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Race versus place of service in mortality among Medicare beneficiaries with cancer

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Abstract

Background—Evidence suggests that excess mortality among African-American cancer patients is explained in part by health care setting. Our objective was to compare mortality among African-American and Caucasian cancer patients and to evaluate the influence of NCI-Cancer Center attendance.

Methods—We conducted a retrospective cohort analysis of Medicare beneficiaries with an incident diagnosis of lung, breast, colorectal, or prostate cancer from 1998–2002, as identified in SEER. Multivariate logistic regression models assessed the impact of NCI-Cancer Center attendance and race on all-cause and cancer-specific mortality at one and three years from diagnosis.

Results—Likelihoods of one- and three-year all-cause and cancer-specific mortality were higher for African-Americans than for Caucasians in crude and adjusted models (cancer-specific adjusted: Caucasian referent, 1year: OR=1.13; 95% CI 1.07–1.19, 3-year OR=1.23; 95% CI 1.17–

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1.30). By cancer site, cancer-specific mortality was higher among African-Americans at one year for breast and colorectal cancers and for all cancers at three years. NCI-Cancer Center attendance was associated with significantly lower odds of mortality for African-Americans (1-year: OR=0.63; 95% CI 0.56–0.76, 3-years: OR=0.71; 95% CI 0.62–0.81). The excess mortality risk among African-Americans was no longer observed for all-cause or cancer-specific mortality risk among patients attending NCI-Cancer Centers (Caucasian referent, cancer-specific mortality at 1-year: OR=0.95; 95% CI 0.76–1.19, 3-years: OR=1.00; 95% CI 0.82–1.21).

Conclusions—African-American Medicare beneficiaries with lung, breast, colorectal, and prostate cancers have higher mortality compared to their Caucasian counterparts; however, there were no significant mortality differences by race among those attending NCI-Cancer Centers. This study suggests that place of service may explain some of the cancer mortality excess observed in African Americans.

Keywords

Healthcare Disparities; Quality of Healthcare; Mortality; Health facilities

INTRODUCTION

Recent efforts to understand racial and ethnic health disparities have examined the extent to which individual, social, and health care factors contribute to observed disparities. The Institute of Medicine reviewed a large number of studies and reported that racial/ethnic disparities exist, but diminish somewhat when accounting for variation in health insurance coverage and system attributes that influence access to, and quality of, health care ¹. The role of these factors in health disparities are still not well understood, and even less so for cancer care.

Cancer-related mortality in African American cancer patients has repeatedly been shown to be higher than that in Caucasians, although the causal factors are not clear. A 2007 Robert Wood Johnson Foundation review and synthesis focused on disparities in access to and quality of health care and drew several cancer-specific conclusions: breast cancer screening was similar for blacks and whites when adjusting for other factors; and, cancer treatment differences between blacks and whites are significant, with blacks less likely to undergo newer treatments and invasive treatments ². At the same time, other evidence demonstrates that blacks and whites treated in the same health care setting receive similar cancer care ^{3–5}. Other studies ^{6,7} not confined to cancer care, reported that blacks and whites in Medicare managed care plans were comparable in receipt of recommended processes of care, but differed significantly in intermediate outcomes, such as blood pressure control in hypertensive patients.

While treatment and mortality differences have been examined for African American and Caucasian cancer patients, very little effort has focused on racial/ethnic differences in where cancer care is received. Our objective was to assess whether place of service is associated with differences in mortality for African American and Caucasian patients with lung, breast, colorectal, or prostate cancer in the Medicare population.

MATERIALS AND METHODS

Study Population and Data

We used SEER-Medicare data to identify incident primary cases of lung, breast, colorectal, and prostate cancers from 1998–2002, with linked claims through 2003. The 14 SEER

registries represent ~26% of the U.S. population⁸. For the cancer sites included – lung, breast, colorectal, and prostate -- the majority occur in individuals over age 65⁹.

We did not include individuals from Hawaii since the restricted variable, patient zip code, was not available for this state. Washington State residents were excluded due to missing data from the NCI Cancer Center in the Seattle/Puget Sound registry (N=15,661). From a total of 558,663 cancer cases, we excluded 329,520 based on several criteria, including: unequal parts A and B Medicare enrollment (n=24,657) which can limit ascertainment of services, any enrollment in a Medicare risk-bearing HMO in 12 months prior to diagnosis (n=113,854), <66 years of age at diagnosis (121,411), indeterminate month of diagnosis (n=2,357), initial entitlement due to end stage renal disease (n=164), cancer diagnosis prior to 1998 (23,789), death within one month of diagnosis (n=20,247), and absence of MedPAR or Outpatient claims in the first 12 months following diagnosis (n=7,380). Patients with only one hospital-based claim (MEDPAR or Outpatient) in the first year following diagnosis (n=3,974) were further excluded for the main analysis, since assignment to a care setting based on one claim did not meet our threshold; however, these patients were included in subsequent sensitivity analyses (described below). Due to small numbers individuals reporting race other than Caucasian or African American were excluded from further analysis (n=9,743).

Variables

The main variables of interest were race, NCI Cancer Center attendance, and overall and cancer-specific mortality at one and three years. Racial categories included Caucasian and African American and were mutually exclusive. Race was self-designated during the application processing at the Social Security Administration (SSA). We excluded other racial/ethnic categories based on previous studies using this cohort that demonstrated a lack of statistical power.

During our study period (1998–2003), 47 institutions held continuous designation as an NCI-designated comprehensive or clinical cancer center (hereafter referred to as “NCI-Cancer Centers”). Of these, 15 were located within SEER areas corresponding to the most recent complete data. NCI Cancer Center attendance was defined as two or more claim-days for inpatient or outpatient procedural care occurring at an NCI Cancer Center within 12 months of the index cancer diagnosis as recorded by SEER¹⁰. A claim-day was defined as one calendar date on which one or more of the above claims occurred; inpatient stays were considered as one claim, and Outpatient claims (those from institutional outpatient providers) occurring during an inpatient stay were not counted. An index cancer was defined as the first primary cancer of the breast, lung, colon/rectum, or lung within the study period. Claims were identified as occurring at an NCI Cancer Center through the SEER-Medicare Hospital file¹¹.

We used date of death as recorded in the Medicare Denominator File, in conjunction with date of diagnosis, to determine all-cause and cancer-specific mortality at one and three years. Cause of death was obtained from SEER records. To account for possible referral and/or health care encounter patterns that might influence mortality we determined the dominant physician care type in the 6 months prior to diagnosis. This measure was derived by tabulating physician encounters as recorded in Carrier claims according to physician type, generalist or specialist, and assigning primary care predominance to those with ≥ 50% generalist care. We also adjusted for comorbid conditions identified by ICD-9 codes for all hospital and physician encounters within 12 months preceding the date of diagnosis, then calculated a Charlson score, modified to exclude solid tumors^{12–15}. Stage at diagnosis was based on TNM Staging Classification 1–4, as recorded by SEER registries. Receipt of cancer-directed surgery in the first year following diagnosis was determined using procedure

codes from the International Classification of Diseases (ICD-9) and Current Procedural Terminology (CPT).

Group-level variables included median household income and educational attainment for the ZIP code of residence, and travel time to the nearest NCI-Cancer Center, travel time to nearest academic-based care, and per-capita oncologist supply, as described previously¹⁶. We found median income and median education by ZIP to be 99% correlated, thus we included only median income in subsequent analyses.

Statistical Analysis

We evaluated 1- and 3-year all-cause and cancer-specific mortality for African Americans and Caucasians by modeling mortality as a logit function of NCI-Cancer Center attendance and race. We evaluated models of 1- and 3-year mortality for African Americans compared to Caucasians (referent), with and without adjusted for NCI Cancer Center attendance, age, sex, stage at diagnosis, travel time to nearest NCI Cancer Center, cancer site, predominance of primary care prior to diagnosis, median household income quintile for ZIP code of residence, and SEER registry at diagnosis. We evaluated models stratified by cancer site and for all cancers combined. We also examined the effect of NCI Cancer Center attendance on 1- and 3-year mortality stratifying by race. The logistic regression models of mortality were then stratified by NCI-Cancer Center attendance to assess potential interactions between race and place of cancer care. We performed *post hoc* analyses to examine differences in baseline characteristics such as comorbidities, stage, and number of primaries, and also in the likelihood of receiving cancer-directed surgery. To account for potential correlation of unmeasured factors, we also applied random effects models with clustering at the level of the hospital referral region, and separately for SEER registry. Because variances were exceedingly low for residuals from these random effects models (0.04), here we report only multivariate logistic regression models.

All analyses were performed using Stata statistical software v.9.2 (Stata Corporation, College Station, TX). This study was approved by the Committee for Protection of Human Subjects at Dartmouth Medical School.

RESULTS

The analytic sample consisted of 201,305 Medicare beneficiaries, of whom 18,008 (8.9%) were African American (Table 1). A higher proportion of African Americans attended an NCI Cancer Center than Caucasians (11.1% vs. 6.9%). Some of the notable characteristics which differed between African Americans and Caucasians who attended NCI Cancer Centers included: 1. predominance of primary care prior to diagnosis (NCI Cancer Center attendees: Caucasian, 40.5%, African American, 49.6%; non-NCI Cancer Center attendees: Caucasian, 46.5%, African American, 55.8%), 2. number of comorbidities (5 or more comorbidities -- NCI Cancer Center attendees: Caucasian, 2.5%, African American, 3.9%; non-NCI Cancer Center attendees: Caucasian, 3.8%, African American, 6.0%), and receipt of cancer-directed surgery (NCI Cancer Center attendees: Caucasian, 60.4%, African American, 53.8%; non-NCI Cancer Center attendees: Caucasian, 58.2%, African American, 49.9%) (Table 1). These factors were included in subsequent adjusted models.

Overall cancer-specific mortality occurred in a higher proportion of African American patients compared to Caucasian at both one and three years (one year: 18.0% vs. 14.7%, respectively; three years: 25.0% vs. 20.0%, respectively) (Table 2). These mortality differences were nearly the same for patients not attending NCI Cancer Centers. Among NCI Cancer Center attendees, no material differences in mortality was seen by race: cancer-

specific mortality at one year: 12.3% (African Americans), 12.4% (Caucasians); at three years: 19.9% (African American), 20.0% (Caucasian).

To examine the observed differences in mortality by race and NCI Cancer Center attendance while accounting for covariates, we developed logistic regression models. We first compared likelihood of 1- and 3- year mortality between Caucasians and African Americans in our study population. Crude models demonstrated the expected greater odds of mortality at both one and three years for African Americans relative to Caucasians (Table 3). Higher odds for 1- and 3-year all-cause mortality among African Americans compared to Caucasians persisted, although attenuated in models adjusted for age at diagnosis, sex, travel time to the nearest NCI Cancer Center, attendance at an NCI Cancer Center, predominance of primary care prior to diagnosis, stage at diagnosis, cancer site, rurality, comorbidities, median household income for ZIP code of residence, and SEER registry of residence, higher odds (Table 3). Likelihoods of cancer-specific mortality were similar to those of all-cause mortality (Table 3). To account more fully for differing risks of mortality based on cancer site, we performed logistic regression models stratified by cancer site. Excess risk of mortality for African Americans was seen for all four cancers, with the strongest effect at three years (Figure 1). (Caucasian referent – 1-year mortality: Breast:OR=1.19; 95% CI 1.03–1.37, Lung:OR=1.10; 95% CI 1.02–1.19, Colorectal:OR=1.19; 95% CI 1.08–1.31, Prostate:OR= 1.12; 95% CI 0.99–1.26. 3-year mortality: Breast:OR=1.22; 95% CI 1.10–1.36, Lung:OR=1.15; 95% CI 1.06–1.24, Colorectal:OR=1.30; 95% CI 1.20–1.41, Prostate:OR=1.18; 95% CI 1.08–1.28).

Based on previous evidence of a mortality benefit among NCI Cancer Center attendees at one and three years from diagnosis¹⁷, we sought to examine whether the benefit was observed for both African Americans and Caucasians. Stratifying our mortality models by race, NCI Cancer Center attendance was associated with a significant decrease in the likelihood of 1- and 3-year mortality for both African Americans and Caucasians, with a somewhat greater decrease for African Americans (1-year mortality – Caucasians: OR=0.77; 95% CI 0.72–0.82, African Americans: OR=0.65; 95% CI 0.55–0.79. 3-year mortality – Caucasians: OR=0.95; 95% CI 0.89–1.00, African Americans: OR=0.74; 95% CI 0.63–0.86) (Figure 2). We further examined the interaction of NCI Cancer Center attendance with race by comparing mortality among African Americans and Caucasians for those patients who attended an NCI Cancer Center and those who did not (Table 4). When stratifying by NCI Cancer Center attendance, we found that the adjusted 1- and 3-year all-cause and cancer-specific mortality excess for African Americans was not evident for attendees (Table 4). Post-hoc analyses to investigate potential explanatory factors for the observed mortality differences revealed a greater likelihood for African Americans to be diagnosed at late stage and a lower likelihood to receive cancer-directed surgery (Data not shown). These differences were largely accounted for by NCI Cancer Center attendance.

DISCUSSION

This study suggests a strong role for place of service in cancer mortality disparities by race. We found an overall, all-cause mortality excess for African American Medicare beneficiaries compared to Caucasians that is similar to the range reported in the literature (20–30%)^{18–28}. These 1- and 3-year mortality disparities were consistently significant across the four major cancers we examined, even while accounting for racial differences in stage at diagnosis, comorbidities, and socioeconomic measures. NCI Cancer Center attendance has been associated with decreased mortality in this population²⁹. The present study demonstrates that this mortality benefit is similar for African Americans and Caucasians. Specifically, this study provides evidence that when African American and

Caucasian cancer patients attend similar types of specialized cancer care settings, all-cause and cancer-specific mortality is similar.

The idea that racial disparities in health outcomes are mediated by different care is well-documented. Most of this evidence stems from studies of differential treatment patterns for minorities. The majority of population-based studies examining cancer treatment differences between African Americans and Caucasians have found African Americans to be less likely to receive surgery, chemotherapy, radiation, and surveillance^{1, 28, 30–38}. A driving force behind these treatment differences appears to be in location of care, in addition to other factors such as treatment choices. That is, African Americans and Caucasians with comparable baseline characteristics attending the same facilities receive similar treatment. However, much less evidence is available to for the role of facilities/health care systems than for specific treatments. Studies within equal access systems, such as the military, have demonstrated an absence of racial disparities for cancer and acute myocardial infarction^{39–41}. An examination of facility-level racial disparities in treatment suggests that the effect of the hospital attended was more influential than race in explaining observed population-level racial disparities^{42–44}.

Focusing on NCI Cancer Centers in assessing the influence of race versus place on mortality is salient for cancer patients given its high degree of specialization for cancer care and research, and the demonstrated clinical benefit associated with these institutions^{29, 45}. Further, examining cancer settings or health care systems makes sense in racial disparities research since organizations and facilities represent actionable units. That is, identifying differences in treatment patterns can only lead to change through systems that provide that treatment.

Although attendance at an NCI Cancer Center obviated the mortality differences between African Americans and Caucasians in our study, racial disparities in cancer are complex and multifactorial. The oncology health disparities model of Polite et al. illustrates the likely interplay of lifestyle and environment factors, personal health beliefs, health system factors, and biological factors³³. In our sub-analysis of potential intervening variables in the overall relation between race and mortality, we found African Americans more likely to be diagnosed at a later stage, less likely to receive cancer-directed surgery, and, as previously reported by this group --- more likely to attend an NCI Cancer Center¹⁰. African Americans have been shown to present at a later stage for breast cancer^{46–48} and colorectal cancer,^{24, 49} and lower surgery rates among African Americans have been noted for lung cancer^{46, 50} and colon/rectal cancer^{30, 49}.

As in any observational research, there is the potential for bias related to unmeasured factors differing between the comparison groups. We accounted for this by adjustment, examining clustered correlations, and performing sub-analyses. Given that this study question is not amenable to randomization, we believe these results are important, although interpreted cautiously. Also inherent in observational research is the potential for lead time bias to distort measures of survival/mortality. Our study attempted to minimize this possibility by controlling for stage at diagnosis. Although such a bias is possible, our results for lung cancer are unlikely to be influenced by lead-time bias because lung cancer currently is not screened for routinely and clinical interventions typically yield only a modest benefit. We were unable to examine patients receiving no hospital-based services and those of other racial/ethnic groups (due to insufficient sample size). Finally, we could not ascertain complete provider utilization longitudinally, such as office-based physician visits.

Our results suggest that when care is received in similar, specialized cancer care settings, African American and Caucasian cancer patients have similar risk for mortality. These

results extend previous research and have implications for efforts to address racial disparities in cancer outcomes. From a clinical perspective, primary care physicians may wish to focus increased effort on early cancer detection in African American patients to address disparities in stage at diagnosis, and on referral patterns that incorporate performance measures, which may optimize cancer care and outcomes. From a policy standpoint, this study augments the impetus for validated, public reporting of quality measures for cancer care. If these results are found to be generalizable to other cancer care settings, then patients, referring physicians, health care organizations, and policy-makers should place a premium on reliable facility-level quality reporting in order to maximize equal benefits for all patients.

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Figure 1.

Predictive models of 1- and 3-year cancer-specific mortality as a function of cancer site in African American Medicare beneficiaries compared to Caucasian beneficiaries with an incident diagnosis of breast, lung, colon/rectal, or prostate cancer as identified in SEER-Medicare data from 1998–2002.

* Adjusted models include the covariates: age at diagnosis, sex, travel time to nearest NCI Cancer Center, predominance of primary care prior to diagnosis, stage, rurality, comorbidities, median household income for ZIP of residence at diagnosis, SEER registry of residence at diagnosis, and year of diagnosis.

Cancer-specific Mortality for NCI Cancer Center Attendees

Figure 2.

Predictive models of 1- and 3-year cancer-specific mortality as a function of NCI Cancer Center attendance in Medicare beneficiaries with an incident diagnosis of breast, lung, colon/rectal, or prostate cancer as identified in SEER-Medicare data from 1998–2002.

* Adjusted models include the covariates: age at diagnosis, sex, travel time to nearest NCI Cancer Center, predominance of primary care prior to diagnosis, stage, rurality, comorbidities, median household income for ZIP of residence at diagnosis, SEER registry of residence at diagnosis, and year of diagnosis.

Table 1

Characteristics of African-American and Caucasian Medicare Beneficiaries With an Incident Diagnosis of Breast Cancer as Recorded in the Surveillance, Epidemiology, and End Results Program From 1998 to 2002 (n=201,305)

Variable	NCI Cancer Center Attendance: No. of Patients (%) ^a			
	Caucasians		African Americans	
	Yes	No	Yes	No
Total	12,690 (6.9)	170,607 (93.1)	1993 (11.1)	16,015 (88.9)
Woman	5631 (44.4)	82,768 (48.5)	867 (43.5)	6944 (43.4)
Predominant primary care ^b	5136 (40.5)	79,391 (46.5)	988 (49.6)	8930 (55.8)
Rurality				
Urban/suburban	10,339 (81.4)	132,361 (77.6)	1968 (98.8)	14,117 (88.2)
Large town/rural	2351 (18.6)	38,246 (22.4)	25 (1.2)	1898 (11.8)
Cancer Site				
Breast	2933 (23.1)	41,662 (24.4)	465 (23.3)	3126 (19.5)
Lung	3178 (25)	39,644 (23.2)	383 (19.2)	3632 (22.7)
Colon/rectum	2407 (19)	40,662 (23.8)	336 (16.9)	3673 (22.9)
Prostate	4172 (32.9)	48,639 (32.9)	809 (40.6)	5584 (34.9)
Charlson Score				
0	8338 (65.7)	104,210 (61.1)	1171 (58.8)	8436 (52.7)
1–2	3041 (24)	43,371 (25.4)	528 (26.5)	4610 (28.8)
3–4	993 (7.8)	16,604 (9.7)	216 (10.8)	2005 (12.5)
≥5	318 (2.5)	6422 (3.8)	78 (3.9)	964 (6)
Cancer-directed surgery	7660 (60.4)	99,213 (58.2)	1072 (53.8)	7985 (49.9)
Stage				
I	2817 (22.2)	42,024 (24.6)	419 (21)	2852 (17.8)
II	1697 (15.7)	27,107 (15.9)	224 (11.2)	2390 (14.9)
III	1814 (14.3)	23,189 (13.6)	249 (12.5)	2283 (14.3)
IV	1943 (15.3)	22,189 (13)	286 (14.3)	2608 (16.3)
Unknown	4419 (34.8)	56,158 (32.9)	815 (40.9)	5882 (36.7)
Age at diagnosis: Median [interquartile range], y	73 [69–77]	75 [70–80]	73 [69–77]	74 [69–79]
Travel time to nearest: Median [interquartile range], min				
NCI cancer center	28 [16–64]	55 [24–137]	10 [7–15]	29 [15–152]
Academic-based care	19 [11–50]	25 [13–70]	7 [5–8]	10 [6–24]
Income of zip code in \$1000: Median [interquartile range]	48.6 [36.1–60.4]	46.4 [33.5–59.1]	31.8 [24.6–41.0]	32.2 [25.1–44.3]
Physician supply by hospital referral region: Median [interquartile range]				
Primary care, per 1000	1.3 [1.0–1.9]	1.2 [0.9–1.6]	1.0 [0.8–2.3]	1.2 [0.8–1.5]
Oncologists, per 100,000	3.4 [2.3–4.3]	2.5 [2.0–3.8]	3.8 [3.8–3.8]	3.7 [2.4–3.8]

NCI indicates National Cancer Institute.

^a NCI cancer Center attendance was defined as having two or more claim-days in the first 12 months following diagnosis.

^b Predominant primary care was defined as having the same number or equal numbers of primary care visits and specialist visits in the 6 months before diagnosis.

Characteristics of African-American (n=18,008) and Caucasian (n=183,297) Medicare Beneficiaries With Breast, Lung, Colorectal, or Prostate Cancer at 1-Year or 3-Years After Diagnosis

Table 2

Variable	Mortality: No. of Patients(%)				
	None	Caucasians Cancer-Specific	Other Cause	None	African Americans Cancer-Specific
1-Year mortality					
Overall	148,86 (81)	27,008 (14.7)	7453 (4)	13,865 (77)	3164 (18)
NCI cancer center attendance					
No	138,084 (80.9)	25,430 (14.9)	7093 (4.2)	12,190 (76.1)	2918 (18.2)
Yes	10,752 (84.7)	1578 (12.4)	360 (2.8)	1675 (84)	246 (12.3)
Cancer site					
Breast	41,827 (93.8)	1622 (3.6)	1146 (2.6)	3205 (89.2)	252 (7)
Lung	22,172 (51.8)	18,195 (42.5)	2455 (5.7)	1807 (45)	1915 (47.7)
Colorectal	35,106 (81.5)	5479 (12.7)	2484 (5.8)	3019 (75.3)	672 (16.8)
Prostate	49,731 (94.2)	1712 (3.2)	1368 (2.6)	5834 (91.3)	325(5.1)
Stage					
I or II	68,545 (93.1)	2567 (3.5)	2533 (3.4)	5325 (90.5)	280 (4.8)
III or IV	27,819 (56.7)	18,801 (38.3)	2455 (5)	2805 (51.7)	2268 (41.8)
Unknown	52,472 (82.6)	5640 (9.3)	2465 (4.1)	5735 (85.6)	616 (9.2)
No. of comorbidities					
0	96,797 (86)	12,942 (11.5)	2809 (2.5)	7868 (81.9)	1401 (14.6)
1-2	35,945 (77.4)	8222 (17.7)	2245 (4.8)	3918 (76.3)	946 (18.4)
3-4	12,028 (68.3)	4131 (23.5)	1438 (8.2)	1490 (67.1)	533 (24)
≥5	4066 (60.3)	1713 (25.4)	961 (14.3)	589 (56.5)	284 (27.3)
3-Year mortality					
Overall	12,217 (73)	37,523 (20)	13,557 (7)	11,745 (66)	4546 (25)
NCI cancer center attendance					
No	122,733 (71.9)	35,003 (20.5)	12,871 (7.5)	10,293 (64.3)	4150 (25.9)
Yes	9484 (74.5)	2520 (20)	686 (5.4)	1452 (72.8)	396 (19.9)
Cancer site					
Breast	38,893 (87.2)	3014 (6.8)	2688 (6)	2846 (79.2)	459 (12.8)
					286 (8)

Variable	Mortality: No. of Patients(%)					
	Caucasians		African Americans		Other Cause	
	None	Cancer-Specific	None	Cancer-Specific	Other Cause	Other Cause
Lung	16,469 (38.5)	22,902 (53.5)	1216 (30.3)	2413 (60.1)	3451 (8)	386 (9.6)
Colorectal	30,651 (71.2)	8256 (19.2)	2446 (61)	1059 (26.4)	4162 (9.6)	504 (12.6)
Prostate	46,204 (87.5)	3351 (6.4)	5237 (81.9)	615 (9.6)	3256 (6.1)	541 (8.5)
Stage						
I or II	63,134 (85.7)	5272 (7.2)	4773 (81.2)	566 (9.5)	5239 (7.1)	546 (9.3)
III or IV	21,645 (44.1)	23,930 (48.8)	1950 (35.9)	2983 (55)	3500 (7.1)	493 (9.1)
Unknown	47,438 (78.3)	8321 (13.7)	5022 (75)	997 (14.9)	4818 (8)	678 (10.1)
No. of comorbidities						
0	88,359 (78.5)	18,588 (16.5)	6867 (71.5)	2098 (21.8)	5601 (5)	642 (6.7)
1-2	31,008 (66.8)	11,311 (24.4)	3274 (63.7)	1366 (26.6)	4093 (8.8)	498 (9.7)
3-4	9793 (55.6)	5410 (30.7)	1180 (53.2)	719 (32.3)	2394 (13.6)	322 (14.5)
≥5	3057 (45.4)	2214 (32.8)	424 (40.7)	363 (34.8)	1469 (21.8)	255 (24.5)

NCI indicates National Cancer Institute.

Table 3

Comparison of Crude and Adjusted Predictive Models of Mortality for African Americans Relative to Caucasians at 1 Year and 3 Years After Diagnosis Among Medicare Beneficiaries (n=201,305) With an Incident Diagnosis of Breast, Lung, Colon/Rectal, or Prostate Cancer as Identified in Surveillance, Epidemiology, and End Results-Medicare Data From 1998–2002

Race/Ethnicity	Crude	Mortality: OR (95% CI)	
		Adjusted Overall ^a	Adjusted Cancer-Specific
1-Year mortality			
Caucasian	1.00 (Referent)	1.00 (Referent)	1.00 (Referent)
African American	1.29 (1.24–1.34)	1.16 (1.10–1.22)	1.13 (1.07–1.19)
3-Year mortality			
Caucasian	1.00 (Referent)	1.00 (Referent)	1.00 (Referent)
African American	1.38 (1.34–1.43)	1.22 (1.17–1.28)	1.23 (1.17–1.30)

OR indicates odds ratio; CI, confidence interval.

^a Adjusted models included the covariates age at diagnosis; sex; travel time to the nearest National Cancer Institute cancer center; predominance of primary care before diagnosis; cancer site; rurality; comorbidities; Surveillance, Epidemiology, and End Results registry of residence at diagnosis; median household income of zip code at diagnosis; and year of diagnosis.

Table 4

Predictive Models of 1-Year and 3-Year Mortality as a Function of National Cancer Center Cancer Center Attendance in African-American Medicare Beneficiaries With an Incident Diagnosis of Breast, Lung, Colon/Rectal, or Prostate Cancer as Identified in Surveillance, Epidemiology, and End Results-Medicare Data^a

	Mortality: OR (95% CI) ^b			
	Attended an NCI Cancer Center		Did Not Attend an NCI Cancer Center	
African Americans vs Caucasians	All-Cause	Cancer-Specific	All Cause	Cancer-Specific
1-Year mortality	0.95 (0.77–1.17)	0.95 (0.76–1.19)	1.15 (1.09–1.21)	1.14 (1.08–1.21)
3-Year mortality	0.98 (0.82–1.18)	1.00 (0.82–1.21)	1.23 (1.17–1.28)	1.26 (1.20–1.33)

OR indicates odds ratio; CI, confidence interval; NCI, National Cancer Institute.

^a Attendance was defined as 2 or more claim days in the first 12 months after diagnosis.

^b Adjusted models included the covariates age at diagnosis; sex; travel time to the nearest NCI cancer center; predominance of primary care before diagnosis; stage; cancer site; rurality; comorbidities; Surveillance, Epidemiology, and End Results registry of residence at diagnosis; and year of diagnosis.