majority of patients with colorectal cancer (FFS, 54.8% and HMO, 52.3%). The majority of patients with breast and colorectal cancer were non–Hispanic Whites. White patients represented a larger percentage of patients in FFS with either breast or colorectal cancer than in HMO [breast, 88.5% versus 83.4%; colorectal, 85.7% versus 78.8% ($P < 0.01$ for both cancers)].

Compared with the HMO patients, FFS patients had a greater proportion from census tracts with a median income less than $20,000 [breast, 8.7% versus 5.1%; colorectal, 10.4% versus 6.2% ($P < 0.01$ for both cancers)], and from census tracts with <30% of residents with a college education [breast, 70.2% versus 67.4%; colorectal, 74.0% versus 69.8% ($P < 0.01$ for both cancers)]. These cut points were used as proxy measures of lower socioeconomic areas and patients who lived in these census tracts. Patients with breast cancer enrolled in a HMO had a significantly higher proportion of being married at the time of diagnosis (46.6%) than the FFS patients ($P < 0.01$), but the opposite was observed for colorectal cancer [HMO, 44.7% versus 49.3% ($P < 0.01$)].

A greater proportion of HMO patients with either breast or colorectal cancer were diagnosed at an early stage. For example, the proportion of those diagnosed at an *in situ* stage was 13.1% in HMO patients versus 10.8% in FFS for breast cancer; and 5.6% of HMO patients versus 5.5% for FFS patients for colorectal cancer ($P < 0.01$ for both cancers). The proportion diagnosed at a local stage was 62.9% of HMO patients versus 59.5% of FFS patients for breast cancer and 38.0% of HMO patients versus 36.7% of FFS patients for colorectal cancer ($P < 0.01$ for both cancers).

The results of the Kaplan-Meier survival analyses were presented in Figs. 1-4. Patients with breast cancer enrolled in HMOs had significantly better overall survival than FFS patients (Fig. 1, $P < 0.01$); the same was true for HMO patients with colorectal cancers (Fig. 2, $P < 0.01$) where the overall survival was better for patients enrolled in a HMO. The comparisons of survival by stage at diagnosis for breast cancer revealed that HMO patients diagnosed at a local stage

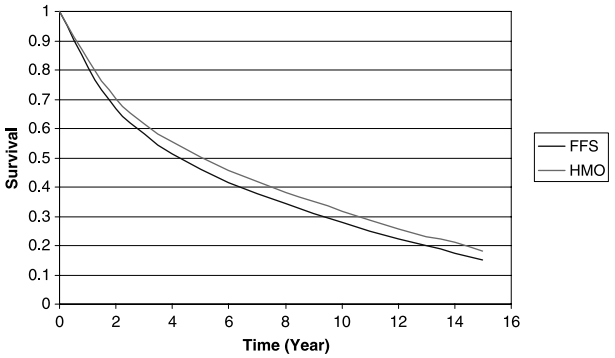

Figure 2. Kaplan-Meier survival curve for colon cancer by HMO status.

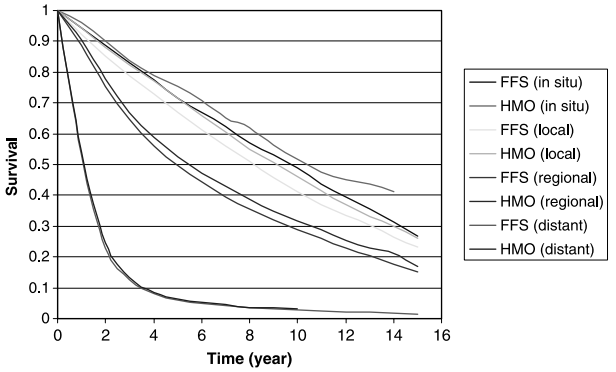

Figure 4. Kaplan-Meier survival curves for colon cancer patients by stage at diagnosis and HMO status.

($P < 0.01$), regional stage ($P < 0.01$), or distant stage ($P < 0.01$) had significantly improved survival than their FFS counterparts. The same trends were observed in patients with colorectal cancer where patients enrolled in an HMO had better survival than FFS patients when the cancer was diagnosed at the *in situ* stage ($P = 0.04$), local stage ($P < 0.01$), or regional stage ($P < 0.01$), but the difference was not significant when the colorectal cancer patient was diagnosed at the distant stage ($P = 0.14$).

Multivariate analyses using Cox proportional hazards model were done to evaluate the survival between HMO and FFS patients (Table 2). After initial adjustment for stage at diagnosis, patients with breast cancer enrolled in a HMO had a 14% significantly better survival than FFS patients (hazard ratio, 0.86; 95% confidence interval, 0.83-0.88), and patients with colorectal cancer enrolled in a HMO a 9% significantly better survival than FFS patients (hazard ratio, 0.91; 0.89-0.93). After further adjustment for potential confounding factors [i.e., age, race, marital status, census track income and education, and gender (colorectal cancer only)], these improvements in survival among HMO patients were still significant for both breast cancer (0.91; 0.88-0.93) and colorectal cancer (0.94; 0.92-0.97).

Discussion

The main study finding was that Medicare patients enrolled in HMO health care delivery systems had greater survival when diagnosed with either breast and colorectal cancer compared with patients enrolled in FFS systems. These differences remained even after attempting to control for potential confounders (such as stage at diagnosis, age, race, socioeconomic status, and marital status). Patients enrolled in FFS compared with those enrolled in HMOs had a 9% better survival for female breast cancer, and 6% better survival for colorectal cancer. The existence of a health care delivery system effect is strengthened by the consistency of our findings for two cancer sites that are epidemiologically and clinically quite distinct.

In our study, both breast cancer and colorectal cancer were diagnosed at earlier stages for patients enrolled in HMO as compared with FFS. For breast cancer, for example, 13.1% of HMO patients were diagnosed at an *in situ* stage compared with 10.8% of FFS patients. The differences were much less dramatic for colorectal cancer, with 5.6% of HMO patients diagnosed at an *in situ* stage compared with 5.5% for FFS patients, and 38.0% of HMO patients diagnosed at a local stage compared with 36.7% of FFS patients.

One explanation for these findings could be the phenomenon termed the ''HMO effect.'' This term has been used to describe the greater likelihood of HMO patients, compared with FFS patients, to use preventive services including disease screening (6). This effect could be related to either plan differences in promotion and access to preventive services, or to qualitative differences among HMO patients in terms of education, income, or health consciousness (23-24). We have found data for differences in either promotion or access to preventive services (25). Although we attempted to adjust for differences in socioeconomic data, limitations of using information related to which census tract a person resided may exist and may not completely correlate with individual level data (26).

Differences in preventive health services have been found between different health care delivery systems, and between uninsured compared with insured populations as well as within racial and ethnic minorities (27, 28). For example, Hispanics in HMOs were more likely than their FFS counterparts to report receiving preventive services (4). In a survey of >7,500 patients, greater frequency of both clinical breast examination and Pap smear use were reported among HMO patients (5). Others have found similar results of differences in the use of screening tests among patients enrolled in different health care delivery systems. In one such study, the use of six different cancer screening tests (i.e., mammography, clinical breast exam, Pap smear, fecal occult blood test, and digital rectal exam) varied according to type of health care coverage. HMO enrollees at all ages were ~10% more likely to be screened than persons enrolled in private FFS plans (8).

However, in addition to earlier detection, other survival advantages seem to be associated with HMO enrollment. For stage-specific diagnoses using the Kaplan Meier statistic, as well as after controlling for stage at diagnosis, patients enrolled in HMOs showed significantly greater survival. In addition to screening utilization, differences in treatment patterns have been noted between health care delivery systems as well. For earlier stage breast cancer cases requiring surgery, HMO enrollees were significantly more likely to receive radiation therapy (9). Age may also affect treatment choices because a higher percentage of breast-conserving surgery and radiation therapy has been found among elderly women with early stage breast cancer (29). Both cancer stage at diagnosis and treatment patterns may result in differences in mortality, therefore, possible differences in cancer survival among health care delivery systems should be evaluated as well. Systems within HMOs (such as the use of case managers), devised to improve patient compliance with care and follow-up, could be at play in the improved survival noted. It may also be possible that, in general, healthier patients are enrolled in HMO plans, however, comorbid conditions were not evaluated in this study (30). Although we did not study regional variation, others have found that differences in the managed care market share had a limited effect on care for cancer patients (31).

The current study has several additional limitations. By definition, the study population was 65 years of age or older, and it is not clear that the results are generalizable to a younger patient population. Furthermore, the SEER data do not constitute a probability sample of the nation, despite being the primary source of national information on cancer incidence and survival (2, 22); SEER areas are mostly urban and concentrated in western U.S. states, with an undersampling of African-Americans. Health plans and patients from these SEER areas may not be representative of the nation as a whole. Additionally, performance among individual or types of HMOs may vary (9). However, we did not study whether differences exist for specific type of managed care plans. Furthermore, despite controlling for potential confounders, differences in overall health of patients enrolled in the differing health care systems might exist, which we did not assess. Finally, we also were not able to measure smoking or dietary factors that may affect patient outcomes.

Nevertheless, the principal finding of significantly improved survival after diagnosis with breast cancer or colorectal cancer, especially after controlling for potential confounding

Table 2. Cox proportional hazard ratios of mortality from primary breast and colorectal cancer for HMO versus FFS patients

	Breast cancer	Colorectal cancer
	Hazard ratio (95% confidence interval)	Hazard ratio (95% confidence interval)
Crude	0.80 (0.78-0.83)	0.89 (0.87-0.91)
Adjusted for stage at diagnosis	0.86 (0.83-0.88)	0.91 (0.89-0.93)
Further adjusted for other covariates*	0.91 (0.88-0.93)	0.94 (0.92-0.97)

*Includes age, race, marital status, census track income and education, and gender (the latter, for colorectal cancer only).

factors, in patients enrolled in HMOs compared with FFS warrants further evaluation. Eventually, modeling ''best practices'' which result in improved outcomes should become the standard of care.

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