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Colon cancer treatment: Are there racial disparities in an equal-access healthcare system?

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Abstract

Background—In the general US population, blacks and whites have been shown to undergo colon cancer treatment at disproportionate rates. Accessibility to medical care may be the most important factor influencing differences in colon cancer treatment among whites and blacks.

Objective—This study assessed whether racial disparities in colon cancer surgery and chemotherapy existed in an equal-access healthcare system. Additionally, we sought to examine whether racial differences varied by demographic and tumor characteristics.

Design and Setting—Database research using the United States Department of Defense's (DoD) Military Health System.

Patients—Patients included 2,560 Non-Hispanic Whites (NHW) and Non-Hispanic Blacks (NHB) with colon cancer diagnosed from 1998 to 2007.

Main Outcome Measures—Logistic regression was used to assess the associations between race and the receipt of colon cancer surgery or chemotherapy, while controlling for available potential confounders, both overall and stratified by age at diagnosis, sex, and tumor stage.

Results—After multivariate adjustment, the odds of receiving colon cancer surgery or chemotherapy NHBs versus NHWs were similar (OR: 0.75, 95% CI: 0.37–1.53; OR: 0.79, 95% CI: 0.59–1.04; respectively). Additionally, no effect modification by age at diagnosis, sex, and tumor stage were observed.

Limitations—Treatment data might not be complete for beneficiaries who also had non-DoD health insurance.

Conclusions—When access to medical care is equal, racial disparities in the provision of colon cancer surgery and chemotherapy were not apparent. Thus, it is possible that the inequalities in access to care play a major role in the racial disparities seen in colon cancer treatment in the general population.

Keywords

race; colon cancer; treatment; surgery; chemotherapy; equal-access

Introduction

Colorectal cancer (CRC) is the third leading cause of cancer incidence and mortality among men and women in the United States (US).¹ The American Cancer Society estimated that 143,460 new cases and 51,690 deaths would result from CRC in 2012; the majority (72%) of these incidence cases were expected to occur in the colon.¹ Although CRC mortality rates

have declined over time for both sexes among blacks and whites, racial disparities have widened and are not fully understood.^{2, 3} Tumor stage at diagnosis is a strong predictor of CRC mortality; given that blacks tend to be diagnosed with later stage CRC,⁴ racial variation in tumor stage at diagnosis likely accounts for much of the racial disparity in CRC mortality. However, within the same tumor stage the decline in CRC mortality over time has been less among blacks than whites.³ Thus, racial variation in other factors, such as cancer treatment^{5, 6} and follow-up care,⁷ are likely important factors as well.

In the general US population, blacks and whites have been shown to undergo colon cancer treatment at disproportionate rates given the same tumor stage^{6, 8} or after adjusting for tumor stage.^{5, 9} Even though the gap between whites and blacks in the receipt of colon cancer surgery and chemotherapy has lessened over the years, racial differences are still apparent.^{10, 11} Compared to whites, blacks tend to be less likely to receive surgery^{9, 12, 13} and chemotherapy.^{8, 9, 13}

Racial disparities in treatment may be related to patient and physician characteristics, as well as factors related to the health care system.^{14, 15} While physician recommendations on treatment,^{16, 17} patient's knowledge and beliefs on cancer^{18, 19} patient-doctor interaction,^{20, 21} and shared decision making with family and friends^{22, 23} may be related to the receipt of cancer treatment, accessibility to medical care (i.e. cost and location of care,^{24, 25} insurance type²⁴) may be the most important because it is directly related to the availability and implementation of treatment. In the US, blacks tend to be less likely than whites to have health insurance and more likely to be insured through government programs and thus have lower access to medical care.^{24, 26–28} Therefore, blacks may be less likely to receive sufficient and timely treatment than white patients.

In an equal-access healthcare system, different racial/ethnic groups have the same level of access to medical care. Thus, any racial differences in the system may result from factors related to the actual utilization of care rather than the access. Among studies performed in an equal-access system, whites and black colorectal cancer patients were found to undergo surgery, chemotherapy, and radiation therapy at equal rates.^{29, 30} In addition to the studies in equal-access systems, research in “quality seeking” facilities, such as the National Cancer Institute-designated cancer centers and American College of Surgeons National Surgical Quality Improvement Program hospitals, showed similar cancer outcomes between racial/ethnic groups.^{31, 32} Patients who visit these facilities may have good access to care despite their race and the similar outcomes might result from similar treatment between whites and blacks.

The U.S. Department of Defense's (DoD's) Military Health System (MHS) provides equal medical care to all its beneficiaries, regardless of racial background; therefore, the MHS offers an excellent environment to assess whether racial differences in cancer treatment exist given equal access to care. A recent study by Hofmann, et al. found no differences in colon cancer treatment between whites and blacks who were treated at DoD facilities.²⁹ However, several issues that may have affected the results should be investigated further. First, treatment data, which were ascertained from the cancer registry only, may have been incomplete because treatment that occurs multiple months after diagnosis might be under

ascertained; utilization of medical claims data in conjunction with registry data may provide more complete information. Second, Hispanic ethnicity, which may confound the white-black comparison, was not considered. Third, comorbidities, which can affect the use of treatment and are known to vary by race,^{33, 34} were not considered. Furthermore, the potential confounding effects of demographic factors, tumor characteristics, and comorbidities were not considered simultaneously.

The objective of the current study was to use data from both the cancer registry and the medical claims system of the MHS to examine colon cancer treatment among Non-Hispanic White (NHW) and Non-Hispanic Black (NHB) beneficiaries. We aimed to assess whether racial disparities in colon cancer surgery and chemotherapy exist in an equal-access healthcare system; we simultaneously controlled for all available potential confounders, including ethnicity and comorbidities, and assessed whether the relationship between race/ethnicity and treatment varied by age at diagnosis, sex, or tumor stage.

Materials & Method

Data source

This project used consolidated data from two sources: (1) the DoD's Central Cancer Registry (CCR) and (2) the Military Health System Data Repository (MDR). Both data sources contain information from DoD beneficiaries, including active duty members, retirees, National Guard and Reserve members and their dependents. CCR includes all cancer cases that are diagnosed and/or treated at military treatment facilities (MTFs) and information is abstracted from patient records and entered into the CCR database by certified cancer registrars. CCR contains data on demographics (age, gender, race/ethnicity, and marital status), tumor characteristics (stage, grade, and histology), screening, treatment (e.g. surgery, chemotherapy, and radiation), and diagnosis. MDR contains administrative and medical care claims data (i.e. information on clinical diagnoses, diagnostic procedures, prescription medications, and treatment) for in-patient and out-patient services that are provided directly at MTFs or paid for by the DoD at civilian facilities.

The project on which this analysis was based was reviewed and approved by the institutional review boards of the Walter Reed National Military Medical Center, Tricare Management Activity, and the National Institutes of Health Office of Human Subjects Research.

Study population

Patients with colon adenocarcinoma were eligible for this study. The initial study population included 3,311 patients (1,960 men and 1,351 women) who were diagnosed with histologically confirmed colon cancer between 1998 and 2007 in both CCR and MDR. Tumors that were solely reported via death certificate or autopsy were not included. Patients who were neither NHW nor NHB (n= 644), did not have an adenocarcinoma histology (n=97), or had in-situ tumors (n=10) were excluded from the study.

Study variables

Demographic variables were obtained from CCR unless the values were missing then supplemental data from MDR were included. Values missing in both CCR and MDR were classified as unknown. Race was categorized into two mutually exclusive groups based on the definitions used in the 2000 US Census and was classified as NHW and NHB. Marital status at diagnosis was classified as never married, married, other (separated, divorced or widowed), and unknown. Beneficiaries were classified as either active duty or non-active duty (i.e. retiree and dependent) at the time of diagnosis. Affiliated service branch was categorized as Army, Air Force, Marines, Navy, other (i.e. Coast Guard and Public Health Service), and unknown.

Tumor characteristic data were obtained from CCR. Tumor stage at diagnosis was defined according to the American Joint Committee on Cancer staging recommendations and was categorized as stage I, stage II, stage III, and stage IV.³⁵ Tumor grade was classified into four categories, by level of differentiation: well differentiated, moderately differentiated, poorly differentiated, and unknown.³⁵ Colon cancer sites included cecum (C180), ascending colon (C182), hepatic flexure (C183), transverse colon (C184), splenic flexure (C185), descending colon (C186), sigmoid colon (C187), and unknown/colon, NOS (C188–C189).

Treatments compared were determined according to the NIH clinical guideline that does not indicate radiation treatment for colon cancer patients;³⁶ thus, receipt of radiation was not assessed in this study. The receipt of colon cancer surgery and chemotherapy was determined by combining CCR and MDR data and was considered “yes” if either database recorded their occurrence within 12 months post diagnosis. Yes/no concordance between CCR and MDR were 88% for surgery and 82% for chemotherapy.

Comorbidities were considered present if a diagnosis based on the ninth version of the International Classification of Diseases (ICD-9) codes was recorded in inpatient and/or outpatient MDR data during the year prior to colon cancer diagnosis; to reduce the possibility of false diagnoses, a comorbidity had to be recorded in the data at least three times. The level of comorbidity for each individual was calculated based on the Charlson comorbidity index,³⁷ excluding colon cancer diagnosis, and was categorized as having a weighted comorbidity of none, one, or two or more.

Statistical analysis

Chi-square tests of significance were used to compare demographic, tumor, and health characteristics, as well as colon cancer treatment, between the two racial groups. Logistic regression was used to control for potential confounders in assessing the associations between race and the receipt of colon cancer surgery or chemotherapy. Variables that are associated with both race/ethnicity and treatment or could possibly confound results were adjusted for in regression analyses. These variables included age at diagnosis, sex, marital status, active duty status, service branch, tumor stage, tumor grade, colon cancer site, the presence of comorbidities, and recurrence. Regression analyses were conducted both overall and stratified by age at diagnosis (<50 years, 50–64 years, ≥65 years), sex, and tumor stage. The ages of 50 and 65 years were chosen as cut-off points because 50 is the age

recommended for colon cancer screening³⁸ and 65 is the age eligible for Medicare coverage.³⁹ Individuals with Medicare may visit medical facilities not covered by MHS and the data completeness may vary by race/ethnicity. Odds ratios (OR) and 95% confidence intervals (CI) were calculated. All statistical analyses were performed using Statistical Analysis System (SAS) software, Version 9.3 for Windows (SAS Institute, Inc., Cary, North Carolina), with all tests of significance were two-sided and performed at an alpha of 0.05.

Results

A total of 2,560 patients were included in the study (2,047 NHWs and 513 NHBs). Racial differences in demographics and tumor characteristics were observed (Tables 1 and 2). Compared to NHWs, at the time of diagnosis NHBs were more likely to be younger, never married, on active duty, and affiliated with the Army ($p \leq 0.02$; Table 1). Additionally, NHBs were more likely than NHWs to be diagnosed with later stage colon cancer and cancers located in the cecum or descending colon, and less likely to have cancer in the sigmoid colon ($p < 0.01$; Table 2). Tumor grade, level of comorbidity, and recurrence did not differ significantly by race.

Univariate analysis revealed racial differences in colon cancer treatment overall and/or when stratified by demographic characteristics (Table 3). No differences in surgery were seen among NHWs and NHBs overall, however, racial differences were seen by age at diagnosis, with younger NHBs undergoing surgery less frequently than NHWs ($p\text{-value} = 0.04$). Racial differences in chemotherapy were observed overall and by sex in univariate analyses. Overall, NHBs were more likely than NHWs to receive chemotherapy ($p < 0.01$). This difference was seen, however, only among men ($p < 0.01$). After controlling for demographic, tumor, and health characteristics, the odds of receiving surgery or chemotherapy were similar between NHWs and NHBs (Table 4). Additionally, racial differences in the receipt of chemotherapy did not vary by age at diagnosis, sex, and tumor stage. Stratified analyses were not conducted for surgery since almost all NHBs underwent surgery for certain strata.

Discussion

In this study we examined racial disparities in colon cancer surgery and chemotherapy among DoD beneficiaries of all stages of disease who have equal access to care. Univariate analysis revealed that, overall, there were no racial differences in surgery but that NHBs were more likely to receive chemotherapy than NHWs. Additionally, younger NHWs were more likely to undergo surgery compared to NHBs, while NHB men were more likely to receive chemotherapy than their NHW counterparts. However, after multivariate adjustment the odds of receiving colon cancer surgery or chemotherapy were similar between the two racial groups.

Our findings suggest no racial/ethnic differences in the receipt of therapy in MHS beneficiaries. These results are consistent with a previous analysis within the MHS;²⁹ however, the current study utilized not only cancer registry but also medical claims data to provide more complete treatment information and considered potential effects of additional

factors that could influence the receipt of treatment (such as Hispanic ethnicity and the presence of comorbidities). In a previous study within the Veterans Affairs (VA) healthcare system,³⁰ which is another 'equal-access' system, there were also no differences in the receipt of colon cancer treatment between white and black patients. Findings of these studies in an equal-access system contrast that of previous studies in the general population that have found that blacks are less likely to receive surgery and chemotherapy compared to whites.^{8, 9, 12, 13} Accessibility to medical care may play a role in the receipt of disproportionate treatment among whites and blacks in these studies. For example, in a population-based study that examined the effects of race on use of surgery, lack of health insurance and use of Medicaid resulted in decrease receipt of surgical resection among blacks.⁹ In the MHS, all beneficiaries receive health care without charge or for a minimal fee regardless of racial/ethnic background and thus access to care is equal between various racial/ethnic groups. These findings in an equal-access system suggest that racial variations in colon cancer treatment observed in the general population likely result mainly from different levels of access to healthcare, which may affect treatment received.

Beyond access to care, physician's treatment recommendations,^{16, 17} patient-provider communication,^{20, 21} patient-physician race concordance,⁴⁰ shared decision making with family and friends,^{22, 23, 34, 35} and a patient's knowledge, attitude, and beliefs on cancer^{18, 19} may also be related to the racial differences in colon cancer treatment observed in the general population. However, similar treatment utilization among MHS beneficiaries in this study suggests that these factors may not be substantially different between racial and ethnic groups. As a result, it is possible that patient and physician factors may not play a crucial role when access to medical care is equal and treatment is available. Thus, it is likely that racial disparities in colon cancer treatment can be reduced through equal access to care.

Although this study had strengths in using more complete treatment data and considering the potential effects by ethnicity and comorbidities, there were also some limitations. DoD beneficiaries with supplemental health insurance may obtain healthcare services that are not paid for by the DoD; thus, our treatment data may not have been complete. However, during sensitivity analysis when data was confined to DoD beneficiaries with TRICARE Prime, a healthcare program provided by DoD where beneficiaries receive free care or pay minimal fees for services in a HMO-like setting and are thus less likely to receive healthcare services not paid by the DoD, no differences in the receipt of colon cancer treatment were observed between NHWs and NHBs regardless of age at diagnosis, sex, and tumor stage (data not shown). Therefore, it appears that incomplete treatment information might not have substantially affected our results. Accurate timing and duration of chemotherapy and surgery could also not be calculated in this study since only starting and ending month and year (rather than day) of a treatment were available based on the approved IRB protocol. Therefore, our results should be tempered with potential caution because similar treatment frequencies between the different racial groups may, but do not necessarily, mean that the different racial groups received treatment in a comparable manner in terms of treatment timing and duration. Furthermore our study did not address whether black and white patients differed in terms of the time interval between diagnosis and treatment and the frequency and duration of chemotherapy. As a result, further research is warranted.

In conclusion, in a healthcare system where NHWs and NHBs have the same level of access to medical care, racial disparities in the receipt of colon cancer surgery and chemotherapy were not apparent. Our study suggests the possibility that unequal access to care plays a major role in the racial disparities seen in colon cancer treatment in the general population.

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Table 1

Racial comparisons of demographic characteristics among Department of Defense colon cancer cases, 1998–2007 (N=2,560).

Characteristic	Non-Hispanic White (n=2,047)				Non-Hispanic Black (n=513)				p-value ^d
	n	%	n	%	n	%	n	%	
Age at diagnosis									<0.01
<50 years	287	14	122	24					
50–54 years	201	10	65	13					
55–59 years	258	13	65	13					
60–64 years	375	18	94	18					
65–69 years	232	11	67	13					
70–74 years	233	11	47	9					
75–79 years	202	10	31	6					
80+ years	259	13	22	4					
Sex									0.92
Men	1,254	61	313	61					
Women	793	39	200	39					
Marital status at diagnosis									0.02
Never married	56	3	27	5					
Married	1,563	76	378	74					
Other	342	17	91	18					
Unknown	86	4	17	3					
Active duty status at diagnosis									<0.01
No	1,895	93	447	87					
Yes	152	7	66	13					
Service branch ^b									<0.01
Amy	667	33	256	50					
Air force	690	34	130	25					
Marines	85	4	19	4					
Navy	470	23	81	16					
Other	22	1	4	1					
Unknown	113	6	23	4					

a 2-sided p -value.

b Service branch of active duty member or sponsor.

Table 2

Racial comparisons of tumor and health characteristics among Department of Defense colon cancer cases, 1998–2007 (N=2,560).

Characteristic	Non-Hispanic White (n=2,047)				Non-Hispanic Black (n=513)				p-value ^d
	n	%	n	%	n	%	n	%	
Tumor stage									<0.01
Stage I	504	25	92	18					
Stage II	500	24	111	22					
Stage III	552	27	152	30					
Stage IV	309	15	109	21					
Unknown	182	9	49	10					
Tumor grade									0.32
Well differentiated	321	16	67	13					
Moderately differentiated	1,295	63	342	67					
Poorly differentiated	293	14	66	13					
Unknown	138	7	38	7					
Colon cancer site									<0.01
Cecum	437	21	117	23					
Ascending colon	407	20	96	19					
Hepatic flexure	101	5	25	5					
Transverse colon	166	8	47	9					
Splenic flexure	68	3	34	7					
Descending colon	130	6	52	10					
Sigmoid colon	687	34	128	25					
Unknown/Colon, NOS	51	2	14	3					
Comorbidities ^b									0.18
None	1,217	59	328	64					
One	275	13	62	12					
Two or more	555	27	123	24					
Recurrence									0.09
No	1,797	88	436	85					
Yes	250	12	77	15					

^a 2-sided *p*-value.

^b Charlson comorbidity index. Colon cancer was not included in calculation.

Table 3

Racial comparison of colon cancer treatment among Department of Defense colon cancer cases, 1998–2007 (N=2,560).

Study subjects	Treatment	Non-Hispanic White (n=2,047)				Non-Hispanic Black (n=513)			
		Yes	%	Yes	%	Yes	%	Yes	%
All	Surgery	1,995	97	496	97				
	Chemotherapy	940	46	273	53				
Tumor stage									
I	Surgery	503	100	92	100				
	Chemotherapy	12	2	5	5				
II	Surgery	498	100	111	100				
	Chemotherapy	184	37	47	42				
III	Surgery	551	100	151	99				
	Chemotherapy	447	81	124	82				
IV	Surgery	300	97	105	96				
	Chemotherapy	231	75	81	74				
Age at diagnosis									
<50 years	Surgery	284	99	117	96				
	Chemotherapy	209	73	92	75				
50–64 years	Surgery	822	99	219	98				
	Chemotherapy	448	54	124	55				
65 years	Surgery	889	96	160	96				
	Chemotherapy	283	31	57	34				
Sex									
Men	Surgery	1,216	97	303	97				
	Chemotherapy	552	44	163	52				
Women	Surgery	779	98	193	97				
	Chemotherapy	388	49	110	55				

^a 2-sided p-value.

Table 4

Multivariate regression analyses assessing race and the odds of treatment among all study subjects and by tumor stage, age, and sex (N=2,560).

Treatment	Study subjects	OR ^a	95% CI ^b	
Surgery	All	0.75	0.37	1.53
Chemotherapy	All	0.79	0.59	1.04
	Tumor stage			
	I	2.52	0.64	9.98
	II	0.98	0.61	1.60
	III	0.55	0.30	1.00
	IV	0.80	0.40	1.58
	Age at diagnosis			
	<50 years	1.10	0.47	2.59
	50–64 years	0.74	0.48	1.15
	65 years	0.93	0.60	1.44
	Sex			
	Men	0.80	0.56	1.14
	Women	0.74	0.45	1.22

^a Odds ratio (OR) and ^b95% confidence intervals (CI) of race (non-Hispanic black versus non-Hispanic white) and treatment after adjusting for race, year of diagnosis, age at diagnosis (continuous), sex, marital status at diagnosis, active duty status at diagnosis, service branch of active duty member/sponsor, colon cancer site, tumor stage, tumor grade, surgery, chemotherapy, recurrence, and comorbidities. Respective treatments and stratified variables were not included in stratified analysis.