Racial Differences in Colorectal Cancer Survival in the Detroit Metropolitan Area

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BACKGROUND: Colorectal carcinoma is the second most common cause of cancer death with African Americans having lower survival compared with White Americans. The purpose of this study was to investigate the effect of demographics, clinical factors, and socioeconomic status (SES) on racial disparities in colorectal cancer survival in the Detroit Metropolitan Area. **METHODS:** The study population included 9078 individuals with primary invasive colorectal cancer identified between 1988 and 1992 through the Surveillance, Epidemiology, and End Results (SEER) program. Demographics, clinical information, and survival were obtained through SEER. SES was categorized using occupation, educational level, and poverty status at the census tract level. Kaplan-Meier survival curves and Cox proportional hazards regression were used to compare overall survival by race. **RESULTS:** African Americans were more likely to be diagnosed with stage IV disease ($P < .001$), and to reside within poor census tracts ($P < .001$) compared with White Americans. Unadjusted analysis showed that African Americans had a significantly higher risk of death compared with their White American counterparts (hazards ratio [HR], 1.13; 95% confidence interval [CI], 1.07-1.20). After adjusting for age, marital status, sex, SES group, TNM stage, and treatment, race was no longer significantly associated with overall survival (HR, 1.00; 95% CI, 0.92-1.09). Similar results were seen with colorectal cancer-specific survival. **CONCLUSIONS:** Racial disparities in colorectal cancer survival dissipate after adjusting for other demographic and clinical factors. These results can potentially affect medical guidelines regarding screening and treatment, and possibly influence public health policies that can have a positive impact on equalizing racial differences in access to care. **Cancer 2009;115:3791–800. © 2009 American Cancer Society.**

KEY WORDS: survival, colorectal cancer, SEER, racial disparities, socioeconomic status.

Colorectal carcinoma (colorectal cancer) is the third most frequently diagnosed malignancy and the second most common cause of death related to cancer, accounting for almost 10% of annual cancer-related deaths in the United States. The American Cancer Society reports that there were 53,760 new cases of colorectal cancer diagnosed, and 52,180 deaths due to colorectal cancer in 2007.[1] Recent data from the

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National Cancer Institute's Surveillance, Epidemiology, and End Results (SEER) program, and the American Cancer Society's annual Cancer Facts and Figures Report, show that from 1975 through 2004 overall colorectal cancer incidence and mortality rates have decreased.[2] However, for African Americans diagnosed with colorectal cancer in the same time frame, both incidence and mortality rates have increased, and 5-year survival rates have decreased compared with White Americans. According to SEER, colorectal cancer mortality rates in 2004 were 24.8 per 100,000 for African Americans compared with 17.4 per 100,000 for White Americans. From 1996 through 2003, 5-year survival rates for African Americans and White Americans with colorectal cancer were 55.7% and 65.9%, respectively. Furthermore, SEER data also suggest that the 5-year overall survival disparity among African American and White American individuals with colorectal cancer has increased over time. From 1975 to 2003, 5-year survival increased by 14.2 % for White Americans and by only 9.8 % for African Americans.[3]

Many prior studies have aimed at elucidating reasons for the noted racial disparity in colorectal cancer survival, and multiple factors have been implicated including differences in stage at diagnosis, tumor biology, and socioeconomic status (SES) among others.[4-7] Although stage at diagnosis is consistently more advanced among African American colorectal cancer patients compared with White Americans, adjustment for stage alone does not explain all of the racial disparity in survival.[48-105,11] Previous reports show that African Americans diagnosed with colorectal cancer are more likely to reside within lower SES areas than their White American counterparts, suggesting that race may act as a proxy for the influence of SES on survival.[4,5,8] Marcella[8] found that SES differences explained a large portion of the racial disparity in colorectal cancer survival, and in a meta-analysis of SES influences on racial differences in colorectal cancer survival, Du et al[4] demonstrated that after adjusting for SES, no significant survival disparity was observed. It is important to note that individual SES is difficult to assess in large cancer registries such as SEER, and that SES has been inconsistently defined in several studies.[12]

We used data from the Metropolitan Detroit Cancer Surveillance System (MDCSS), a founding member of the SEER program, to determine the important clinical and demographic factors associated with the observed difference in survival among African American and White American individuals with colorectal cancer. The goals of this study were to examine survival differences and the factors associated with those differences among African American and White American individuals diagnosed with a first primary colorectal cancer between 1988 and 1992, with follow-up through 2006, in the metropolitan Detroit area. The MDCSS database provided us the unique opportunity to study survival differences in an urban cohort with a large African American population, and with a period of follow-up ranging from 11 through 18 years.

MATERIALS AND METHODS

Population for Analysis

The study population comprised men and women diagnosed with a first primary invasive colon or rectal/rectosigmoid junction cancer (International Classification of Diseases for Oncology - ICD-O codes C18.0-20.9)[13] from 1988 through 1992, identified through the MDCSS and followed through 2006. The SEER program of the National Cancer Institute reports cancer incidence and survival data on approximately 26% of the United States population. SEER was initiated in 1973, with Detroit as 1 of 7 founding members, and now consists of 17 registries throughout the United States.[14] There were 9078 incident cases of invasive colorectal cancer diagnosed in the Detroit Metropolitan area: 7215 cases (79.5%) were classified as White American and 1863 (20.5%) as African American. Races other than White American or African American were excluded from the study population because of small numbers including American Indian (N = 2), Chinese (N = 13), Japanese (N = 6), Filipino (N = 11), Hawaiian (N = 2), Korean (N = 4), Asian Indian/Pakistani (N = 8), Laotian (N = 1), other Asian (N = 1), Other (N = 5), and Unknown (N = 13).

Definition of Variables

Age at diagnosis was categorized into 3 categories: <49, 49-64, and >64 years old. Marital status was defined as married, other, or unknown.

We used TNM staging and the SEER summary stage to categorize stage at diagnosis. The extent of disease (EOD) variable was used to derive the tumor size, the

lymph node status (N), as well as whether distant disease was present. Because SEER data were not complete regarding the number of positive lymph nodes, we could not further subdivide stage III disease. The SEER summary stage was also used to categorize individuals as having distant or stage IV disease. Histologic tumor grade was defined as grades1, 2, 3, or 4. Grades 1 and grade 2 (well to moderately differentiated) were collapsed to create a low grade category and tumor grade 3 and grade 4 (poorly differentiated) were collapsed to form a high-grade category.

Chemotherapy was classified as none or refused, chemotherapy received or planned, or unknown. Radiation therapy was categorized as none or refused versus radiation received or planned. Information on receipt of chemotherapy and radiation is incomplete within the SEER database because of the finding that most of these treatments are administered on an outpatient basis, and SEER does not routinely collect therapy data in nonhospital settings. It is, therefore, uncertain whether any of the individuals categorized as not receiving chemotherapy or radiation (none/refused) actually received one or the other treatment.

The SEER program categorizes surgery into several subgroups ranging from local tumor resection up to total colectomy. Because many of these subcategories are not very specific in their description or definition of the kind or site of surgery performed, we stratified patients in the analysis as either undergoing some surgery or no surgery at all.

Socioeconomic Status

Given that individual socioeconomic status (SES) data are not available in the SEER database, we used information from the 1990 U.S. census to create a SES variable at the level of the census tract. This variable was named "SES Group", and it served as a proxy for the SES of each individual in the study. The SES Group variable was derived from the 1990 U.S. Census of Population and Housing Summary Tape File 3A, which provided data on occupation, poverty status in 1990, and educational attainment at the level of the census tract (average population 2000 to 8000).[15] Individual census tract information was determined based on the address of residence for each individual at the time of their diagnosis obtained through SEER.

On the basis of the work of Krieger et al,[12] we defined working class census tracts as those with at least 66% of the employed persons having jobs that mainly comprised nonsupervisory roles (eg, administrative support or laborers). Professional census tracts were defined as those areas with at least 34% of the employed persons having jobs that are mainly executive, professional, self-employed, or in supervisory roles. Poor tracts were those areas with at least 20% of the population living below the poverty level, which, in 1990, was defined as $12,674 for a family of 4. Census tracts were also categorized by the level of education achieved by their residents. A census tract was defined as "educated" if 75% or more of the population in that tract had attained at least a high school diploma. A census tract was defined as "undereducated" if it comprised an area where <25% of the population had attained a high school diploma.

As previously defined, SES group categories were constructed yielding a total of 8 specific groups[1]: Working, Poor, Undereducated,[2] Working, Poor, Educated,[3] Working, Nonpoor, Undereducated,[4] Working, Nonpoor, Educated,[5] Professional, Poor, Undereducated,[6] Professional, Poor, Educated,[7] Professional, Nonpoor, Undereducated, and[8] Professional, Poor, Educated. Because some of these categories comprised small numbers, they were collapsed into four mutually exclusive SES groups[1]: Professional (P),[2] Working, Nonpoor, Educated (WNP-E),[3] Working, Non-Poor, Undereducated (WNP-UE), and[4] Working, Poor (WP).

Statistical Analysis

Statistical analyses were carried out using chi-square tests to compare the demographics, tumor characteristics, and treatment modalities for African American and White American patients. *P*-values less than .05 were considered statistically significant. The primary endpoints were overall and cancer-specific survival. Overall survival was defined as the time between the date of diagnosis and death due to any cause; Cancer-specific survival was defined as the time between the data of diagnosis and death due to colorectal cancer. Univariate (unadjusted) analysis of survival was performed using Kaplan-Meier estimates and the log-rank test. Adjusted hazard ratios (HR) and their corresponding 95% confidence intervals

Table 1. Patient Characteristics by Race (N=9078)

Characteristics	WA (N=7215)		AA (N=1863)		*P**
Age at diagnosis, y					<.001
<49	5.5%	(395)	9.2%	(171)	
49-64	24.6%	(1775)	29.3%	(546)	
>64	69.9%	(5045)	61.5%	(1146)	
Sex					.002
Male	52.2%	(3767)	48.3%	(899)	
Female	47.8%	(3448)	51.7%	(964)	
Marital status at diagnosis					<.001
Married	57.6%	(4153)	43.5%	(810)	
Other	39.5%	(2852)	51.4%	(958)	
Unknown	2.9%	(210)	5.1%	(95)	
SES					<.001
Professional	42.5%	(3065)	16.5%	(307)	
Working, non-poor, educated	22.7%	(1637)	3.7%	(69)	
Working, non-poor, under educated	24.7%	(1784)	8.7%	(163)	
Working poor	9.9%	(713)	70.9%	(1321)	
Unknown	0.2%	(16)	0.2%	(3)	
Grade					.30
1 & 2	65.4%	(4718)	65.2%	(1215)	
3 & 4	12.3%	(889)	11.3%	(210)	
Unknown	22.3%	(1608)	23.5%	(438)	
TNM classification					<.001
I	17.0%	(1227)	13.6%	(254)	
II (a & b)	28.1%	(2025)	23.6%	(440)	
III	21.2%	(1533)	19.9%	(370)	
IV	22.0%	(1586)	27.6%	(515)	
Unknown	11.7%	(844)	15.2%	(284)	
Chemotherapy					.01
None/refused	73.3%	(5288)	76.1%	(1418)	
Chemo/planned	26.6%	(1919)	23.8%	(444)	
Unknown	0.1%	(8)	0.1%	(1)	
Radiotherapy					<.001
None/refused	85.6%	(6178)	89.6%	(1669)	
Radiation/planned	14.4%	(1037)	10.4%	(194)	
Surgery					<.001
None	11.4%	(821)	16.6%	(310)	
Some	88.6%	(6394)	83.4%	(1553)	

SES indicates socioeconomic status.
*All tests were performed excluding missing values.

(CI) were estimated using Cox proportional hazards regression. The independent variables considered for the multivariate analysis were as follows: age at diagnosis, sex, marital status, SES group, tumor grade, TNM stage, and receipt of chemotherapy, surgery, and radiotherapy. Because use of radiotherapy had no significant impact on survival and the information on chemotherapy was felt to be incomplete, these variables were excluded from the final survival models.

RESULTS

Table 1 shows the demographic, clinical, and treatment characteristics of the study population stratified by race. All statistical tests were performed excluding missing values. There were statistically significant differences between African Americans and White Americans for all characteristics evaluated except for tumor grade ($P = .30$), for which there was a large amount of missing data (22.3% missing for White Americans and 23.5% for African Americans).

Table 2. Multivariable Predictors of Overall Survival Using Cox Proportional Hazards Modeling Individuals Diagnosed With Colorectal Cancer From the Detroit SEER Database (1988-1992) (N=6,296)

Variable	Comparison	Time since diagnosis, y	HR	95% CI	*P*
Race	Black vs White	Any	1.00	0.92-1.09	.96
Age, y	49-64 vs <49	Any	1.32	1.14-1.53	.0002
	>64 vs <49	Any	2.41	2.10-2.77	<.001
Sex	Female vs male	Any	0.78	0.73-0.82	<.001
Marital status at diagnosis	Other vs married	Any	1.38	1.30-1.47	<.001
SES	WP vs P	Any	1.17	1.07-1.28	<.001
	WNP-UE vs P	Any	1.14	1.06-1.22	<.001
	WNP-E vs P	Any	1.04	0.96-1.12	.37
Grade	III & IV vs I & II	Any	1.38	1.28-1.49	<.001
SEER stage	II vs I	2	1.41	1.25-1.60	<.001
		5	1.30	1.18-1.43	<.001
		10	1.14	1.02-1.27	.02
	III vs I	2	2.52	2.23-2.85	<.001
		5	1.89	1.71-2.08	<.001
		10	1.16	1.02-1.33	.03
	IV vs I	2	7.71	6.81-8.73	<.001
		5	3.91	3.40-4.48	<.001
		10	1.26	0.97-1.64	.09
Surgery	Some vs none	Any	0.37	0.32-0.42	<.001

SES indicates socioeconomic status; WP, working poor; P, professional; WNP-UE, working, nonpoor, undereducated; WNP-E, working, nonpoor, educated; SEER, Surveillance, Epidemiology and End Results; HR, hazard ratio; CI, confidence interval.

With regard to demographics, African Americans were more likely than White Americans to be diagnosed at a younger age (38.5% versus 30.1% diagnosed at less than age 64 respectively, $p \leq .001$). White Americans were significantly more likely to be male and to be married than African Americans. The majority of the African American patients (70.9%) resided within working class, poor census tracts (WP) compared with only 9.9% of White Americans ($P < .001$).

With regard to clinical variables, African Americans were more likely than White Americans to present with stage IV disease at the time of diagnosis (27.6% vs 22.0%, respectively, $P \leq .001$). African Americans were less likely to receive cancer-directed surgery than White Americans (83.4% vs 88.6%, $P \leq .001$), and they were less likely to receive chemotherapy (23.8% vs 26.6%, $P = .01$) and radiation therapy (10.4% vs.14.4%, $P \leq .001$).

Survival Analysis

The median overall survival for the entire cohort was 45 months with a 5-year survival rate of 44%. For overall survival, the unadjusted analysis showed that African American patients had a significantly increased risk of death (HR, 1.13; 95% CI, 1.07-1.20) compared with White American patients. However, in the multivariate model (Table 2), when simultaneously adjusted for age, sex, marital status, SES, tumor grade, TNM stage, and surgical treatment, race was no longer significantly associated with survival (HR, 1.00; 95% CI, 0.92-1.09).

Older patients had lower survival rates than younger patients. Female patients had better overall survival than males (HR, 0.78; 95% CI, 0.73-0.82). Being single, widowed, or divorced at the time of diagnosis conveyed a negative influence on survival compared with being married (HR, 1.38; 95% CI, 1.30-1.47). Residing in a census tract that was either WP or WNP-UE compared with a P tract was associated with poorer overall survival with HRs and 95% CI, respectively, of 1.17; 95% CI, 1.07-1.28 and 1.14; 95% CI, 1.06-1.22. There was no significant difference in risk of death for the P and WNP-E SES groups. Higher grade tumors conveyed a survival disadvantage over lower grade tumors (HR, 1.38; 95% CI, 1.28-1.49). Patients who received any type of surgery were significantly less likely to die than those that did not receive surgery of any kind (HR, 0.37; 95% CI, 0.32-0.42).

Individuals with stage II, III and IV disease had a higher risk of death compared with stage I disease. However, the level of relative risk diminished over time (ie,

Table 3. Multivariate Predictors of Cancer Specific Survival Using Cox Proportional Hazards Modeling of Individuals Diagnosed With Colorectal Cancer From the Detroit SEER Database (1988-1992) (N=6,296)

Variable	Comparison	Time since diagnosis, y	HR	95% CI	*P*
Race	Black vs White	Any	1.06	0.94-1.19	.34
Age, y	49-64 vs <49	Any	1.17	0.99-1.39	.07
	>64 vs <49	Any	1.37	1.17-1.62	<.001
Sex	Female vs male	Any	0.84	0.78-0.92	<.001
Marital status at diagnosis	Other vs married	Any	1.26	1.15-1.37	<.001
SES	WP vs P	Any	1.19	1.05-1.35	.01
	WNP-UE vs P	Any	1.12	1.01-1.25	.04
	WNP-E vs P	Any	0.99	0.88-1.11	.88
Grade	III & IV vs I & II	Any	1.49	1.35-1.64	<.001
SEER stage	II vs I	2	2.35	1.84-2.99	<.001
		5	1.84	1.50-2.25	<.001
		10	1.22	0.83-1.79	.31
	III vs I	2	6.72	5.33-8.47	<.001
		5	4.22	3.48-5.12	<.001
		10	1.94	1.33-2.83	.001
	IV vs I	2	25.05	19.8-31.7	<.001
		5	8.35	6.33-11.0	<.001
		10	1.34	0.74-2.43	.34
Surgery	Some vs none	Any	0.42	0.36-0.50	<.001

SES indicates socioeconomic status; WP, working poor; P, professional; WNP-UE, working, nonpoor, undereducated; WNP-E, working, nonpoor, educated; SEER, Surveillance, Epidemiology and End Results; HR, hazard ratio; CI, confidence interval.

nonproportional hazards).By using stage I as the reference group, individuals with stage II, III, and IV disease had a higher risk of death compared with stage 1 disease, yet the level of risk diminished with increasing time from diagnosis (Table 2). Compared with stage I, stage II patients had HRs of 1.41, 1.30, and 1.14 with 95% CI of 1.25-1.60, 1.18-1.43, and 1.02-1.27 at 2, 5, and 10 years postdiagnosis, respectively. Compared with stage I, stage III patients had HRs of 2.52, 1.89, and 1.16 with 95% CI of 2.23-2.85, 1.71-2.08 and 1.02-1.33 at 2, 5, and 10 years postdiagnosis, respectively. Compared with stage I, stage IV conveyed HRs of 7.71, 3.91 and 1.26, with 95% CIs of 6.81-8.73, 3.40-4.48 and 0.97-1.64 at 2, 5, and 10 years postdiagnosis, respectively.

Table 3 shows the results of the multivariate analysis of cancer-specific survival. The 5-year cancer-specific survival rate was 61%. For cancer-specific survival, the unadjusted analysis showed that African American patients had a significantly increased risk of death (HR, 1.28; 95% CI, 1.18-1.38) compared with White American patients. However, in the multivariate model, when simultaneously adjusted for age, sex, marital status, SES, tumor grade, TNM stage, and surgical treatment, race was no longer significantly associated with cancer-specific survival (HR, 1.06; 95% CI, 0.94-1.19). In addition, the result for each specific variable for the cancer-specific survival model was similar to that seen in the overall survival model.

DISCUSSION

The initial univariate analysis demonstrated that African American patients with colorectal cancer in metropolitan Detroit had significantly worse survival than White American patients. After controlling for multiple variables, including SES, these survival differences were no longer statistically significant. Furthermore, when adjusting for either SES alone or stage alone, risk no longer had a significant impact on survival. The 2002 Institute of Medicine's report highlighted racial disparities in healthcare.[16] Multiple authors have evaluated survival differences between African Americans and White Americans with colorectal cancer showing overall poorer survival for African Americans (3;8-10;17).

The strongest predictor of excess risk of death for colorectal cancer patients has been consistently shown to be stage at diagnosis, which accounted for >50% of the excess mortality in some studies.[8,9] Similarly, when our data was adjusted for race and TMN stage alone (taking into account the nonproportional hazards for stage), race no longer had a significant impact on survival (HR, 1.06: 95% CI, 0.99-1.12; data not shown). Besides the obvious

benefits of early stage at diagnosis, detecting tumors earlier reduces both short-term and long-term morbidity and mortality by increasing the chances of successful curative surgeries and decreasing the number of treatment-related complications such as bowel obstruction, perforation, or excessive bleeding. Data from the 2000 National Health Interview Survey[18] indicate that African Americans and White Americans report similar rates of screening with either occult blood stool sampling or colorectal endoscopy. In addition, between 1987 and 2000, African Americans actually had improved their rates of screening for colon cancer as compared with White Americans. These findings, along with data suggesting that African Americans present with more proximal tumors[19] and at a younger age, has heralded the suggestion among some experts to recommend that African Americans receive colonoscopies as first-line screening starting at age 45.[20]

Although the relatively poor outcomes associated with advanced stage alone accounted for all of the excess mortality experienced by African American patients seen in our study, the differences in survival by stage decreased dramatically over time from diagnosis. Tables 2 and 3 show that at 10 years post diagnosis, survival differences for individuals with stage II, stage III, or stage IV versus stage I disease were diminished for both overall and cancer-specific survival. The clinical implications of these findings are unknown, although it is possible that the higher mortality associated with advanced disease takes its full toll closer to the time of diagnosis, and if patients survive beyond the first few years of their disease, other factors such as comorbid diseases may make a greater contribution to mortality.

Relatively few studies have looked specifically at SES as a prognostic indicator for colorectal cancer survival. In a meta-analysis of racial disparities in colorectal cancer survival, Du et al found after adjusting for multiple confounding variables, including SES, that there was only a marginally higher hazard of death for African Americans compared with White American colorectal cancer patients.[4] When our data was adjusted for race and SES group alone, race no longer had a significant impact on survival (HR, 0.99; 95% CI, 0.92-1.06; data not shown). In previous work using a similar sample population from the same years, we have shown that SES group is independently related to colorectal cancer stage at presentation, which explains why both SES and TNM stage alone account for the differences in survival between African Americans and White Americans with colorectal cancer.[15]

Studies that have looked at SES as a factor in colorectal cancer survival have defined SES in a myriad of ways that make it difficult to interpret and compare their results.[9,11,21] Mayberry et al used self-reported income and family structure to define SES, while other investigators used Census or Medicaid and Medicare based information. Our study used each individual's address at the time of diagnosis to categorize them into corresponding census tracts and subsequently into SES groupings based on the sociodemographic characteristics of that census tract. A strength in using census tract data is that the definition of SES categories for census tracts can be reproduced across studies, thereby eliminating inconsistencies in the definition of SES. A major limitation, though, is that there are likely to be residents of each census tract who do not fit into the definition of SES defined for their particular tract.

Other variables associated with decreased survival among individuals with colorectal cancer in our study included increasing age at diagnosis, tumor grade, marital status, and treatment disparity. Age at diagnosis is an important predictor of survival for patients with colorectal cancer[9,10,17,22] and our data clearly supports this observation. Aging is associated with decrease in many bodily functions and the elderly generally do not have as much physical reserve to combat a serious illness such as colorectal cancer as do their younger counterparts. In addition, proximal colon cancers become relatively more common as age increases and such tumors are less likely to be diagnosed at an early stage, potentially leading to increased mortality rates seen among older patients with colorectal cancer.[19,23] African Americans are more likely to be diagnosed at a younger age than White Americans, which is supported by our data.[3] The implications of this are uncertain, but, coupled with the increased likelihood that African Americans have proximal colon tumors led the American College of Gastroenterology to recommend colonoscopy as a primary screening tool for colorectal cancer in African Americans along with starting screening at an earlier age. In regards to treatment, age alone does not increase the risks associated with primary tumor resection as described by McGinnis,[24] and aggressive surgical options should be considered, regardless of age, depending on the presence of comorbidities.

High-grade tumor is also associated with worse outcomes. Alexander et al found that African Americans with high-grade colon cancers were more likely to die than White Americans with the same tumor grade.[6] In a study by Chen et al, however, African Americans were significantly less likely than White Americans to have poorly differentiated tumors.[25] Our data indicate high-grade tumors are associated with poorer survival, but there was no significant difference in distribution of tumor grade by race; however, a substantial proportion of individuals were missing information on tumor grade.

The relation between marital status and colon cancer survival has not been completely explained, and data on the subject are sparse. In a Danish study by Johansen et al,[26] being married was found to have a positive influence on survival among colorectal cancer patients. Our data show similar findings, with married patients having a significantly increased survival as compared with their nonmarried counterparts. Furthermore, relatively more White Americans tended to be married at the time of diagnosis than African Americans. The significance of these data is uncertain, but they may suggest the potential positive influence of social support and family.

Disparity in the availability of cancer-directed treatment for colorectal and other cancers has been previously described.[6,27] Most studies show that African Americans with colorectal cancer receive less surgery, chemotherapy, and radiotherapy than White Americans.[10,28,29] These findings are alarming especially because surgery is the definitive first-line treatment for colorectal cancer. Even when Alexander et al[30] controlled for use of surgery, racial disparities in survival were still seen, leading the authors to conclude that differences in tumor biology and sociodemographic variables may play an important role in explaining survival disparities. It is also of interest that when access to and receipt of healthcare is equalized as in a system such as the Veterans Affairs Medical Centers, racial disparities in colorectal cancer survival are not observed.[22,31] Other patient comorbidities and pre, intra, and postoperative complications, such as bowel obstruction and perforation, all add morbidity and mortality to any surgery. McGinnis suggests in her article that limiting comorbidities and operative complications along with aggressive surgical intervention in the elderly and earlier detection of tumors is of utmost importance in increasing colorectal cancer survival.[24]

In our study, African Americans were less likely to receive surgery, radiation therapy, and chemotherapy than White American individuals. Because information on chemotherapy within the SEER database is limited, we excluded the information on chemotherapy from our multivariate analysis. Only surgery was found to have a significant impact on survival within our analysis with the use of radiotherapy having no significant association. The reason why African Americans do not receive similar treatments as White Americans is not known. Baldwin et al examined this subject, using a cohort of Medicare-insured patients to reduce healthcare access bias, and found that while African Americans and White Americans seek medical oncology consultation equally, they do not obtain subsequent therapy equally.[29] Understaging, lack of environmental and social support, differential tolerance to therapy, and individual preference to therapy have been implicated in explaining racial disparities in regards to cancer directed treatment,[5,29] and a combination of these factors likely plays a role in receipt of treatment. These issues should be addressed in future research.

Our study provides an examination of survival among individuals with colorectal cancer using a large population based cohort. The MDCSS includes a large proportion of African Americans, which allows for study of cancer disparities. In addition to a large sample size, the length of follow-up for our cohort, >10 years, allows for more comprehensive assessment of overall survival and cancer-specific survival. Limitations of our study include the lack of specific information on treatment including specific chemotherapy regimens, length of treatment with either chemotherapy or radiotherapy, and lack of data on comorbid conditions. Complications during or after primary therapy with surgical resection, which affect morbidity and mortality, are not collected in SEER. In addition, low SES may be associated with increased numbers of comorbid conditions, including hypertension, obesity, physical inactivity, and diabetes,[32-34] which are associated with poorer survival[35-37] and are not collected by SEER. Although the causal factors of these comorbid conditions are not completely known, African Americans suffer from many of these conditions in excess compared with White Americans.[38] Low levels of physical activity and the metabolic syndrome, which includes obesity, are associated with higher rates of colorectal cancer, decreased overall survival, and increased rates of recurrence,[39,40] and

African Americans are more likely to be obese and physically inactive than White Americans.[41,42] To what extent these and other comorbid conditions contribute to the excess mortality observed for African Americans with colorectal cancer is uncertain.

In summary, our study shows that multiple factors account for decreased colorectal cancer survival observed among African Americans. Advanced stage at diagnosis contributed to poorer survival experienced by African American patients, especially in the first few years after diagnosis, but other factors, including SES and treatment, were also associated with the observed decreased survival for African Americans. Lower SES is associated with decreased access to adequate healthcare as lack of insurance severely limits one's ability to obtain adequate screening opportunities and appropriate treatment. The Breast & Cervical Cancer Prevention & Treatment Act, passed in 2000 (Public Law 106-354), which allows every patient diagnosed with breast and cervical cancer to become automatically eligible through Medicaid for medical assistance, provides precedent for future public policy to include all cancers into such programs so that every patient may receive timely and effective treatment. Furthermore, the Centers for Disease Control and Prevention's National Breast and Cervical Cancer Early Detection Program (NBCCEDP) provides free breast and cervical cancer screening and follow-up diagnostic testing for those who would otherwise not have access to these services (http://www.cms.hhs.gov/MedicaidSpecialCovCond/02_BreastandCervicalCancer_Preventionand-Treatment.asp). More aggressive screening and equal treatment opportunities would do much to remedy the survival disparity seen among African American and White American individuals with colorectal cancer.

Conflict of Interest Disclosures

The authors made no disclosures.

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