

Colorectal Cancer in the 21st Century: Insights from SEER and National Health Surveys

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Abstract

Background: Colorectal Carcinoma (CRC) is one of the leading causes of deaths worldwide and forth most common cancer in the United States. Overall incidence rates of CRC has been decreasing in United States with evolution of colorectal cancer screening over the years. Colonoscopy is gold standard for screening colonoscopy.

Methods: We used Surveillance, Epidemiology, and End Results (SEER), 22 Registries database to analyze the incidence rate based on different domains like gender, race and extent of disease to determine the rates and differences in rates in different domains. Join point software was used to assess trends further and their significance level. We used National Health Interview Survey to correlate the trends.

Results: Significantly higher rates of CRC are found among males and black population. However, rates for both genders have been declining over the years with soaring decline at almost double rate of 3.8% annually from 2007 to 2011. Similar decline in rates were notes in white population at 4.1% from 2007 to 2011. Black population have steady decline in CRC incidence rates. Incidence rates of localized and advanced CRC both are declining at approximately 4% annually, but rates plateaued for advanced CRC in 2011. There is increasing trend of CRC with lower socioeconomic class. Sigmoidoscopy and colonoscopy rate trends have been improving in both gender and all races except for Hispanic population whose rates remain below national average.

Conclusion: The incidence rate of CRC is decreasing with largest decline from 2007 to 2011. CRC was more prevalent among patients with low income class and nonmetropolitan counties. The sigmoidoscopy/colonoscopy trend has improving with highest leap in rates in earlier years. These trends are complementary to each other. However, the effect of a decrease in smoking and red meat consumption should be taken into account.

Keywords

Colorectal Carcinoma, Incidence, NHIS, SEER, Trend.

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Introduction

Colorectal cancer (CRC) is one of the leading causes of cancer-related deaths worldwide [1]. It is the fourth most common cancer and the second most common cause of cancer-related deaths among males and females combined in the United States. The overall risk of colorectal cancer is 1 in 23 (4.3%) males, and 1 in 26 (3.9%) females in their lifetime [2].

Occult blood testing started the history of CRC screening, and later, in 1895, the most experienced colorectal surgeons introduced rigid sigmoidoscopy. Colorectal cancer screening studies with rigid sigmoidoscopy in 1948 and 1960 showed a significant decrease in CRC incidence and improved patient survival [3,4]. Colonoscopy was first introduced in early 1970. Mandel et al. conducted an RCT of CRC screening with a Fecal Occult Blood test (FOBT) followed by a diagnostic colonoscopy, which showed reduced mortality with improved survival in those with CRC with early detection [5]. In 1997, the GI consortium, the American Cancer Society (ACS), and several other organizations widely accepted screening colonoscopy in the guidelines. Finally, the United States Preventive Services Task Force (USPSTF), American Cancer Society (ACS), and American College of Radiology (ACR)-joint guidelines from year 2008 recommended CRC screening for asymptomatic men and women of age 50-75 years.

Despite advances in management of CRC, the mortality rate remains high, especially in patients with advanced stages of the disease. Screening colonoscopy can improve mortality rates by allowing for earlier intervention as a strategy for the early detection of CRC. A large cohort study by Zauber et al. found that screening colonoscopy was associated with a 53% reduction in CRC mortality [6]. A systematic review and meta-analysis by Brenner et al. found that screening colonoscopy was associated with a 31% reduction in CRC mortality [7].

The main aim of this study is to evaluate the incidence of CRC at population level and the effectiveness of screening colonoscopy in CRC incidence in US population [8].

Methods

The Surveillance, Epidemiology, and End Results (SEER) database is a program of the National Cancer Institute (NCI) in the United States that collects and publishes cancer statistics. We used the Surveillance Research Program, National Cancer Institute SEER*Stat software (www.seer.cancer.gov/seerstat) version 8.4.0.1 to calculate the incidence rate of colorectal carcinoma from 2000 to 2019. We used Joinpoint software, version 4.9.1.0 by National Cancer Institute, annually to create log-linear time trends [9]. By analyzing the rates from the SEER database, we could illustrate the trend from 2001 to 2019. We used P-Values for statistical significance with a level of significance less than 0.05.

Incidence - SEER Research Limited-Field Data, 22 Registries, Nov 2021 Sub (2000-2019) which was released April 2022, based on the November 2021 submission, served as the basis for analysis based on gender, race, and extent of disease. SEER 22 covers approximately 47.9% of the U.S. population (based on the 2010 census) which includes adjustments for areas affected by hurricanes Katrina and Rita. The geographic area covered includes San Francisco-Oakland SMSA, Connecticut, Hawaii, Iowa, New Mexico, Seattle (Puget Sound), Utah, Atlanta (Metropolitan), San Jose-Monterey, Los Angeles, Alaska Natives, Rural Georgia, California excluding SF/SJM/LA, Kentucky, Louisiana, New Jersey, Greater Georgia, Idaho, New York, Massachusetts, Illinois, and Texas.

We included only cases diagnosed with CRC from ages 50 to 74 from 2000 to 2019 using the selection tab in SEER*Stat as malignant behavior, with known age and the first matching record for each person. The session type in the SEER*Stat was a rate session. We computed the number of new colon cancer incidence rates occurring in a specified population during a year, usually expressed as the number of cancers per 100,000 population at risk. We classified the extent of CRC based on the Combined Summary stage 2000, which is only available from 2004 to 2017 at the moment. Classification is based on all available information in medical record combining both clinical and pathological documentation to precisely determine extent of disease.

We analyzed the trends of screening procedures for CRC based on the Centers for Disease Control and Prevention, National Center for Health Statistics, and National Health Interview Survey, 1987–2019, to correlate evidence of screening techniques to prevent CRC [10]. Data are age-adjusted to the 2000 US standard population using age groups: 50-64, and 65-75 for NHIS. Respondents to the 2000-2008 NHIS were asked about their most recent proctoscopy, colonoscopy, or sigmoidoscopy, while 2010 respondents were asked separately about their most recent sigmoidoscopy and colonoscopy, which may have led to under-reported estimates for 2000-2008. We calculated weighted regression lines using the Joinpoint Trend Analysis Software, Version 4.8 April 2020, National Cancer Institute.

Results

Total 717, 555 indexed cases of CRC were identified of which 405,116 were males and 312,439 were females as illustrated in the table below. Non-Hispanic White had highest proportion of population followed by non-Hispanic black. The number of advanced diseases were higher.

The overall incidence rate of CRC decreased from 2000 to 2007 at 2.4%* annually (95% CI, -2.7 to -2.0, P <0.001) which declined at almost a double rate of 3.8%* annually from 2007 to 2011 (95% CI, -5.0 to -2.6, P <0.001), with a further declining incidence rate of

1.1%* (95% CI, -1.1 to -0.8, P <0.001). We noted a higher incidence rate of CRC among males compared to females. Among males, the incidence rate of CRC is trending down. We observed the greatest decline in incidence rate from 2008 to 2011 at a rate of 4.2%* annually (95% CI, -7.2 to -1, P =0.014). The incidence rate of CRC declines from 2000 to 2019 for both males and females.

Table 1: Incidence rates of CRC.

| Variables | | Total number (n) | Overall rate (per 100,000 and age adjusted to 2000 US Standard Population. (95% CI, Upper CI-Lower CI) |
|------------------------|---|------------------|--|
| Incidence rates of CRC | | | |
| Total | | 717,555 | 101.5 (101.3-101.7) |
| Gender | Male | 405,116 | 121.2 (120.8-121.6) |
| | Female | 312,439 | 84 (83.7-84.3) |
| Races | Non-Hispanic White | 486,524 | 100.6 (100.3-100.9) |
| | Non-Hispanic Black | 95,361 | 133 (132.1-133.9) |
| | Non-Hispanic American Indian/ Alaska Native | 3,631 | 92.4 (89.4-95.4) |
| | Non-Hispanic Asian or Pacific Islander | 44,381 | 85 (84.2-85.8) |
| Hispanic (All races) | | 87,658 | 91.4 (90.7-92) |
| Extent of disease | Localized disease | 167,044 | 33 (32.9-33.2) |
| | Advanced disease | 230,850 | 45.3 (45.2-45.5) |

Among Non-Hispanic whites, the CRC incidence rate has been decreasing from 2000 to 2007 by 2.9%* annually (95% CI, -3.2 to -2.6, P <0.001) which further reduced drastically from 2007 to 2011 by 4.1%* annually (95% CI, -5.3 to -3.0, P <0.001). The incidence rate is trending down from 2011 to 2019 by 0.95% annually (95% CI, -1.2 to -0.7, P <0.001) for non-Hispanic whites. Among Non-Hispanic black, the incidence rate decreased steadily from 2003 through 2019 by 2.4%* annually (95% CI, -5.3 to -3.0, P <0.001). The incidence rate among Non-Hispanic American Indians/Alaska Natives showed no changes over time while Asian/Pacific Islanders showed a progressive decline of 1.7%* (95% CI, -1.9 to -1.5, P <0.001) annually from 2000 to 2019. Among Hispanics, CRC incidence rates decline from 2004 to 2012 by 2.36%* (95% CI, -5.3 to -3.0, P <0.001) annually and further decreased from 2015 to 2019 by 1.7% annually (95% CI, -3.0 to -0.4, P =0.02). Non-Hispanic blacks had the highest incidence rate of CRC, followed by whites.

Among localized CRC, the incidence rate has been decreasing from 2004 to 2017 with an annual percentage change of (APC) of 4%* (95% CI, -4.4 to -3.7, P <0.001) while among advanced CRC cases, the incidence rate decreased from 2004 to 2011 by 3.8%* (95% CI, -4.4 to -3.2, P <0.001) annually and decreased from 2011 to 2017 by 0.6% every year. (95% CI, -1.3 to 0.1, P =0.09).

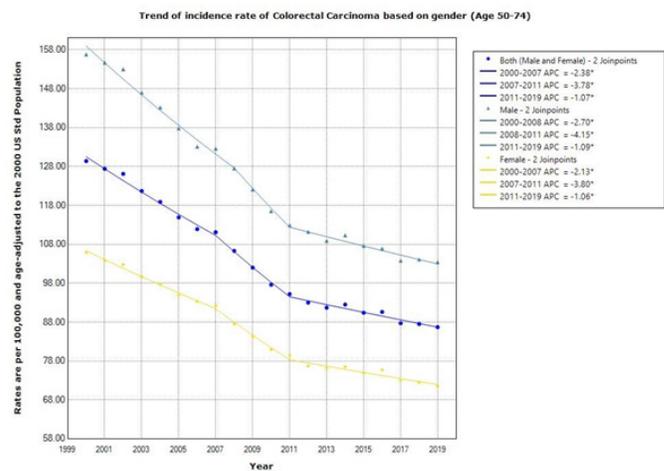


Figure 1: Trends of CRC based on gender.

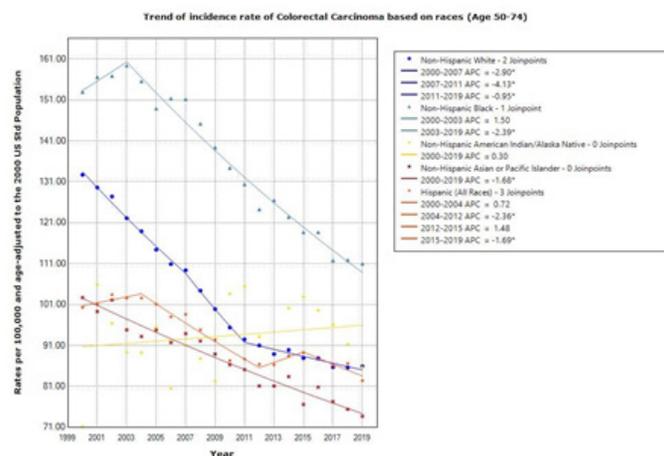


Figure 2: Trend of CRC based on the races.

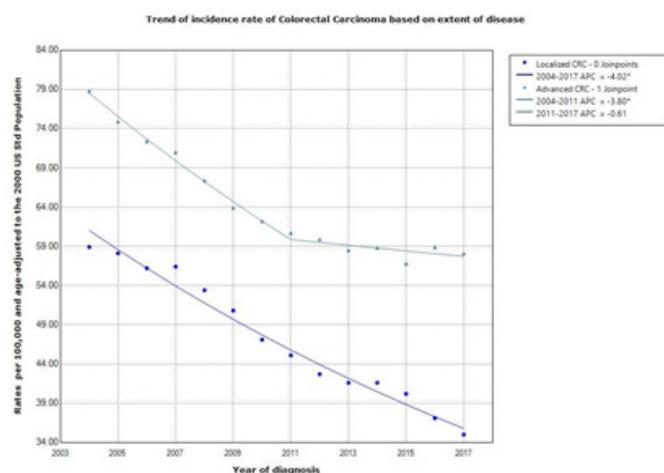


Figure 3: Trend of CRC based on the extent of the disease.

Based on annual income.

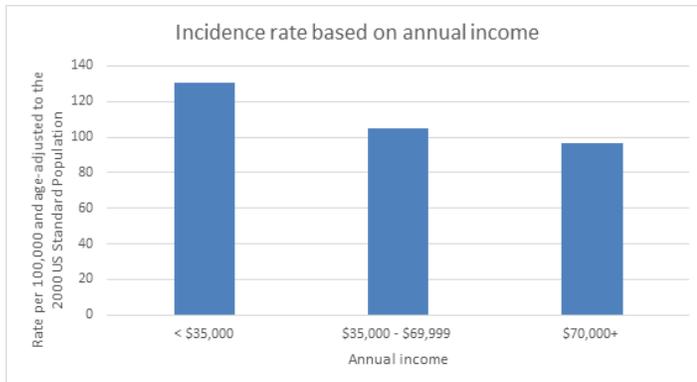


Figure 4: Incidence of CRC based on annual income.

The incidence rate of colorectal carcinoma was highest among the low-income group. The incidence rate decreases progressively with higher income classes.

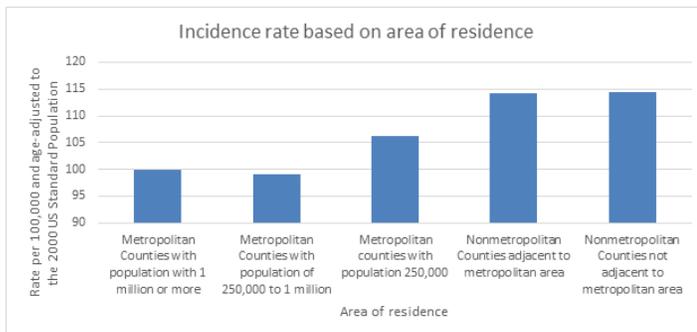


Figure 5: Incidence of CRC based on area of residence.

The incidence of colorectal carcinoma was higher in Nonmetropolitan counties compared to metropolitan counties, as illustrated above.

Trends of CRC screening tests in the US population.

Percentage of adults aged 50-75 years who had a sigmoidoscopy in the past 5 years or had a colonoscopy in the past 10 years by sex, 2000-2019

Source: Centers for Disease Control and Prevention, National Center for Health Statistics, National Health Interview Survey.

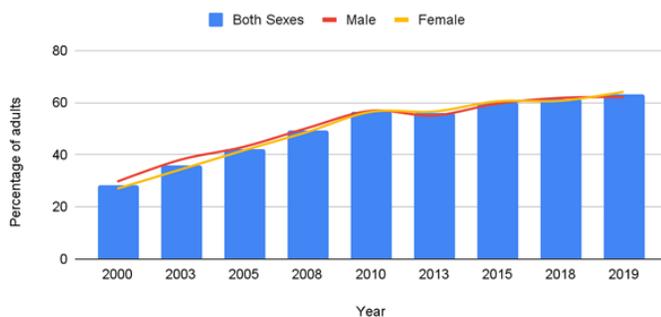


Figure 6: Trend of sigmoidoscopy/colonoscopy in the US population.

Based on the National Health Interview Survey, for all adults aged 50-75 years, the popularity of screening colonoscopy/

sigmoidoscopy increased drastically from 2000 to 2010 with an APC of 6.6%* which continues to increase by 1.26% annually. Both males and females showed similar trends with an APC of 5.9%* and 7.2% * respectively, from 2000 to 2010. The trend of screening colonoscopy/sigmoidoscopy continues to increase for both males and females at a steadier rate from 2010 to 2019.

Percentage of adults aged 50-75 years who had a sigmoidoscopy in the past 5 years or had a colonoscopy in the past 10 years by race/ethnicity, 2000-2019

Source: Centers for Disease Control and Prevention, National Center for Health Statistics, National Health Interview Survey.

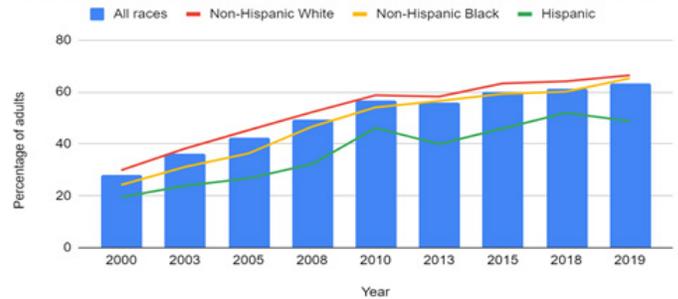


Figure 7: Trend of sigmoidoscopy/colonoscopy based on races.

Based on race, among non-Hispanic whites, the percentage of adults aged 50-75 years getting a colonoscopy skyrocketed from 2000 to 2008 at a rate of 7.6%* annually and continues to trend high from 2008 to 2019 at 1.7%* annually. We noted a similar trend among Non-Hispanic Blacks: the popularity of screening colonoscopy/Sigmoidoscopy increased from 2000 to 2010 with an APC of 8.2%* annually and the rate continues to increase at 1.9%* annually. We found growing popularity among the Hispanic population, with an APC of 4.38%* annually.

Based on the National Health Interview Survey, the trend of home FOBT/FIT declined significantly from 2000 to 2010 at 11.04% annually and plateaued from 2010 to 2019, accounting for less than 3.3% population [10]. The trend of CT colonography slowly rose from 2015 to 2019, however, only making up 1.2% of the population. The popularity of home fecal DNA tests has been trending down and comprises only 2.4% of the population [10].

Discussion

The findings of this study may have significant implications for public health policy and the management of colon cancer. The overall incidence of CRC has been declining, at almost double rate from 2007 to 2011. Similar trend in decline was noted among non-Hispanic whites with steepest decline from 2007 to 2011. Higher incidence rate is prevalent among males. Steady decline in rates were noted for non-Hispanic Black and Asian/Pacific Islanders. Non-Hispanic males have highest incidence among all races. Decreasing trend of CRC for both localized and advanced CRC was noted in the study. Incidence rates were higher in lower income class and nonmetropolitan counties. The popularity of screening colonoscopy has been improving in both gender and all races; however, at slower pace in Hispanics. This can be correlated to relatively slower decline in CRC incidence in this subgroup of population.

Colorectal cancer has been a thoroughly investigated topic given its high mortality, including the exploration of risk factors and genetic components contributing to its progression and increasing public awareness. The risk factors are multifactorial among different races and studied genetic mutations [8]. We can divide them into high risk (IBD, 1st degree relative with CRC)

and moderate risk (increased BMI, cigarette smoking, alcohol use, red meat intake, low physical activity, etc) [9]. The inherited forms of CRC account for approximately 30% of all CRC cases, a majority of which are linked to a 1st degree relative to CRC. Other well-defined syndromes with a genetic basis of inheritance include Lynch syndrome, familial adenomatous polyposis (FAP),

Table 2: Evolution of Colorectal Screening over years.

| Organization, Year | Recommendations |
|--|---|
| USPSTF, 1996 | Screening for adults 50 and over (Grade B) FOBT annually or sigmoidoscopy every 3- 5 year, or combination of FOBT and sigmoidoscopy every 5 years |
| ACG, 2000 | Screening for CRC at age 50 Preferred Screening Strategy: Colonoscopy every 10 yr Alternative: Annual FOBT, Flexible sigmoidoscopy every 5 yr, Annual FOBT plus flexible sigmoidoscopy every 5 yr, Double-contrast barium enema every 5–10 yr, Colonoscopy every 10 yr |
| USPSTF, 2002 | Screen for CRC starting at 50 years or older (Grade A) Home FOBT annually, flexible sigmoidoscopy every 5 yr, the combination of home FOBT and flexible sigmoidoscopy every 5 yr, colonoscopy every 10 yr, and double-contrast barium enema every 5 yr |
| USPSTF, 2008 | Screening for CRC for adults age 50 to 75 years (Grade A), Adults age 76 to 85 years (Grade B) Colonoscopy every 10 years, annual FIT, annual high-sensitivity FOBT, or flexible sigmoidoscopy every 5 years combined with high-sensitivity FOBT every 3 years. |
| ACG, 2008 | Screening should begin at 50 years of age (Grade 1B), except that in African Americans, screening should begin at the age of 45 years (Grade 2C) Preferred CRC prevention test: colonoscopy every 10 years (Grade 1 B) Alternative CRC prevention tests: Flexible sigmoidoscopy every 5 – 10 years (Grade 2 B), CT colonography every 5 years (Grade 1 C) Alternative cancer detection tests: Annual Hemoccult Sensa (Grade 1 B), Fecal DNA testing every 3 years (Grade 2 B) |
| Joint guideline by MSTF, ACS, and ACR - 2008 | CRC screening for Individuals aged 50 or older Flexible Sigmoidoscopy every 5 years, colonoscopy every 10 years, computed tomographic colonography (CT colonography) every 5 years, and double-contrast barium enema every 5 years Guaiac-based FOBT annually, Fecal immunochemical test (FIT) annually, stool DNA test at uncertain interval |
| ACG, 2009 | Preferred CRC prevention test is a colonoscopy every 10 years, beginning at age 50. (Grade 1B), 45 years in African Americans (Grade 2C), the Preferred cancer detection test is annual FIT for blood (Grade 1B). Alternative CRC prevention test: Flexible sigmoidoscopy every 5–10 years (Grade 2 B), CT colonography every 5 years (Grade 1C) Alternative cancer detection tests: Annual Hemoccult Sensa (Grade 1B), Fecal DNA testing every 3 years (Grade 2B) |
| USPSTF, 2016 | Screening for colorectal cancer starting at age 50 years and continuing until age 75 years (Grade A), CRC screening for 76-85 years based on patient's overall health and prior screening history (Grade C) Stool-based tests (gFOBT annually, FIT annually, and FIT-DNA every 1-3 years), Direct Visualization test (Colonoscopy every 10 years, CT colonography/flexible sigmoidoscopy every 5 years, Flexible sigmoidoscopy with FIT: Flexible sigmoidoscopy every 10 y plus FIT every year). |
| USPSTF, 2021 | Screening for CRC in all adults from 45 to 75 years (Grade A), 76 to 85 years (Grade C) Stool based tests (High-sensitivity gFOBT annually, FIT annually, sDNA-FIT every 1 to 3 y), Directly visualization test (Colonoscopy every 10 years, CT colonography/Flexible Sigmoidoscopy every 5 year, Flexible sigmoidoscopy with FIT flexible sigmoidoscopy every 10 y plus FIT every year |
| ACG, 2021 | CRC screening in average-risk individuals between ages 50 and 75 years (Strong recommendation) CRC screening for Age 45-49: Conditional recommendation Strong recommendation: FIT every 1 year, Colonoscopy every 10 years Conditional recommendation: Multi-target stool DNA test every 3 years, Flexible sigmoidoscopy every 5–10 years, CT Colonography every 5 years, Colon capsule every 5 years. |

MUTYH-associated polyposis (MAP), etc. It is worth mentioning that our study included only those aged 50 to 75, and thus excluded hereditary forms of colorectal cancer which are present at younger ages and have higher mortality [9].

As observed in Figure 1, males have a higher incidence of colorectal carcinoma than females. Studies have found a 33% higher rate of CRC among males [10]. However, all genders are trending down in incidence overall. Strides have been made to address health disparity, which is reflected in the increase in screening over the years for people aged 50-75, regardless of race or gender, as shown in Figures 4 and 5. The trend in the National Cancer Database (NCDB) also suggests that access to health care (private insurance, urban geography, and white race) is associated with rising proportions of earlier onset colon cancer [11]. Although the incidence of CRC is highest among adults over the age of 50, there has been an alarming rise in the incidence of sporadic CRC among young adults over the past two decades [12]. A retrospective study from the NCDB registry showed the proportion of cases diagnosed before the age of 50 years rose from 13.9% to 15.2% for rectal primary tumors and from 8.4% to 10.8% for colon primary tumors with an overall rise from 10.0% to 12.2% for all CRC [13]. This has brought about a lowering of the recommended screening age to 45 years by multiple societies in 2021, as stated in Table 2 [13].

We can note the racial disparity in Figure 2. Between year 2012 to 2015, Hispanic people had intermittent drops in incidence, while Non-Hispanic Whites have been trending down consistently since 2000 which is more pronounced from 2007 to 2011. The incidence rates of minorities such as the American Indians/Alaskan natives had no significant drop, while the Black population has the highest incidence among all other groups across all the years, and exhibited a soaring decline from 2003. The major culprit is thought to be socioeconomic disparity, as pointed out in Figure 4, that with increasing annual income, the incidence of colorectal incidence decreases overall. This is then iterated in Figure 5, where the incidence of CRC in vast metropolitan cities is less than in non-metropolitan counties. Another explanation to consider would be microbiome differences between races, which illustrate routine dietary habits and alternate microbiomes, which could give rise to CRC, and socioeconomic disparity infiltrates to a microscopic level never previously attested [14,15].

The colorectal adenoma-carcinoma sequence depicts the transformation from a normal colonic epithelium to an adenoma, followed by carcinoma, and finally metastatic disease [16]. By increasing the rate of screening, we can find more adenomatous polyps and prevent the adenoma-carcinoma sequence, which helps explain the inverse relationship between CRC incidence and screening colonoscopies. Polypectomy at the time of screening colonoscopy is the main driving force to stop the adenomatous polyp progression to cancer. However, we are well aware of modifiable risk factors, and their trends could also partially explain the decrease in the incidence of CRC. A measure of the public health impact of exposure to a risk factor on a disease outcome

in a population, population-attributable fraction estimated that 47% of CRC cases in the USA and 45% in the UK were caused by obesity, low physical activity, poor diets (such as high red and processed meat, low fiber, low whole grain, and low calcium) and alcohol [17,18]. In addition, smoking increases the risk of CRC [18]. The smoking trend declined from 21% in 2005 to 12.5% in the US population. This decline in the smoking trend could partially have contributed to declining incidence rates. High-fiber diets have been proven to lower the risk of CRC, yet despite appropriate guidelines, total dietary fiber remains well below the recommendations [19,20]. Alcohol consumption of more than 1 drink per day has been linked with CRC risk, yet a recent study by Breslow et al. revealed an increase in alcohol consumption in adults over 60, particularly women, between 1997 and 2014 [21,22]. High body mass index (BMI) is a major risk factor for CRC, and there have been no signs of down-trending BMIs among men or women as of 2014 [23,24]. In a cohort consisting of mainly white women in the USA, women with a BMI of ≥ 23 at 18 years of age had an approximately 60% increased risk of early-onset CRCs compared with women with a BMI of 18.5–20.9 at the equivalent age [25].

Diets rich in red and processed meats have been linked with a higher incidence of CRC [26]. No changes in processed meat and a decrease in red meat consumption from 1999 to 2016 in the US population [27]. Importantly, the effect of a decrease in smoking and red meat consumption in decreasing incidence rate cannot be discounted, however, the magnitude of the effect is unclear.

As previously mentioned, multiple societies as listed in Table 3 have provided screening recommendations that advised increasing the frequency of screening for colorectal cancer, starting at younger ages, and providing multiple modalities of screening with the goal of detecting colorectal cancer early on [28]. Early screening has significantly contributed to the overall downward trend of localized colorectal carcinomas over the years [28]. We can observe a decrease in the slope of reduced incidence since 2011 for advanced colorectal cancer, which is hypothesized to be because of a more effective diagnosis of the tumor. However, the tumor itself is armed with mechanisms of resisting treatment such as resisting the effect of checkpoint inhibitors [29].

Various screening modalities have been examined to decrease the incidence and mortality of CRC in individuals at average risk [5,30-32]. These include stool-based options, a semi-invasive method using computed tomography (CT) imaging or capsule endoscopy, and direct visualization of the distal or entire colon with sigmoidoscopy or colonoscopy [33]. Starting screening from age 50 was started back in 1996, which led to early detection and a lower incidence of CRC, as shown in Figure 3. Scientists have developed artificial intelligence (AI) tools for detecting polyps during colonoscopy in order to improve detection rates [34]. Initial studies show these tools increase the average detection rate of endoscopists from 25% to 37% [34]. However, the use of AI did not lead to increased detection of larger and more advanced polyps, which carry a higher risk of malignancy [35].

Conclusion

In conclusion, the overall incidence of colorectal cancer in the United States in the 21st century is trending down. Concurrently, there is an overall steady increase in the number of screening colonoscopies and/or sigmoidoscopies among adults aged 50-75 years. We can comprehend that the increase in screening tests correlates with a decrease in the incidence of CRC. As the screening guidelines are shifting towards early age implementation of screening techniques and prioritizing colonoscopy, we can expect a further decline in the incidence of CRC in the future. However, we cannot discount other causes for the decrease in the incidence of CRC, particularly modifiable risk factor such as smoking and dietary habits.

References

1. Rawla P, Sunkara T, Barsouk A. Epidemiology of colorectal cancer: incidence, mortality, survival, and risk factors. *Prz Gastroenterol.* 2019; 14: 89-103.
2. <https://www.cancer.org/research/cancer-facts-statistics/all-cancer-facts-figures/2023-cancer-facts-figures.html>.
3. Gilbertsen VA, Nelms JM. The prevention of invasive cancer of the rectum. *Cancer.* 1978; 41: 1137-1139.
4. Hertz RE, Deddish MR, Day E. Value of periodic examinations in detecting cancer of the rectum and colon. *Postgrad Med.* 1960; 27: 290-294.
5. Mandel JS, Bond JH, Church TR, Snover DC, Bradley GM, et al. Reducing mortality from colorectal cancer by screening for fecal occult blood. Minnesota Colon Cancer Control Study. *N Engl J Med.* 1993; 328: 1365-1371.
6. Zauber AG, Winawer SJ, O'Brien MJ, Lansdorp-Vogelaar I, van Ballegooijen M, et al. Colonoscopic polypectomy and long-term prevention of colorectal-cancer deaths. *N Engl J Med.* 2012; 366: 687-696.
7. Brenner H, Stock C, Hoffmeister M. Effect of screening sigmoidoscopy and screening colonoscopy on colorectal cancer incidence and mortality: systematic review and meta-analysis of randomised controlled trials and observational studies. *BMJ.* 2014; 348: g2467.
8. Baidoun F, Elshiwiy K, Elkeraiye Y, Merjaneh Z, Khoudari G, et al. Colorectal Cancer Epidemiology: Recent Trends and Impact on Outcomes. *Curr Drug Targets.* 2021; 22: 998-1009.
9. Johnson CM, Wei C, Ensor JE, Smolenski DJ, Amos CI, et al. Meta-analyses of colorectal cancer risk factors. *Cancer Causes Control.* 2013; 24: 1207-1222.
10. Siegel RL, Miller KD, Wagle NS, Jemal A. Cancer statistics, 2023. *CA Cancer J Clin.* 2023; 73: 17-48.
11. Royston KJ, Adedokun B, Olopade OI. Race, the microbiome and colorectal cancer. *World J Gastrointest Oncol.* 2019; 11: 773-787.
12. Force USPST, Davidson KW, Barry MJ, Mangione CM, Cabana M, et al. Screening for Colorectal Cancer: US Preventive Services Task Force Recommendation Statement. *JAMA.* 2021; 325: 1965-1977.
13. Carethers JM, Doubeni CA. Causes of Socioeconomic Disparities in Colorectal Cancer and Intervention Framework and Strategies. *Gastroenterology.* 2020; 158: 354-367.
14. Carvalho B, Sillars-Hardebol AH, Postma C, Mongera S, Terhaar Sive Droste J, et al. Colorectal adenoma to carcinoma progression is accompanied by changes in gene expression associated with ageing, chromosomal instability, and fatty acid metabolism. *Cell Oncol (Dordr).* 2012; 35: 53-63.
15. Keum N, Giovannucci E. Global burden of colorectal cancer: emerging trends, risk factors and prevention strategies. *Nat Rev Gastroenterol Hepatol.* 2019; 16: 713-732.
16. Mansournia MA, Altman DG. Population attributable fraction. *BMJ.* 2018; 360: k757.
17. Siegel RL, Ward EM, Jemal A. Trends in colorectal cancer incidence rates in the United States by tumor location and stage, 1992-2008. *Cancer Epidemiol Biomarkers Prev.* 2012; 21: 411-416.
18. Cornelius ME, Loretan CG, Wang TW, Jamal A, Homa DM. Tobacco Product Use Among Adults - United States, 2020. *MMWR Morb Mortal Wkly Rep.* 2022; 71: 397-405.
19. Kunzmann AT, Coleman HG, Huang WY, Kitahara CM, Cantwell MM, et al. Dietary fiber intake and risk of colorectal cancer and incident and recurrent adenoma in the Prostate, Lung, Colorectal, and Ovarian Cancer Screening Trial. *Am J Clin Nutr.* 2015; 102: 881-890.
20. McGill CR, Fulgoni III VL, Devareddy L. Ten-year trends in fiber and whole grain intakes and food sources for the United States population: National Health and Nutrition Examination Survey 2001-2010. *Nutrients.* 2015; 7: 1119-1130.
21. Breslow RA, Castle IP, Chen CM, Graubard BI. Trends in Alcohol Consumption Among Older Americans: National Health Interview Surveys, 1997 to 2014. *Alcohol Clin Exp Res.* 2017; 41: 976-986.
22. Fedirko V, Tramacere I, Bagnardi V, Rota M, Scotti L, et al. Alcohol drinking and colorectal cancer risk: an overall and dose-response meta-analysis of published studies. *Ann Oncol.* 2011; 22: 1958-1972.
23. Aleksandrova K, Nimptsch K, Pischon T. Obesity and colorectal cancer. *Front Biosci (Elite Ed).* 2013; 5: 61-77.
24. Flegal KM, Kruszon-Moran D, Carroll MD, Fryar CD, Ogden CL. Trends in Obesity Among Adults in the United States, 2005 to 2014. *JAMA.* 2016; 315: 2284-2291.
25. Liu PH, Wu K, Ng K, Zauber AG, Nguyen LH, et al. Association of Obesity With Risk of Early-Onset Colorectal Cancer Among Women. *JAMA Oncol.* 2019; 5: 37-44.
26. Zhao Z, Feng Q, Yin Z, Shuang J, Bai B, et al. Red and processed meat consumption and colorectal cancer risk: a systematic review and meta-analysis. *Oncotarget.* 2017; 8: 83306-83314.
27. Zeng L, Ruan M, Liu J, Wilde P, Naumova EN, et al. Trends in Processed Meat, Unprocessed Red Meat, Poultry, and Fish Consumption in the United States, 1999-2016. *J Acad Nutr Diet.* 2019; 119: 1085-1098.e12.

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28. Doubeni CA. The impact of colorectal cancer screening on the US population: is it time to celebrate?. *Cancer*. 2014; 120: 2810-2813.
 29. Van der Jeught K, Xu HC, Li YJ, Lu XB, Ji G. Drug resistance and new therapies in colorectal cancer. *World J Gastroenterol*. 2018; 24: 3834-3848.
 30. Nagata K, Endo S, Honda T, Yasuda T, Hirayama M, et al. Accuracy of CT Colonography for Detection of Polypoid and Nonpolypoid Neoplasia by Gastroenterologists and Radiologists: A Nationwide Multicenter Study in Japan. *Am J Gastroenterol*. 2017; 112: 163-171.
 31. Imperiale TF, Ransohoff DF, Itzkowitz SH, Levin TR, Lavin P, et al. Multitarget stool DNA testing for colorectal-cancer screening. *N Engl J Med*. 2014; 370: 1287-1297.
 32. Nishihara R, Wu K, Lochhead P, Morikawa T, Liao X, et al. Long-term colorectal-cancer incidence and mortality after lower endoscopy. *N Engl J Med*. 2013; 369: 1095-1105.
 33. Rex DK, Boland CR, Dominitz JA, Giardiello FM, Johnson DA, et al. Colorectal Cancer Screening: Recommendations for Physicians and Patients from the U.S. Multi-Society Task Force on Colorectal Cancer. *Am J Gastroenterol*. 2017; 112: 1016-1030.
 34. Hassan C, Spadaccini M, Iannone A, Maselli R, Jovani M, et al. Performance of artificial intelligence in colonoscopy for adenoma and polyp detection: a systematic review and meta-analysis. *Gastrointest Endosc*. 2021; 93: 77-85.
 35. Barua I, Vinsard DG, Jodal HC, Loberg M, Kalager M, et al. Artificial intelligence for polyp detection during colonoscopy: a systematic review and meta-analysis. *Endoscopy*. 2021; 53: 277-284.