



Disparities in timeliness of care for U.S. Medicare patients diagnosed with cancer

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ABSTRACT

Background

Timeliness of care (rapid initiation of treatment after definitive diagnosis) is a key component of high-quality cancer treatment. The present study evaluated factors influencing timeliness of care for U.S. Medicare enrollees.

Methods

Data for Medicare enrollees diagnosed with breast, colorectal, lung, or prostate cancer while living in U.S. SEER (Surveillance, Epidemiology and End Results) regions in 2000–2002 were analyzed. Patients were classified as experiencing delayed treatment if the interval between diagnosis and treatment was greater than the 95th percentile for each cancer site. The impacts of patient sociodemographic, clinical, and area-based factors on the likelihood of delayed treatment were analyzed using multivariate logistic regression.

Results

Black patients (compared with white patients) and patients initially treated with radiation therapy or chemotherapy (rather than surgery) had a greater likelihood of treatment delays across all four cancer sites. Hispanic status, dual Medicare–Medicaid status, location of initial treatment (inpatient vs. outpatient), and stage at diagnosis also affected timeliness of care for some cancer sites. Surprisingly, area-based factors reflecting availability of cancer care services were not significantly associated with timeliness of care or were associated with greater delays in areas with greater numbers of service providers.

Conclusions

Multiple factors affected receipt of timely cancer care for members of the study population, all of whom had

coverage of medical care services through Medicare. Because delays in treatment initiation can increase morbidity, decrease quality of life, shorten survival, and result in greater costs, prospective studies and tailored interventions are needed to address those factors among at-risk patient groups.

KEY WORDS

Neoplasms, access to health care, Medicare, health care disparities

1. INTRODUCTION

Multiple sociodemographic factors affect cancer care patterns, including age, sex, race or ethnicity, insurance status, household income, level of education, and usual source of health care^{1–9}. Timeliness of care (that is, rapid initiation of treatment after definitive diagnosis) is a key component of high-quality cancer treatment. For many types of cancer, timely treatment after diagnosis can improve morbidity, quality of life, and survival.

Only a few studies have examined the influence of patient sociodemographic factors on the receipt of timely cancer care. Both Gwyn *et al.*¹⁰ and Elmore *et al.*¹¹ found that, compared with white women, black women were more likely to experience treatment delays. In contrast, among prostate cancer patients treated in the U.S. military health care system (that is, an “equal-access medical care system”), no significant differences in wait time were observed between black and white men¹².

A number of studies have used data from the U.S. National Cancer Institute’s Surveillance, Epidemiology and End Results (SEER) program cancer registry linked to Medicare claims data (SEER–Medicare). Based on such data, Gorin *et al.*¹³ reported that, compared with white women, black women with breast cancer experienced increased odds of treatment delays. Other studies using SEER–Medicare data found that older patients or those residing in rural areas

had an increased likelihood of delay in initiation of adjuvant chemotherapy for breast cancer¹⁴, and older patients or those with more comorbid conditions had an increased likelihood of delays in starting adjuvant chemotherapy for colorectal cancer¹⁵.

One recent study used data from the National Cancer Data Base, a hospital-based cancer registry jointly sponsored by the American Cancer Society and the American College of Surgeons, to examine the impact of patient sociodemographic factors on timeliness of cancer care¹⁶. The study reported that, compared with white patients, black and Hispanic patients with cancer were at greater risk of experiencing delays in care. In addition, insurance status, geographic region, and type of treatment hospital were associated timelines of care. The study concluded that additional research was needed to examine the role of health system, physician, clinical, and patient characteristics in treatment delays.

To provide further information about factors that may affect treatment delays for common types of cancer, particularly among older people, who experience the greatest rates of cancer incidence, we used SEER-Medicare claims data to examine disparities in timeliness of care. Our study assesses the role of individual-level and area-level characteristics on timeliness of care for individuals with the four most common types of cancer in the United States.

2. METHODS

2.1 Study Population

For this application, we included SEER-Medicare data for patients diagnosed with breast (female only), colorectal, lung, or prostate cancer during 2000–2002 (the most recent SEER-Medicare data at the time of study initiation) in all available SEER regions¹⁷. Of patients with a cancer diagnosis listed in the SEER registry, we included only those who received chemotherapy, radiation therapy, or surgical cancer treatment within 12 months after the diagnosis and who were continuously enrolled in Medicare Part A and B for 12 months after the diagnosis. This approach allowed us to exclude patients who did not receive cancer therapy with curative intent because of comorbidities, patient preference, or other factors. Further, because the date of cancer diagnosis might be set to the date of Medicare enrollment for individuals diagnosed with cancer before age 65, only patients diagnosed with cancer at age 66 or older were included.

2.2 Study Variables

We used SEER registry data to identify the site and stage of cancer, age at diagnosis, date of diagnosis, race and ethnicity, county of residence, and rural or urban status of residence. Because the American Joint Committee on Cancer stage was missing for

many patients (particularly those with prostate cancer), SEER stage categories of *in situ*, local, regional, distant, and unstaged were used. Because very few breast cancer patients were unstaged (<1%), those unstaged patients were eliminated from the study population. Further, because almost no lung cancer patients were diagnosed with *in situ* disease, the patients classified as *in situ* were combined with those diagnosed with local disease. Similarly, because of small sample sizes, prostate cancer patients with *in situ* or local disease at diagnosis were combined with patients having regional disease at diagnosis.

Using SEER data, race and ethnicity were coded as white, black, Hispanic, Asian, and other (the latter combining the SEER categories “Native American,” “unknown,” and “other”). Rural or urban status for the patients’ county of residence was coded based on definitions in the 2004 area resource file (ARF), which ranged from “counties of metro areas of 1 million population or more” (referent group) to “completely rural or less than 2,500 urban population.” The smallest two categories of the continuum (completely rural or less than 2,500 urban population adjacent to a metro area, and the corresponding population not adjacent to a metro area) were combined because of small numbers. Marital status was included in the model as single, married, divorced, or widowed.

Medicare enrollment information was used to assess dual Medicare–Medicaid coverage status (indicating the low-income status of Medicare enrollees). Part A and B claims were used to determine the date and type of initial cancer therapy [based on selected CPT (Current Procedural Terminology), ICD-9 (International Classification of Diseases, 9th Revision), and HCPCS (Healthcare Common Procedure Coding System) procedure codes] and the level of patient comorbidities (scored based on the modified Charlson comorbidity index as adapted by Deyo *et al.*¹⁸). Patients were classified into four comorbidity groups based on Charlson scores of 0–3 (fewest comorbidities), 4–6, 7–9, and 10 or more (most comorbidities).

The SEER-Medicare dataset includes limited information directly assessing patient socioeconomic status and ease of access to medical care. Because both of those factors may affect timeliness of care, we used a number of variables measuring characteristics of the patients’ census tract or county of residence as proxies. Using information on the county of residence (Federal Information Processing Standard code, also included in the SEER file), we merged data from the ARF to assess county-specific medical care access variables: number of hospitals offering oncology services or radiation therapy services, and four cancer site-specific access variables. These county-based site-specific variables were number of hospitals offering breast cancer screening or mammography services (for breast cancer patients), number of colorectal cancer surgeons engaged in patient care (for colorectal cancer patients), number

of thoracic surgeons engaged in patient care (for lung cancer patients), and number of urologists engaged in patient care (for prostate cancer patients). Neither the number of breast cancer surgeons nor the number of medical oncologists was available in the ARF data by county. Each county-based cancer site-specific variable was included only in the regressions for the relevant patient group. We also used ARF data to control for the percentage of Medicare managed-care penetration in each county. For all variables, ARF data from 2002 or the most recent year of data before 2002 were used.

2.3 Outcome Measure

The study evaluated factors affecting timeliness of care, defined as the time from cancer diagnosis to initiation of first treatment. Date of cancer diagnosis was obtained from the SEER “first diagnosis date at age 65 or older” field, specified as month and year. Date of treatment initiation was determined by examining Medicare Part A and B claims for procedure codes (CPT, ICD-9, or HCPCS; see Appendix A) corresponding to chemotherapy, radiation therapy, or surgery specific to the indicated cancer site. Time from diagnosis to initial treatment was determined as the number of months from diagnosis to the first Medicare treatment claim.

To evaluate patient characteristics associated with significant delays in therapy, we used delays greater than the 95th percentile of time from diagnosis to treatment initiation as the dependent variable. The 95th percentile was chosen to represent delays that would correspond to a statistically significant one-tailed time period (that is, $p < 0.05$) from diagnosis to treatment initiation. Our intent in using the 95th percentile was to identify relative “outliers” in terms of delays in treatment for each cancer site, particularly given that the United States has no widely accepted guidelines for wait times from diagnosis to treatment. Part A and B claims were also used to categorize the venue of initial treatment (hospital inpatient vs. hospital outpatient vs. physician office), which was included in the multivariate regression analyses as discussed later.

2.4 Statistical Analysis

Multivariate logistic regression was used to assess the likelihood of a patient’s being in the top 5% of time from diagnosis to treatment initiation, controlling for age group (quartiles of the study population), sex (when appropriate), race or ethnicity, dual Medicare–Medicaid status, marital status, level of comorbidities, urban or rural residence status, year of diagnosis (2000, 2001, 2002), venue of initial treatment (hospital inpatient vs. hospital outpatient vs. physician office), and the area-based variables described earlier. For all analyses, patient age, Charlson

score, and values of area-based variables were categorized in quartiles by cancer site, with the lowest quartile being used as the reference group. A single multivariate logistic model was run for each cancer type, incorporating the specified demographic, clinical, and area-based variables. All analyses were performed using the SAS software application (version 9.1; SAS Institute, Cary, NC, U.S.A.).

3. RESULTS

3.1 Study Population Characteristics

A total of 161,274 patients met the study’s inclusion criteria. Table 1 presents details of the study population (all patients included in the analyses). Prostate cancer patients constituted the largest population, followed by colorectal, breast, and lung cancer patients. Most patients were non-Hispanic white. Between 9% and 16% of patients were covered by dual Medicare–Medicaid insurance, depending on the cancer site. Level of comorbidities (based on Charlson score) varied substantially between the patients for the four cancer sites, with approximately 15% of prostate cancer patients compared with more than 56% of lung cancer patients being in the group with the most comorbidities. Almost half of the colorectal cancer patients and more than 70% of the breast cancer patients were diagnosed with *in situ* or local-stage disease. In contrast, only 23% of lung cancer patients were diagnosed with local-stage disease.

Table 1 also presents the study outcome measure, the 95th percentile of time (in months) from diagnosis to initial treatment. Colorectal cancer patients experienced the shortest time from diagnosis to treatment initiation, with the 95th percentile being 1 month. The 95th percentile was 2 months for breast cancer patients, 3 months for lung cancer patients, and 5 months for prostate cancer patients.

3.2 Patient Factors Associated with Timeliness of Care

Figure 1 presents results from the multivariate logistic regression analyses examining the association between timeliness of care (that is, treatment starting at or beyond the 95th percentile of time from diagnosis) and patient characteristics by cancer site. Age did not significantly affect delays in care. Compared with patients not having Medicaid coverage, dual Medicare–Medicaid patients with breast or lung cancer were more likely to experience delays. Compared with white patients, black patients with any of the four cancers studied were very significantly more likely to experience delays in care ($p < 0.0001$ or 0.0005); Hispanic patients with colorectal or prostate cancer were similarly more likely to experience delayed initiation of treatment ($p < 0.0005$ or 0.05). No significant differences were observed between

TABLE 1 Characteristics of the study population

Variable	Cancer site			
	Breast	Colorectal	Lung	Prostate
Patients (<i>n</i>)	39,762	39,951	32,899	47,749
Mean age at diagnosis (years)	75.9	77.7	74.6	74.4
Race/ethnicity (%)				
White	88.8	86.3	87.8	84.4
Black	6.6	7.7	7.3	9.3
Hispanic	1.2	1.4	1.1	1.9
Asian	1.7	2.7	2.2	2.6
Other	1.6	1.9	1.5	1.8
Female	100.0	55.1	46.6	0.0
Marital status (%)				
Married	41.8	47.9	53.2	68.7
Single	7.0	7.7	6.4	6.4
Divorced	6.7	5.5	7.5	4.1
Widowed	39.4	32.9	27.2	9.5
Unknown	5.1	6.0	5.7	11.3
Dual Medicare–Medicaid coverage (%)	13.0	15.7	15.0	8.9
Comorbidities (%)				
Charlson score 0–3	35.6	19.5	6.7	41.6
Charlson score 4–6	22.2	21.5	13.2	28.7
Charlson score 7–9	21.3	24.5	23.4	15.1
Charlson score 10+	20.9	34.5	56.6	14.6
Urban/rural residence (%)				
Metro county				
With >1 million population	56.0	56.0	55.1	56.3
With 250,000 to 1 million population	19.5	18.3	17.7	18.2
With <250,000 population	9.6	9.3	10.3	9.8
Urban county (not) adjacent to metro area				
Adjacent with >20,000 population	3.9	3.9	4.4	3.9
Not adjacent with >20,000 population	2.1	2.2	2.3	2.1
Adjacent with 2,500–19,999 population	4.0	4.7	4.6	4.7
Not adjacent with 2,500–19,999 population	3.2	3.8	3.6	3.2
Completely rural county or urban county				
With <2,500 population	1.6	1.9	2.0	1.7
Stage at diagnosis (%)				
<i>In situ</i>	15.1	5.7	NA	NA
Local	58.0	40.9	22.7	NA
Regional	22.7	35.1	39.7	91.9
Distant	4.3	14.2	33.1	4.2
Unstaged	NA	4.1	4.5	3.9
Location of initial therapy (%)				
Inpatient facility	47.7	80.9	58.6	28.7
Hospital outpatient facility	47.9	8.5	33.8	60.3
Physician office	4.4	10.6	7.6	11.0
Type of initial therapy (%)				
Surgery	95.6	95.4	26.8	32.5
Chemotherapy	2.3	2.1	33.4	45.6
Radiation therapy	2.2	2.5	39.8	21.8
Time from diagnosis to treatment (months)				
95th percentile	2	1	3	5

NA = not applicable.

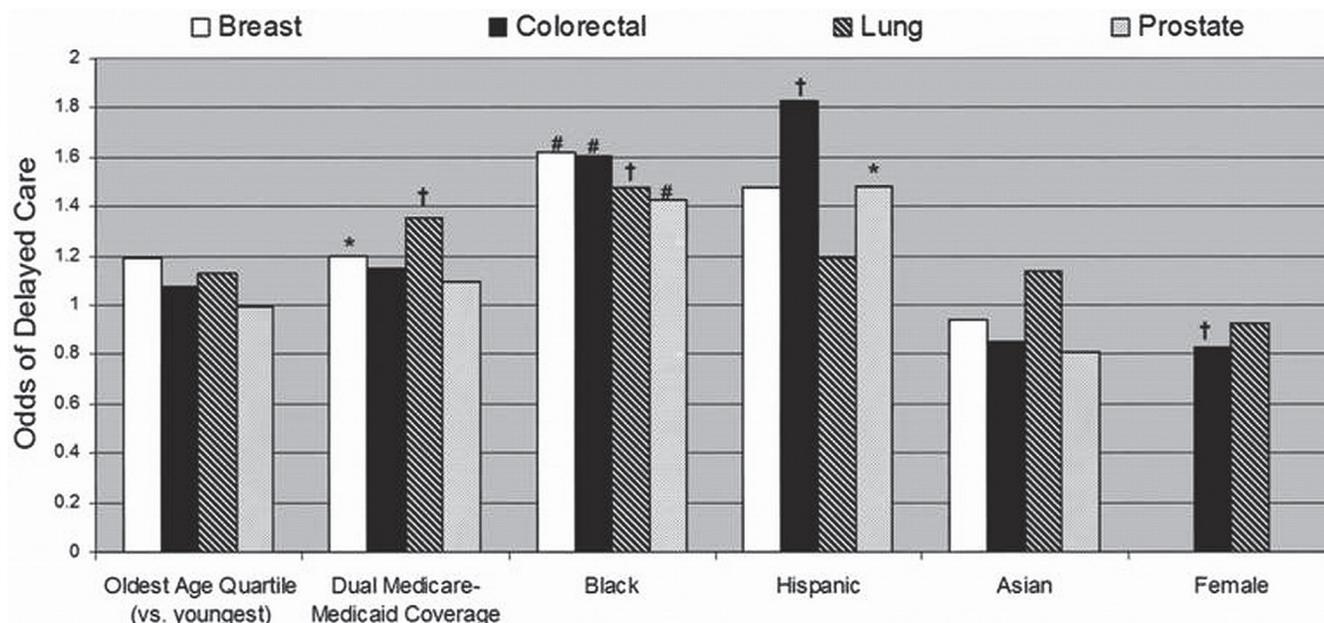


FIGURE 1 Patient factors affecting timeliness of care: odds ratios from the multivariate logistic regression models for the likelihood of delays in initiation of cancer treatment for patients with breast cancer, colorectal cancer, lung cancer, and prostate cancer. Increased likelihood of delay was observed among black patients (compared with white patients) for all four cancer types, and among dual Medicare–Medicaid patients (compared with those enrolled in Medicare only) and among Hispanic patients (compared with white patients) for certain cancer sites. The likelihood of delay was observed to be decreased for women (compared with men) having colorectal cancer. * $p < 0.05$. † $p < 0.0005$. # $p < 0.0001$.

Asian and white patients. Comparisons of patients in the “other” race and ethnicity category with white patients were also nonsignificant (data not shown). Compared with men, women with colorectal cancer were significantly less likely to experience treatment delays, but no differences by sex were observed for lung cancer patients.

Table II presents additional results from individual-level variables included in regression analyses that are not illustrated in Figure 1. Although a small number of significant associations were observed between residence status and delays in care, results were not consistent across the four cancer sites. Residence in the most rural areas was significantly associated with increased treatment delays only among prostate cancer patients.

3.3 Clinical Factors Associated with Timeliness of Care

Table III presents regression results (odds ratios and statistical significance) for selected clinical factors associated with timeliness of care. Comorbidities had a significant impact on treatment delays only for women with breast cancer. The venue of initial treatment was strongly associated with delays in care for three of the four types of cancer studied—that is, significant delays in treatment initiation were observed for colorectal, lung, and prostate cancer patients whose initial treatment episode occurred

in an outpatient setting (either a physician office or a hospital outpatient clinic) rather than as an inpatient episode. However, venue of treatment was not significantly associated with delays for breast cancer patients. That observation may reflect the high rate of surgery as initial treatment (Table I) for breast cancer, and the experience of clinicians in performing breast cancer surgeries, including mastectomies, in outpatient settings.

Table II presents a number of other clinical factors associated with timeliness of care. Among breast cancer patients, those with distant-stage disease at diagnosis (compared with the reference category, local-stage disease) were significantly less likely to experience delays. Lung cancer patients with regional- or distant-stage disease were also less likely to experience delays. In contrast, colorectal cancer patients with *in situ* disease (compared with local-stage disease) at diagnosis were less likely to experience delays (perhaps because the *in situ* cancer was removed at the time of diagnostic colonoscopy), and delays for those with regional- or distant-stage disease were not statistically different from delays for patients with local-stage disease. For both colorectal cancer and prostate cancer patients, individuals with unstaged disease were significantly more likely to experience delays.

Across all four cancer sites, patients who received chemotherapy or radiation therapy as initial treatment were significantly more likely to experience

TABLE II Additional multivariate regression results¹

Variable	Cancer site							
	Breast		Colorectal		Lung		Prostate	
	OR	p Value	OR	p Value	OR	p Value	OR	p Value
Residence (reference: metro county with >1 million population)								
Metro county								
With 250,000 to 1 million population	1.09	NS	0.74	<0.005	0.94	NS	1.09	NS
With <250,000 population	0.85	NS	0.68	<0.005	0.65	<0.005	1.22	NS
Urban county (not) adjacent to metro area								
Adjacent with >20,000 population	1.41	NS	0.90	NS	1.09	NS	1.35	<0.05
Not adjacent with >20,000 population	1.32	NS	0.65	NS	1.18	NS	0.86	NS
Adjacent with 2,500–19,999 population	1.12	NS	0.64	<0.05	0.99	NS	0.89	NS
Not adjacent with 2,500–19,999 population	1.54	NS	0.79	NS	1.05	NS	1.40	<0.05
Completely rural county or urban county								
With <2,500 population	1.30	NS	0.74	NS	0.94	NS	1.53	<0.05
Marital status (reference: married)								
Single	1.33	<0.05	1.07	NS	1.05	NS	1.21	<0.05
Divorced	1.23	NS	1.09	NS	1.35	<0.005	1.13	NS
Widowed	1.21	<0.05	1.10	NS	1.19	<0.05	1.00	NS
Stage at diagnosis								
Reference			Local		Local		Local	
<i>In situ</i>	1.10	NS		0.56	<0.0005	—	—	Locoregional
Regional	1.06	NS		0.89	NS	0.59	<0.0001	—
Distant	0.76	<0.05		1.08	NS	0.29	<0.0001	0.88
Unstaged	—	—		2.81	<0.0001	1.15	NS	1.43
Type of initial treatment (reference: initial surgery)								
Chemotherapy	6.74	<0.0001		6.50	<0.0001		1.32	<0.0005
Radiation therapy	8.76	<0.0001		5.39	<0.0001		2.06	<0.0001

NS = statistically nonsignificant.

treatment delays than were the patients who initially received surgery. These delays were statistically significant for all four groups ($p < 0.0001$), independent of the effect of stage at diagnosis (which was separately controlled for). Further, the observed effects were not related to possible delays resulting from surgery needed before commencement of radiation therapy or chemotherapy, because the patients did not receive prior cancer-specific surgeries. The magnitude of the association was greatest for breast and colorectal cancer patients. That finding may reflect the treatment patterns presented in Table 1: Nearly all breast and colorectal cancer patients (>95%) received surgery as initial therapy, suggesting complicating factors or unusual circumstances that could delay care among the patients receiving initial chemotherapy or radiation therapy.

3.4 Area-Based Factors Associated with Timeliness of Care

Table III also presents results from regression analyses of area-based factors. We expected that greater availability of oncology care in geographic proximity to a study patient would be associated with more timely care. However, the presence of more hospitals offering oncology services or radiation therapy services in a patient's county of residence had little significant association with delays in treatment initiation. Greater numbers of thoracic surgeons or urologists in a county were associated with significantly increased likelihoods of delays in treatment initiation for lung and prostate cancer patients respectively.

We also found that breast cancer and prostate cancer patients residing in counties with the highest

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TABLE III Multivariate regression results for clinical and area-based factors¹

Variable	Cancer site							
	Breast		Colorectal		Lung		Prostate	
	OR	p Value	OR	p Value	OR	p Value	OR	p Value
<i>Clinical factors</i>								
Most comorbidities (vs. fewest)	1.43	0.0005	1.13	NS	1.23	NS	1.12	NS
Year of diagnosis								
2001	0.93	NS	1.18	0.05	1.00	NS	1.04	NS
2002	1.27	0.005	1.20	0.005	1.03	NS	1.00	NS
Treatment site								
Hospital outpatient clinic	1.13	NS	1.34	0.0005	1.36	0.0001	1.17	0.05
Physician office	1.25	NS	1.23	0.005	1.40	0.005	1.53	0.0001
<i>Area-based factors^a</i>								
Number of hospitals with								
Oncology services	1.83	NS	0.73	NS	0.79	NS	0.72	NS
Radiation therapy services	1.11	NS	1.40	0.05	0.95	NS	1.08	NS
Percentage Medicare managed care penetration	1.82	0.0001	1.11	NS	1.00	NS	1.28	0.05
Number of cancer-site specific providers or centres	0.62	NS	0.90	NS	1.52	0.05	1.41	0.05
Census tract								
Percentage non-English speakers	1.20	NS	1.02	NS	1.26	0.05	1.08	NS
Percentage with high school only or less education	0.98	NS	1.04	NS	1.00	NS	0.91	NS

^a Impact of highest quartile compared with lowest quartile.
NS = statistically nonsignificant.

quartile of Medicare managed-care penetration (compared with those residing in counties in the lowest quartile) were more likely to experience delays. Residing in census tracts with a greater proportion of individuals having only high school or lower education was not significantly associated with treatment delays for any of the four cancers.

4. DISCUSSION

Our analyses indicate that delays in treatment initiation after definitive diagnosis for breast, colorectal, lung, and prostate cancer patients are significantly associated with a variety of patient, clinical, and area-level factors. However, our results indicate that those factors affect timeliness of care differently across the four cancer sites. Patient race or ethnicity (particularly for black patients), location of initial treatment (that is, inpatient vs. outpatient), and type of initial treatment (surgery vs. radiation therapy or chemotherapy), were strongly associated with timeliness of care for most or all of the cancer sites. In contrast, other factors such as dual Medicare–Medicaid status were significantly associated with delays in care for only one or two of the cancer sites. That observation likely reflects differences both in treatment patterns and in factors influencing

treatment decisions by patients and clinicians across the four cancer sites.

Greater likelihood of delayed treatment initiation was also observed for three of the four cancer sites (colorectal, lung, and prostate) for patients receiving initial therapy as an outpatient rather than as an inpatient. To our knowledge, that observation has not previously been reported. This treatment location affect is unlikely to be a result of stage at diagnosis or patient comorbidities, because the analyses controlled for both of those factors separately. Discussions with oncologists suggest that this finding may be a result of scheduling issues—that is, finding an available time and bringing together the necessary health care providers to initiate treatment may be more difficult in outpatient settings (for example, private practices) than in inpatient environments. As minimally invasive surgeries and other interventions (including multimodality therapies) that do not require inpatient stays become more common, additional steps will be needed to ensure that patient preference for outpatient treatment does not result in delayed care.

The present study has a number of limitations. First, only individuals age 66 or older residing in SEER regions at the time of diagnosis were included. Furthermore, the outcome measure (time from diagnosis

to treatment initiation) is based on data from the SEER and Medicare datasets and is therefore limited to information available in those datasets. For example, the data contain limited information on patient-level characteristics. Beyond information on dual Medicare–Medicaid status, no data on socioeconomic status were available for the patients. Gwyn *et al.*¹⁰ reported that the poverty index (annual household income adjusted by the number of individuals in the household) was significantly associated with delayed treatment initiation for women with breast cancer, suggesting that individual-level socioeconomic variables may be significantly associated with timeliness of care. In preliminary analyses, we found that ZIP code–based median household income was not significantly associated with timeliness of care (data not shown), and the study regressions therefore did not include that variable. Collection by SEER cancer registries of individual socioeconomic status variables, such as household income or years of education, would permit greater assessment of the impacts of those important factors.

Our study population included only individuals who received treatment, defined as surgery, chemotherapy, or radiation therapy, within 1 year of diagnosis. Although this choice likely includes most Medicare enrollees diagnosed with cancer while residing in SEER regions, there are almost certainly individuals who chose to receive other treatments or no treatment at all. Particularly for men diagnosed with prostate cancer, oral hormonal therapy or expectant management (“watchful waiting”) may be appropriate treatment alternatives. Others may choose best supportive care that does not involve treatments captured in our study. Those possibilities may limit the generalizability of our results to individuals who receive more “standard” and potentially curative treatments for cancer. Further, some patients with late-stage diagnosis of their cancer may have short waits because they require emergent or salvage treatment (for example, locally advanced breast cancer, colorectal cancer with perforation). Adjustment for stage will not necessarily account for that possibility, which therefore may also affect the results. However, it is likely that such patients represent a small proportion of the total study population.

The present study focused on what is essentially an intermediate outcome: delay in treatment initiation. Delays in the timeliness of care matter only if they are associated with other outcomes affecting patient morbidity and mortality, such as the need for more invasive or intensive treatment, increased treatment-associated toxicities, decreased quality of life, and decreased survival. Most studies have reported clinical impacts associated with delays in cancer treatment. For example, Hershman *et al.*^{14,15} reported that delays in initiation of adjuvant chemotherapy were associated with increased mortality for breast and colorectal cancer patients. Colleoni *et al.*¹⁹

reported that early initiation of chemotherapy among estrogen receptor–negative breast cancer patients was associated with increased survival, but early initiation did not significantly affect patients with estrogen receptor–positive breast cancer. In a study of 129 veterans with lung cancer, time to treatment initiation did not significantly affect survival, although a trend toward greater survival among individuals with solitary pulmonary nodules who were treated in a more timely manner was observed²⁰. Recently, a meta-analysis presented by Raphael *et al.*²¹ found that increased delays in the receipt of adjuvant chemotherapy were associated with significant decreases in both overall survival and disease-free survival. More work is needed to delineate the effects of timeliness of care on outcomes other than survival, including quality of life, functional status, and costs.

5. CONCLUSIONS

Our study indicates that multiple factors are associated with disparities in timeliness of care for Medicare enrollees with cancer. Race or ethnicity, dual Medicare–Medicaid status, venue and type of treatment initiation, and stage at diagnosis were all significantly associated with delay in treatment initiation for certain cancer sites. Results from our study accord with studies assessing timeliness of care for individuals diagnosed with cancer in the 1980s and 1990s^{10,11,13,14} and with a recent hospital registry-based study¹⁶. Interventions to address patient, provider, and health system factors that may contribute to delays in care are needed to achieve optimal health outcomes for all cancer patients.

6. CONFLICT OF INTEREST DISCLOSURES

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APPENDIX A: PROCEDURE CODES USED TO IDENTIFY CANCER TREATMENT

<i>Treatment type</i>	<i>Cancer site</i>	<i>Procedure code authority</i>		
		CPT	ICD-9	HCPCS
Chemotherapy	All	96401–96549	99.25, 99.28	J1825, J1830, J9xxx
Radiation therapy	All	77401–77525, 77750–77799, 79000–79999	92.2x, 92.3x	A9600, A9605, Q3001
Surgery	Breast	19120, 19125, 19126, 19160, 19162, 19180, 19182, 19200, 19220, 19240	85.20, 85.21, 85.22, 85.23, 85.33, 85.34, 85.35, 85.36, 85.4x	NA
	Prostate	52601, 52612, 52614, 52647, 52648, 53850–53853, 55801–55845, 55866, 55873	60.2x, 60.3, 60.4, 60.5, 60.6x, 60.96, 60.97	NA
	Colorectal	44140–44160, 44204–44212, 45110–45190, 45308–45315, 45320, 45333, 45338, 45339, 45383–45385, 45395, 45397	45.4x, 45.7x, 45.8x, 48.3x, 48.4x, 48.5x, 48.6x, 48.82	NA
	Lung	32440–32504, 32657, 32662, 32663	32.0x, 32.1, 32.31, 32.28, 32.29, 32.3, 32.4, 32.5, 32.6, 32.9	NA

CPT = Current Procedural Terminology; ICD-9 = International Classification of Diseases, 9th Revision; HCPCS = Healthcare Common Procedure Coding System; x = any additional digit or no additional digit.