RESEARCH LETTER

Disparities in Colorectal Cancer Incidence in the United States, 2000–2019

Colorectal cancer (CRC) is the second leading cause of cancer mortality in the United States.[1] Previous literature showed a significant changes in the epidemiology of CRC, especially increasing incidence in younger adults.[2,3] However, there are limited data on CRC incidence disparities among various racial and ethnic groups. To our knowledge, this is the most updated and first study to objectively analyze the changing trends in incidence among different racial and ethnic groups and stratify them into age groups to better explore reasons behind these trends, which prior studies have shown to be significant.[4] Our study aims to perform a race-specific, age-specific, and sex-specific time trend analysis of CRC incidence rates from 2000 through 2019.

This study analyzed data from Centers for Disease Control and Prevention Wide-Ranging Online Data for Epidemiologic Research cancer incidence database (years: 2000–2019) which covers 100% of cancer diagnosed cases in the United States[3] and followed the Sex and Gender Equity in Research reporting guidelines. This project was exempted from institutional review board approval as the data were deidentified and publicly available, in compliance with the 45 CFR §46.

Age-adjusted incidence rates were calculated per 100,000 people, standardized to the 2000 United States population. Race-specific, age-specific, and sex-specific trend analyses were conducted. Younger adults were defined as individuals below the age of 45, while older adults comprised those aged 45 years or above.[5] Racial groups were ascertained as White, Black, Hispanic, Asian, and American Indian or Alaska Native (AI/AN). Further analysis

Table. CRC Incidence Rates Trend Analysis According to Age, Gender, Racial and Ethnic Group, and Geographical Region

Characteristics	Cancer cases (N = 2,927,574)[a]	Average annual percentage change (95% CI)[b]	Between group differences, % (95% CI)	*P* value[c]		
				Between group differences	Coincidence[d]	Equality[e]
All ages						
Men	1,514,606 (52.7)	−2.6 [−2.8 to −2.4]	0.3 [0.1–0.6]	<.001	<.001	<.001
Women	1,412,968 (48.3)	−2.3 [−2.4 to −2.1]				
All sexes						
≥ 45 y	2,776,278 (94.1)	−2.7 [−2.9 to −2.5]	5.1 [0.1–0.6]	<.001	<.001	<.001
< 45 y	157,814 (5.4)	2.4 [2.2–2.7]				
Aged < 45 y						
Men	81,192 (51.4)	2.3 [2.0–2.6]	0.3 [0.1–0.5]	<.001	<.001	<.001
Women	76,622 (48.6)	2.6 [2.2–2.9]				
Aged ≥ 45 y						
Men	1,437,178 (51.7)	−2.9 [−3.0 to −2.7]	0.4 [0.2–0.6]	<.001	<.001	<.001
Women	1,339,100 (48.3)	−2.5 [−2.7 to −2.3]				
Race-specific						
White	2,448,533 (83.6)	−2.4 [−2.6 to −2.2]	-	-	-	-
Black	341,325 (11.6)	−2.5 [−2.7 to −2.3]	-	-	-	-
Asian	95,487 (3.2)	−2.3 [−2.4 to −2.1]	-	-	-	-
Hispanic	213,985 (7.3)	−1.6 [−1.8 to −1.3]	-	-	-	-
AI/AN	17,653 (0.6)	−1.9 [−2.1 to −1.8]	-	-	-	-
Region-specific						
Northeast	590,302 (20.2)	−2.9 [−3.1 to −2.7]	-	-	-	-
Midwest	685,394 (23.1)	−2.4 [−2.5 to −2.3]	-	-	-	-
West	570,997 (19.5)	−2.3 [−2.4 to −2.2]	-	-	-	-
South	1,080,881 (36.9)	−2.1 [−2.2 to −2.0]	-	-	-	-

[a]Data are expressed as No. (%). The percentages in each row were calculated using the total number of cases as the denominator.
[b]Trends were quantified using version *5.0.2* of the Joinpoint Regression program (National Cancer Institute). Up to 3 joinpoints (4 line segments) were allowed. No joinpoints were identified. The annual percentage change over the whole period (2000–2019) is identical to the average among all subgroups.
[c]$P < .05$ was considered statistically significant.
[d]Tests whether age-specific or sex-specific trends were identical. A significant *P* value indicates that the trends were not identical (ie, they had different incidence rates and coincidence was rejected).
[e]Tests whether age-specific or sex-specific trends were equal. A significant *P* value indicates that the trends were not equal (ie, they had different incidence rates and equality was rejected).

was conducted based on the US Census Bureau regions: Northeast, Midwest, South, and West.

Joinpoint Regression Program (National Cancer Institute), version 5.0.2, was used to conduct the analysis. Monte Carlo permutation analysis was used to quantify time trends to fit the simplest joinpoint model using the incidence rate data.[6] Annual percentage change and average annual percentage change (AAPC) were calculated. To assess the significance of the annual percentage change, a 2-sided t-test was conducted with a significance level of $P < .05$. Pairwise comparisons were performed to evaluate the identicalness and equality of the trends.

From 2000 to 2019, a total of 2,927,574 cases of CRC (48.3% women) were reported. Overall, the AAPCs of the total CRC cases significantly decreased among women (−2.3% [95% confidence interval {CI}, −2.4% to −2.1%]; $P < .001$) and men (−2.6% [95% CI, −2.8% to −2.4%]; $P < .001$) with a statistically significant between-group difference (0.3% [95% CI, 0.1%–0.6%]; $P = .01$), suggesting a greater decrease among men.

The analysis of different age groups showed significant variations in trends. For the past 20 years, there was an overall increasing trend of CRC incidence in individuals younger than 45 years (157,814 cases, 49% women) (AAPC = 2.4% [95% CI, 2.2%–2.7%]; $P < .001$). However, the trend reversed in those aged 45 years or older (2,776,278 cases; 48% women) (AAPC = −2.7% [95% CI, −2.9% to −2.5%]; $P < .001$) with a large between-group difference (5.1% [95% CI, 0.1%–0.6%]; $P < .001$). Despite this increase of incidence, CRC incidence rate in younger adults (< 45 years) is still a small fraction of incidence for those 45 years and older. To evaluate this trend reversal further, the group of individuals younger than 45 years was further analyzed based on sex. Women aged < 45 years had a greater relative increase in incidence rates (AAPC = 2.6% [95% CI, 2.2%–2.9%]; $P < .001$) than men (AAPC = 2.3% [95% CI, 2%–2.6%]; $P < .001$) with nonequal trends ($P = .01$). (Table and Figure).

The stratified analysis of different census region showed a significant variation in trend. Northeast had the highest decrease (AAPC = −2.9% [95% CI, −3.1% to −2.7%]; $P < .001$), followed by Midwest (AAPC = −2.4% [95% CI, −2.5% to −2.3%]; $P < .001$), and West (AAPC = −2.3% [95% CI, −2.4% to −2.1%]; $P < .001$). The South had the lowest AAPC across the United States (−2.1%; [95% CI, −2.0% to −1.9%]; $P < .001$).

Regarding racial and ethnic groups, Non-Hispanic (NH) Black race showed the largest decrease (AAPC = −2.5% [95% CI, −2.7%- −2.3%]; $P < .001$), followed by NH White race (−2.4% [95% CI, −2.6%- −2.2%]; $P < .001$).

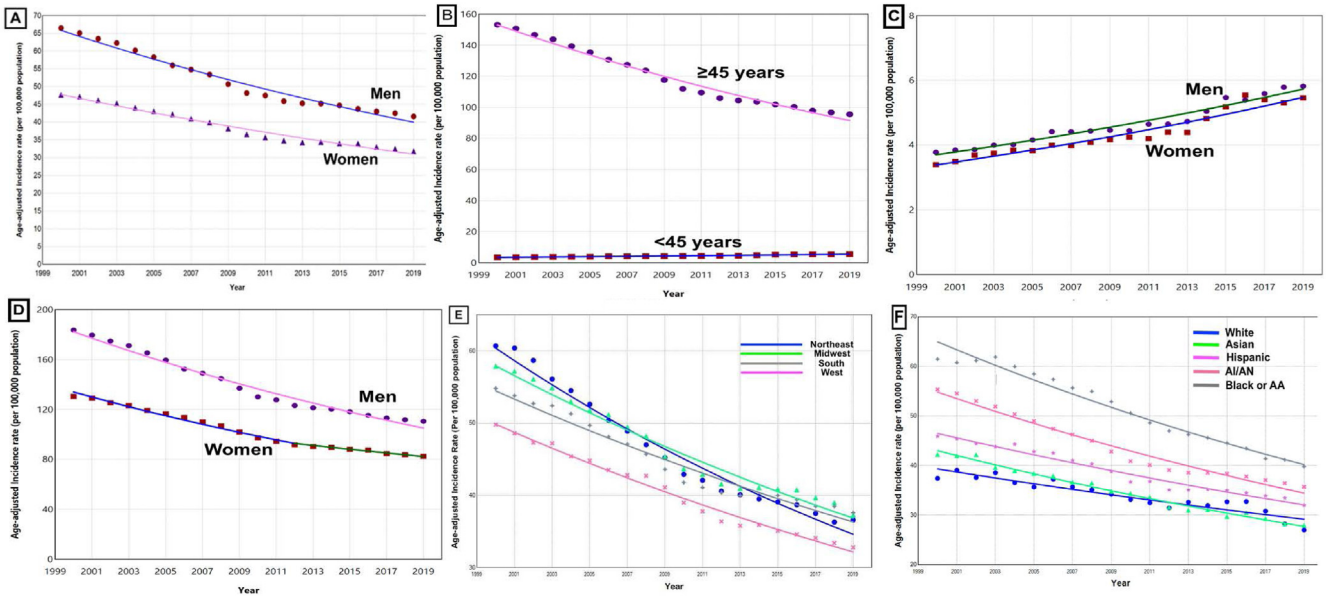

Figure. CRC incidence rates trend analysis according to age, gender, racial and ethnic group, and geographical region. (A) The AAPC in men decreased at a greater rate compared with women (−2.6% vs −2.3%, respectively; $P < .001$ indicating nonequal trends). (B) The AAPC in older age group (≥45 years) decreased, while it increased in the younger age group (<45 years) (−2.7% vs 2.4%, respectively; $P < .001$ indicating nonequal trends). (C) For those aged <45 years, the AAPC in women relatively increased at a greater rate compared to men (2.6% vs 2.3%, respectively; $P < .001$ indicating nonequal trends). (D) For those aged ≥45 years, the AAPC in men relatively decreased at a greater rate compared to women (−2.9% vs −2.5%, respectively; $P < .001$ indicating nonequal trends). (E) The AAPC decreased the greatest in the Northeast (−2.9%; $P < .001$), followed by the Midwest (−2.4%; $P < .001$), and West (−2.3%; $P < .001$). The South had the lowest AAPC across the United States (−2.1%; $P < .001$). (F) The AAPC decreased the greatest in NH Black race (−2.5%; $P < .001$), followed by NH White race (−2.4%; $P < .001$), NH Asian (−2.3%; $P < .001$), and NH American Indian or Alaska Native (AI/AN) (−1.9%; $P < .001$). Hispanic race showed the lowest decrease in incidence rates over the study period (−1.6%; $P < .001$).

However, it is worth mentioning that although AAPC fell most for NH Black race of all racial and ethnic backgrounds, it also started at the highest incidence rates which appears to have exceeded that of Whites at the beginning of the study period. NH Asian (−2.3% [95% CI, −2.4% to −2.1%]; $P < .001$), and NH AI/AN (−1.9% [95% CI, −2.1% to −1.8%]; $P < .001$) had a lower decrease in incidence rates for the past 2 decades. Hispanic race showed the lowest decrease in incidence rates over the study period (−1.6% [95% CI, −1.8% to −1.3%]; $P < .001$). (Table and Figure).

Racial and ethnic groups incidence rates stratified by age groups (< 45 vs ≥ 45 years) is shown in Table A1. The White race had the greatest changes in CRC incidence rates for the past 20 years. White race individuals aged less than 45 years had the highest increase (AAPC = 2.8% [95% CI, 2.5%–3%]; $P < .001$) and those aged ≥ 45 years had the largest decrease (−2.7% [95% CI, −2.9% to −2.5%]; $P < .001$) in incidence across all racial and ethnic groups. The lowest increase in incidence rates was observed in Black race individuals aged < 45 years (0.9% [95% CI, 0.7%–1.1%]; $P < .001$). NH AI/AN older adults (≥ 45 years) had the lowest decrease in incidence across all groups (−1.5% [95% CI, −1.3% to −1.7%]; $P < .001$).

This study found that CRC incidence decreased in both sexes aged ≥45 years with a greater relative decrease in men. Additionally, the greatest decrease in CRC incidence rates was observed in Whites aged ≥45 years. The incidence increased in younger adults <45 years.

Limitations of this study include racial misclassification in the database, limited covariates, and coding reliability. An additional limitation in analyzing the incidence based on census regions is the absence of urban vs rural distinctions, potentially confounding our ability to interpret this finding.

Considering the age-specific findings and the documented surge in colon cancer screening uptake during the study period, it is conceivable that advancements in screening methodologies played a pivotal role in the observed decline in CRC incidence among older individuals. These data can assist clinicians, patients, and policymakers in understanding national trends of decreasing CRC incidence with a simultaneous increase in younger individuals, underscoring the need to prioritize efforts in screening and other interventions.

SAQR ALSAKARNEH[1]
YASSINE KILANI[2]
FOUAD JABER[1]
MOHAMED AHMED[3]
LEEN RAWABDEH[4]
MOHAMMAD BILAL[5]
AASMA SHAUKAT[6]

[1]Department of Internal Medicine, University of Missouri Kansas City, Kansas City, Missouri
[2]Department of Internal Medicine, Lincoln Medical Center, New York, New York
[3]Department of Gastroenterology and Hepatology, University of Missouri Kansas City, Kansas City, Missouri
[4]Division of Gastroenterology and Hepatology, Jordan University, Amman, Jordan
[5]Division of Gastroenterology, Hepatology, and Nutrition, University of Minnesota Medical Center, Minneapolis, Minnesota
[6]Division of Gastroenterology, Department of Medicine and Population Health, NYU Grossman School of Medicine, New York, New York

Correspondence:
Address correspondence to: Aasma Shaukat, MD, MPH, Division of Gastroenterology, Department of Medicine and Population Health, NYU Grossman School of Medicine, 550 1st Ave., New York, New York 10016. e-mail: aasma.shaukat@nyulangone.org.

Supplementary Materials

Material associated with this article can be found in the online version at https://doi.org/10.1016/j.gastha.2024.01.004.

References

1. Siegel RL, et al. CA Cancer J Clin 2023;73(3):233–254.
2. Calip GS, et al. JAMA Oncol 2022; 8(7):981–983.
3. Alsakarneh S, et al. Cancers 2024; 16(1):205.
4. Jackson CS, et al. J Gastrointest Oncol 2015;7(Suppl 1):S32–S43.
5. Siegel RL, et al. JAMA 2017; 318(6):572–574.
6. Kim HJ, et al. Stat Med 2000; 19(3):335–351.

Abbreviations used in this paper: **AI/AN, American Indian or Alaska Native; CI, confidence interval; CRC, colorectal cancer; SAGER, Sex and Gender Equity in Research**

Most current article

2772-5723
https://doi.org/10.1016/j.gastha.2024.01.004

Received August 28, 2023. Accepted January 8, 2024.

Conflicts of Interest:
The authors disclose no conflicts.

Funding:
The authors report no funding.

Ethical Statement:
IRB approval was not needed in this research as the data were deidentified and publicly available.

Data Transparency Statement:
Data included in this research can be found at https://wonder.cdc.gov/?fbclid=IwAR32UlGx0zKUDqw2iM_JqrGR9jZbMgAqAVeI5_v0e5n_AY8XV-9JsOUnBQg.

Reporting Guidelines:
SAGER.