

Disparities in Colorectal Cancer Disease Burden and Stage at Presentation among 18 to 50-Years-Old Black and White Americans

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ABSTRACT

BACKGROUND: The overall colorectal cancer (CRC) disease burden has been significantly increased among young adults <50 years in the United States. The increasing rates of young-onset colorectal cancer have attracted substantial research; however, little is known about the racial disparities of colorectal cancer disease burden and stage of presentation among the Black and White adult Americans <50 years. Therefore, we sought to determine the disparities in colorectal disease burden and presentation stage among Black and White Americans of 18 years to 50 years.

METHODS: Using the data from the SEER (Surveillance, Epidemiology, and End Results) database from 2000 to 2016, we estimated the disparities in colorectal cancer disease burden and stage of presentation among Black and White adult Americans (18 years to 50 years).

RESULTS: From 2000 through 2016, there were 22,184 cases of colorectal cancer among Black and White Americans 18 years to 50 years. Of all incident cases, 20.21% ($n = 4,483$) were diagnosed among Black Americans, and 79.79% ($n = 17,701$) were diagnosed among White Americans. Most of the incident cases (48.58%, $n = 10,776$) were those 46 years to 50 years, and 39.58% ($n = 8,781$) of cases were those 36 years to 45 years. Of all colorectal cancer cases, 11.13% (2,327) were diagnosed at an early cancer stage, and 88.87% (18,584) were diagnosed at a late cancer stage. Among those who presented at an early stage ($n = 2,327$), 20.89% ($n = 484$) were Black Americans, and 79.11% ($n = 1,841$) were White Americans. Among those who presented at a late stage ($n = 18,584$), 19.85% ($n = 3,688$) were Black Americans, and 80.15% ($n = 14,896$) were White Americans.

CONCLUSIONS: The SEER database analysis found that among the young Americans (18 years to 50 years), whites have a greater colorectal cancer disease burden than their Black counterparts. Also, young Americans 18 years to 50 years of age are more likely to be diagnosed at the late stage of the disease.

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KEYWRDS

Colorectal cancer (CRC); SEER (Surveillance, epidemiology, and end results) database; Colorectal cancer disease burden; Colorectal cancer stage of presentation; Colorectal cancer racial disparities

INTRODUCTION

Colorectal cancer is a significant contributor to and is the third leading cause of cancer-related mortality in the United States [1]. Annually, more than 130,000 Americans are diagnosed with colorectal cancer, and more than 49,000 die from the disease each year [1]. The diagnosis, management, and treatment of colorectal cancer are significantly associated with substantial healthcare costs, with approximate annual national expenditures exceeding \$14 billion [2].

There have been longstanding disparities in colorectal cancer disease burden and resulting disease outcomes between White and Black populations in the United States [1,3]. Since the mid-1980s, colorectal cancer incidence among Black Americans surpassed that of their White counterparts. In 2010, colorectal cancer incidence among Black Americans was 63.8 per 100,000, compared to 50.9 per 100,000 among White Americans [1]. Additionally, Black Americans experience excessive colorectal cancer disease burden, with the lowest survival rates and the highest mortality than any other racial or ethnic group [1,4]. In 2010, the rate of colorectal cancer-related mortality was 29.4 per 100,000 among Black Americans compared to 19.2 per 100,000 among White Americans [1].

Five-years disease survival from colorectal cancer varies by cancer stage at the time of presentation. Five-years survival is 90% for those diagnosed at stage I, and it is 13% for those diagnosed with advanced disease [1]. The stage of disease presentation also varies by race. Historically, Black Americans have been more likely to be diagnosed at late disease stages than White Americans, contributing to the limited cancer treatment options, consequently leading

to poorer survival outcomes [1,5]. The disparities in colorectal cancer disease burden, stage at presentation, and outcomes between Black and White Americans have been ascribed to several factors, including genetic predisposition among Black Americans to the disease, more prevalent cancer risk factors among Black Americans (e.g., obesity, low physical activity, low fiber diet, cigarette smoking), and disparities in access to preventive and healthcare services (e.g., cancer screening) [6,7].

There have been many efforts to address these colorectal cancer disparities, including disseminating more information about colorectal cancer risk factors and increasing screening among Black Americans [7-9]. Improved colorectal cancer screening compliance has resulted in reducing the disease prevalence and improved survival, as cancers are being diagnosed at earlier stages [10]. Accordingly, disparities in colorectal cancer incidence and disease stage at presentation are decreasing between Black and White Americans [10]. Since 2004, the absolute difference in colorectal cancer incidence between Black and White Americans has trended downward by 3.8% per year [10]. Moreover, the late disease presentation among Black Americans decreased substantially from 1975 to 2012 [10]. In fact, as of 2012, Black and White Americans reported equivalent colorectal cancer screening rates [9] and late-stage disease presentation was reported to be equal between the two groups [10,11].

Although the overall incidence of colorectal cancer has declined from 2007 to 2016, this decrease in colorectal incidence has been observed more prominently among Americans older than 50 years [1,12-14]. However, numerous studies have demonstrated that the colorectal cancer disease burden has increased among Americans 50 years and younger [15-17]. Amri et al. [18] suggest that

most colorectal cancer cases diagnosed among young individuals are advanced-stage disease and have higher metastasis rates, extramural vascular invasion, and a greater propensity to involve surrounding lymph nodes. Therefore, this younger group of Americans is at increased risk of being diagnosed with advanced stages of colorectal cancer [18,19].

It is unclear to what extent there are disparities in colorectal cancer burden and stage at presentation among Black and White Americans 50 years and younger. Therefore, this study was conducted to examine national trends in colorectal cancer disease burden and disease stage at the time of presentation among Black and White Americans 18 to 50 years.

METHODS

Participants

This study accessed data from the National Cancer Institute (NCI) Surveillance, Epidemiology, and End Results (SEER) 18 databases with histologically confirmed colorectal cancer cases from January 1, 2000, through December 31, 2017. SEER 18 registry includes data from 18 regions of the United States and provides a broad demographic and geographic coverage of the sample. The current study accessed these data and offered inclusion criteria: those identified as Black or White Americans of ages 18 to 50 years and had a histologically-confirmed diagnosis of colorectal cancer.

Instrument

The SEER database represents 34.7% of the US adult population and includes an overrepresentation of minority racial and ethnic groups, foreign-born, and urban populations to ensure adequate representation of these interest groups. The SEER database is comparable with the United States population regarding education (16% vs. 14.6% with less than a high school diploma) and income

level (14.1% vs. 14.3% below the poverty level), respectively.

Data from the SEER 18 database registry included patient demographics such as age, gender, and race. Only those 18 years to 50 years were included in the study because colorectal cancer incidence has been increasing among Americans younger than 50 years [19]. The study sample was stratified by age groups (18 years to 25 years, 26 years to 35 years, 36 years to 45 years, and 46 years to 50 years) to identify colorectal cancer prevalence by age group. This age stratification rationale is to further identify the age group under 50 with greater disease burden and understand its possible etiology. Studies have demonstrated that the possible reasons for the increase in the disease burden among young Americans could be a genetic contribution or the under-detection of colorectal cancer at an earlier age due to lack of screening recommendations in this age group [19].

The primary outcome variables were age-adjusted colorectal cancer disease burden and stage of disease presentation at diagnosis. For the cancer stage at the time of presentation, tumors were categorized as early-stage or late-stage using the SEER database "historic stage A variable" to describe the disease stage. Since this variable was only included from 2000 through 2015, the "Derived_SEER_Cmb_Stg_Grp_2016" is the stage variable was used for 2016 to describe the disease stage.

"Early-stage disease" was defined as a localized disease, confined locally to the colon/rectum or intraluminal extension without lymph node involvement. "Late-stage disease" was defined as those presenting with cancer extending beyond the colon/rectum or involving the remote body parts.

Data Analysis

SAS Version 9.4 and SEER*Stat Version 8.3.6.1 were used to calculate age-related colorectal cancer cases and stage of disease presentation for Black and White Americans for each year, from 2000 through 2016, to outline trends among those 18 years to 50 years. The colorectal cancer disease burden and disease stage difference was also calculated by race, age, and gender. The trends in colorectal cancer incidence rate were examined by race for each year. Cochran Armitage was used for trend analyses to reveal trends in colorectal cancer incidence by race from 2000 through 2016. The autoregressive integrated moving average (ARIMA) model was used to assess the average and variability of the response over time. The associations between cancer status and Stage at Presentation after adjusting demographics variables were tested using a multiple logistic regression model. The parameter estimated were obtained by the maximum likelihood method. In addition, Poisson regression with the log-linked model was used to compare the rates as a function of the year of diagnosis. All data analyses were conducted using SAS 9.4, version 15.1. All statistical tests at $p < 0.05$ were considered to be significant.

RESULTS

From 2000 through 2016, there were 22,184 cases of colorectal cancer among Black and White Americans 18 years to 50 years. Of all colorectal incident cases among those 18 years to 50 years, 20.21% ($n = 4,483$) were

diagnosed among Black Americans, and 79.79% ($n = 17,701$) were diagnosed among White Americans. The frequency of colorectal cancer cases was stable from 2000 through 2011, but there was a gradual decrease in colorectal cancer cases from 2011 to 2016 (Table 1).

The overall incidence rate of colorectal cancer was 2.43 per 10,000. The annual incidence rate of colorectal cancer was higher among White Americans than Black Americans 18 to 50 years. The annual colorectal cancer incidence remained relatively stable from 2000 to 2010, and then it started trending down (Figure 1).

Year of Diagnosis	Frequency	Percent
2000	1,526	6.20%
2001	1,608	6.53%
2002	1,570	6.38%
2003	1,650	6.70%
2004	1,617	6.57%
2005	1,703	6.92%
2006	1,630	6.62%
2007	1,666	6.77%
2008	1,599	6.50%
2009	1,624	6.60%
2010	1,592	6.47%
2011	1,501	6.10%
2012	1,375	5.59%
2013	1,314	5.34%
2014	1,155	4.69%
2015	859	3.49%
2016	627	2.55%

Table 1: Frequency of colorectal cancer among white and black Americans (18 years to 50 years) by year of diagnosis.

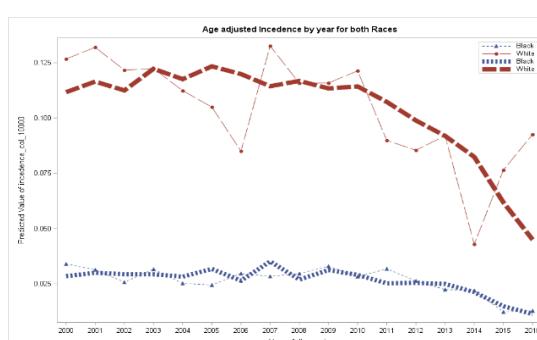


Figure 1: Age-adjusted and Age-unadjusted* Colorectal cancer incidence rate per 10,000 by year and race. Note: * Thinner dashed red and blue lines represent unadjusted rates.

Disparities in colorectal cancer disease burden by race, age, gender, and stage at presentation

Of all incident cases, 20.21% (n = 4,483) and 79.79% (n = 17,701) colorectal cancer cases were diagnosed among Black and White Americans, respectively (Table 2). Almost half of these cases (48.58%, n = 10,776) were those 46 years to 50 years, and 39.58% (n = 8,781) of cases were those 36 years to 45 years. Similarly, 10.04% of cases (n = 2,227) were those 26 years to 35 years, and 1.80% of cases (n = 400) were those 18 years to 25 years. More than half of all colorectal cancer cases (55.54%, n = 12,320) were male, and 44.46% (n = 9,864) were female. Of all colorectal cancer cases, 11.13% (2,327) were diagnosed at an early cancer stage, and 88.87% (18,584) were diagnosed at a late cancer stage (Table 2).

Characteristic	Frequency (Percent)
Race	22,184 (100%)
White	17,701 (79.79%)
Black	4,483 (20.21%)
Age Group (in Years)	22,184 (100%)
18 to 25	400 (1.80%)
26 to 35	2,227 (10.4%)
36 to 45	8,781 (39.58%)
46 to 50	10,776 (48.58%)
Gender	22,184 (100%)
Male	12,320 (55.54%)
Female	9,864 (44.46%)
Stage at Presentation	20,911 (100%)
Early stage	2,327 (11.13%)
Late stage	18,584 (88.87%)

Table 2: Colorectal cancer frequency by race, age, gender, and stage at presentation.

Black Americans 18 years to 50 years were 1.34 times more likely to be diagnosed with colorectal cancer than their White American counterparts (95% CI = 1.23-1.45) (Table 3). There was no difference in colorectal cancer cases between those 18 years to 25 years and those 46 years to 50 years. However, those 26 years to 35 years (OR = 0.87, 95% CI = 0.78-0.93) and those 36 years to 45 years (OR = 0.88, 95% CI = 0.82-0.94) were less likely to develop colorectal cancer compared to those 46 years to 50 years. Similarly, females were more likely to develop

colorectal cancer than males (OR = 1.297, 95% CI = 1.22-1.38) (Table 3).

Variable	Odds Ratio	95% Confidence Interval	
Race			
White vs. Black	1.34	1.23	1.45
Age			
18-25 vs. 46-50	0.91	0.72	1.14
26-35 vs. 46-50	0.87	0.79	0.97
36-45 vs. 46-50	0.88	0.82	0.94
Gender			
Female vs. Male	1.30	1.22	1.38

Table 3: The Likelihood of colorectal cancer by race, age, and gender.

Colorectal cancer stage at presentation disparities by race, age, and gender

Among those who presented at an early stage (n = 2,327), 20.89% (n = 484) were Black Americans, and 79.11% (n = 1,841) were White Americans. Among those who presented at a late stage (n = 18,584), 19.85% (n = 3,688) were Black Americans, and 80.15% (n = 14,896) were White Americans. Regarding age, among those who presented at an early stage, 1.03% (n = 24) were 18 years to 25 years, 8.81% (n = 205) were of 26 years to 35 years, 39.06% (n = 909) were 36 years to 45 years, and 51.10% (n = 1,189) were 46 years to 50 years. Among those who presented at a late stage, 1.90% (n = 353) were of 18 years to 25 years, 10.06% (n = 1,869) were of 26 years to 35 years, 39.65% (n = 7,368) were 36 years to 45 years, and 48.40% (8,994) were of 46 years to 50 years. Regarding gender, among those who presented at an early stage, 56.17% (n = 3688) were males, and 43.83% (14,896) were females. Similarly, among those who presented at a late stage, 54.92% (n = 10,207) were males, and 45.08% (8,377) were females.

Overall, regarding race, there was no difference in colorectal cancer stage at presentation between Black Americans and White Americans (OR = 0.94, 95% CI = 0.84-1.04) (Table 4). Regarding age, those 18 years to 25

years were more likely to be diagnosed at a late stage of colorectal cancer compared to those 46 years to 50 years ($OR = 1.94$, 95% CI = 1.28-2.95). Similarly, those 26 years to 35 years were more likely to be diagnosed at a late stage of colon cancer than to those 46 years to 50 years ($OR = 1.20$, 95% CI = 1.03-1.41). There was no difference between those 36 to 45 years and those between 46 years to 50 years in colorectal cancer stage presentation. Regarding gender, there was no difference between males and females in colorectal cancer stage presentation ($OR = 1.05$, 95% CI = 0.96-1.15).

Variable	Odds Ratio	95% Confidence Interval	
Race			
Black vs. White	0.94	0.84	1.04
Age (in Years)			
18 to 25 vs. 46 to 50	1.94	1.28	2.95
26 to 35 vs. 46 to 50	1.20	1.03	1.40
36 to 45 vs. 46 to 50	1.07	0.98	1.17
Gender			
Female vs. Male	1.05	0.96	1.14

Table 4: The Likelihood of late stage of colorectal cancer presentation by race, age, and gender.

DISCUSSION

This study used a large US database registry to identify trends from 2000 to 2016 regarding colorectal cancer disease burden and disease stage at the time of presentation among Black and White Americans 18 years to 50 years. The number of colorectal cancer cases declined from 2000 to 2016. Previous studies attribute the decline in cases to several factors, including advances in the medical field, modification in lifestyle risk factors, and efforts to improve public awareness for colorectal cancer prevention [19].

Although the colorectal cancer incidence has improved from 2000 to 2016, some disparities in colorectal cancer disease burden and stage at presentation persist. First, this study suggests that there are some colorectal cancer disparities between Black and White Americans. White

American males are more prone to be diagnosed with colorectal cancer at a younger age than their Black counterparts. Thus, the dominant factor driving an increase in overall colorectal cancer disease burden among young Americans has been an increasing colorectal cancer among Whites. These findings are per previous studies' conclusions that a significantly higher proportion of young white adults in the United States are diagnosed with colorectal cancer compared to the Blacks; thus, Whites are driving the incidence changes [20]. However, May et al. demonstrated that the historic Black-White disparities in the colorectal cancer stage at presentation had been resolved [18,20]. Moreover, another study suggests that the colorectal cancer prevalence is much higher among people of the age group 46 years to 50 years than those younger [20].

Second, this study suggests that young Americans are more likely to be diagnosed with colorectal cancer at an advanced disease stage than at the early stage. This finding is consistent with research that suggests that colorectal cancer is more advanced and aggressive among patients younger than 50 years [9,20]. The potential etiology for more progressive disease presentation in this group includes age-related differences in tumor biology and under-detection of disease, using the currently available screening methodology and recommendations [9,20]. Moreover, the current study reveals that there appears to be no difference in the colorectal cancer stage at presentation between males and females. There also appears to be no difference between Black and White Americans.

Discrepancies in the colorectal cancer stage at the presentation by race appear to have diminished; this suggests that prevention and control efforts for colorectal cancer have effectively addressed the mutable risk factors that mainly affect the stage presentation.

Also, this study suggests that females are more likely to develop colorectal cancer than males. These findings are consistent with other data suggesting the females are at a greater risk of developing pure right-sided colon polyps and ultimately colon cancer, and that females are less likely than males to undergo colorectal cancer screening in the United States [21,22].

Many factors can influence colorectal cancer development among those younger than 50 years, such as: dietary habits, lifestyle, environmental factors, and genetics [12,23-29]. Cigarette smoking, increased alcohol intake, low physical activity, low fiber diet, and high animal fat diet are major risk factors associated with colorectal cancer development [30-33]. These behaviors are more frequently practiced among Black Americans than White Americans; these behaviors might contribute to disparities in colorectal cancer cases [30-33].

FUTURE IMPLICATIONS

The task now is to identify etiological differences in the colon and rectal cancer between Black and White Americans that effectively reduce colorectal cancer disparities by addressing rising colorectal cancer cases among the young Americans [24,34]. Moreover, there is a need to develop interventions that will continue to bend the incidence curve among Black and White Americans and help maintain equity in the stage of disease presentation [24,34].

LIMITATIONS

The lack of ethnicity data limits this study. We studied disparities by classifying Americans into Black and White racial categories and did not study colorectal cancer indicators separately by ethnicity. In general, Hispanics have a lower colorectal cancer disease burden but are diagnosed at the late stage of cancer compared to non-

Hispanics. Therefore, the inclusion of ethnicities in this study might have changed the disparities in colorectal cancer and stage at presentation between Black and White Americans.

Also, the SEER database includes colorectal cancer data from population-based registries covering 34% of the United States population; the study findings cannot be generalized to all the US population. However, the SEER database is the most reliable and powerful tool to reflect and investigate national cancer disparities compared to the other cancer registries.

CONCLUSION

This study suggests that the overall colorectal cancer disease burden is trending down among the Black and White Americans 18 years to 50 years from 2000 through 2016. This study also indicates that more young Americans 18 years to 50 years are being diagnosed at the late stage of colorectal cancer. Moreover, colorectal cancer disease burden among White American adults has surpassed their Black counterparts.

AVAILABILITY OF DATA

The study data source was the SEER (Surveillance, Epidemiology, and End Results) registry available online at <https://seer.cancer.gov/registries>.

CONFLICT OF INTEREST

The authors have no conflict of interest.

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