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Association Between Colorectal Cancer Prevalence and Patients Age, Race and Sex

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By

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1. Abstract

Colorectal cancer is one of the top leading causes of cancer deaths affecting people of different ages, sex and races disproportionately. The American Cancer society researchers have studied that lack of physical activities, smoking, consumption of red meat, and heavy alcohol use to be high risk factors for developing colorectal cancer in addition to genetic inheritances. Previous research studies have shown that disparities in cancer screening, socioeconomic status and others impacts on colorectal cancer prevalence and death. The objective of this project is to review the existing literature to better understand the disparities in colorectal cancer prevalence and deaths in relation to patients' demographic characteristics mainly age, sex and race.

2. Introduction

2.1 Colorectal Cancer

Cancer is one of the top four causes of death in the US and the rest of the world [1]. According to the 2018 National Cancer Institute report, colorectal cancer was fourth most common cancer type after breast, lung, and prostate cancers. In 2019 alone, 9.6 million people died from cancer globally [1]. Six hundred thousand eight hundred eighty of those deaths took place in the US. Additionally, in 2020 the US anticipated 1.8 million new cancer patients, as well as an estimated 606,520 deaths [2].

The term "colorectal cancer" (CRC) refers to the occurrence of uncontrolled cell growth in the colon or rectum and its invasion of the normal cells [2]. Any cancer that affects the colon and the rectum area is called colorectal cancer and it's also known by other names such as bowel cancer, colon cancer and rectal cancer. About 1 in 21 men and 1 in 23 women in the United States will develop colorectal cancer throughout their lifespan according to the study conducted by The American Cancer Society [3]. Staging is the process used to determine if cancer has advanced with the colon, rectum, or to other parts of the body. To dictate the best treatment plan for colorectal cancer, staging is particularly important. The process used to find out if cancer has spread within the colon/rectum or to other part of the body is called staging. Staging is important because it helps determine the best treatment plan. A commonly used system gives the stages a number from 0 to 4. The stages of colon cancer are:

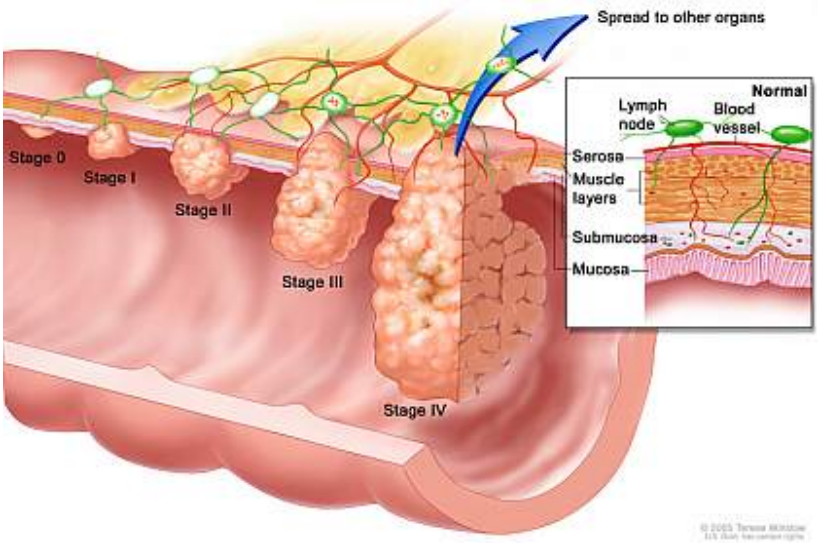

Figure 1. Stages of colorectal cancer. ***NCI, NIH***

Stage 0, is the earliest stage, when the cancer is still within the mucosa, or inner layer, of the colon or rectum. It is also called carcinoma in situ. At stage 1, the cancer has grown through the inner layer of the colon or rectum but has not yet spread beyond the wall of the rectum or colon. Stage 2, the cancer has grown through or into the wall of the colon or rectum, but it has not yet reached the nearby lymph nodes. At stage 3, The cancer has invaded the nearby lymph nodes, but it has not yet affected other parts of the body. Stage 4 is the last stage and , the cancer has spread to other parts of the body, including other organs, such as the liver, the membrane lining the abdominal cavity, the lung, or the ovaries. Recurrent is the possibility of the cancer returning after a patient has been treated. It may come back and affect the rectum, colon, same place the first time you had it or another part of the body.

In 2020, the number of new cases of CRC is estimated to be around 147,950. The incidence of colorectal cancer broadly waned around 1980s due to modifications in the vulnerability to some risk factors and an increase in the early screening procedures [2]. The CRC rate has decreased

The prevalence of CRC is not uniform across the US population. Even though there is a small percentage of colorectal cancer widespread that can be tied to heredity, most of it is caused due the risk factors mentioned above and others [5, 6]. The objective of this study is to review the association between the demographic factors race, sex, and age in conjunction with the prevalence and death of CRC among the US population.

3. Association Between Race and Colorectal Cancer Prevalence

Colorectal Cancer affects the African American community with higher rate of disease and mortality compared to the rest of American communities. While the African American colorectal cancer fatality rate has decreased since the 1980s, when compared to white Americans, the incidence rate has increased by 11% [7]. Disparities in tumor diagnosis , patient treatments, socioeconomic status, health care access and other criteria's are identified as factors that affect the outcome of colorectal cancer [7]. Despite adjustments for these factors in many studies, disparities in CRC survival have persisted, worsened, and are not fully understood [7]. The National Cancer Institute studied differences in health care facilities of CRC and the race disparities which have huge impact with follow-up colonoscopy after abnormal flexible sigmoidoscopy [8].

Some of the variations of colorectal cancer found within the black community can be linked to the population's low socioeconomic status. Education plays a critical role in influencing the high number of cases in the community. A study carried out in Tennessee illustrated that people who have attained higher education are 2.47 times likely to get screened for cancer than those who do not [9]. Education also plays a critical role in influencing an individual's socioeconomic status, which is directly linked to healthcare quality. Low education levels result in most blacks working groups with low-paying jobs, which hinders them from accessing quality care services and balanced diets, critical in an individual's health [10]. Unfortunately, due to the low economic status and the high inequalities in the US, the black community and other minority groups have limited access to quality education and often do not attain a college degree. Therefore, they are more likely not to get screened for cancer. The lack of screening during the

early stages of cancer results in high mortality rates among the black communities compared to their white counterparts.

Insurance coverage plays a critical role in ensuring that all citizens have access to quality healthcare services. Despite affordable healthcare coverage such as Medicaid, Medicare, and ACA, most minority communities remain uninsured. A 2020 report illustrates that 13.6% of black Americans lack any form of insurance coverage [11]. This percentage illustrates a much bigger minority population that lacks access to quality services due to lack of healthcare coverage. The implication of no insurance coverage is the lack of access to services such as screening or cancer treatment, which attributes to the region's high mortality rate.

Additionally, the African American population reported lower quality of health compared to the white population; this is often associated with racial discrimination and inequality regarding health care services. Acculturation also plays a critical role in the survival difference observed between the different racial groups [12]. Compared to the white population, blacks, Asians, and Hispanics have a lower mortality risk. However, their chronic disease morbidity increases the more years they reside in their new country.

Different scholars have explored race and cancer-related death rates amid patients diagnosed with colorectal cancer. For instance, a retrospective study by Fedewa et al. (2017) examined the association between race and cancer mortalities. According to the study, colorectal cancer is considered the third most public health concern that accounts for the highest mortality and morbidity rates. The research indicates that the variance in colorectal cancer mortality associated with race has been explored in-depth. Research showed that the African-American population experience the highest percentage (32%) of death rates associated with colorectal cancer [13]. The identified African American race risk was higher compared to the white

majority race. The study concluded a significantly heightened risk of death rates among the Black Americans, Indians, and Native American patients compared to the white race. The study incorporated 2,735 cases who were followed to evaluate the ethnic and racial disparities in the incidence of colorectal cancer. The identified issues were assessed through a colonoscopy, an intervention associated with a heightened risk for colorectal cancer[13]. Notably, the high interval risk among the Black American groups appeared more profound in the rectal cancer. Overall, among the participants enrolled for interventions, the Black populations exhibited increased risk for incidence than the whites. The discrepancy was more evident for cancer of the rectum and the distal colon.

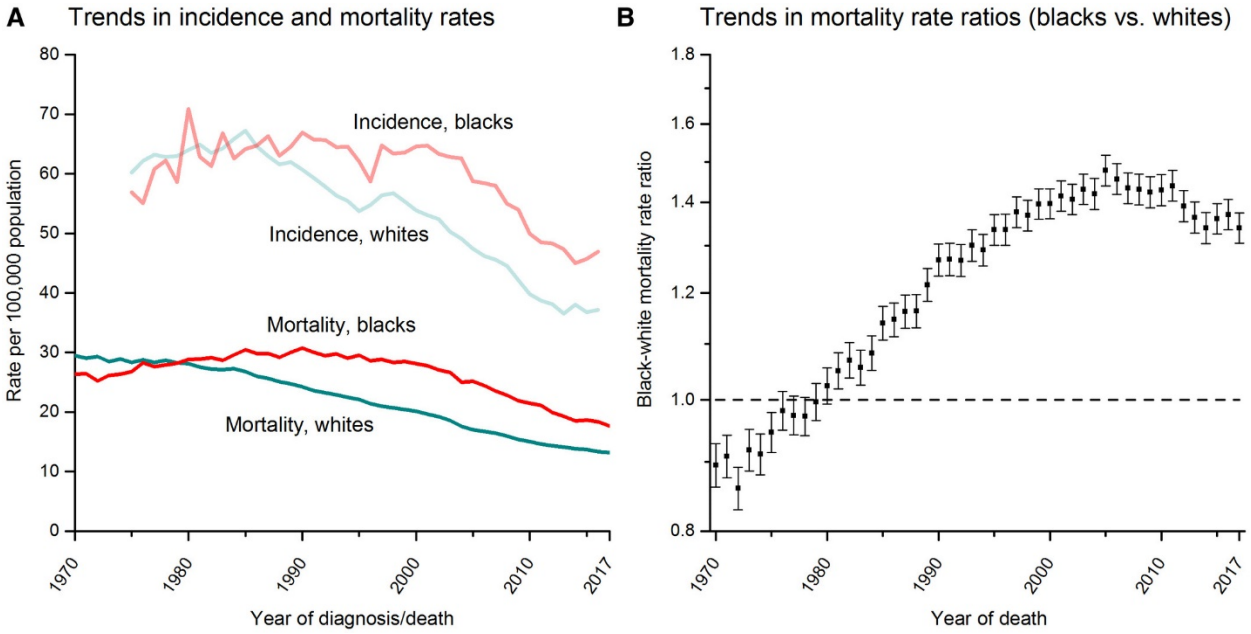

Figure 2. Incidence and Mortality trends of Colorectal Cancer from 1970 to 2017.

Trends in Colorectal Cancer Incidence (1975 to 2016) and Mortality Rates and Rate Ratios (1970 to 2017) by Race, United States. Incidence rates exclude the appendix and are age adjusted to the 2000 US standard population and adjusted for reporting delays. White and black races are not mutually exclusive from Hispanic ethnicity. Error bars indicate 95% confidence limits. The reference group for

mortality rate ratios is whites. Source: Incidence: SEER Program, 2019; Mortality: NCHS, 2019. **Figure 2**

4. Association Between Age and Colorectal Cancer Prevalence

New research has shown that CRC is a significant concern among people aged 50 years and below as newly diagnosed cases increase compared to those who are above 50 years old. This is attributed to regular colonoscopies in recent years. Due to lack of regular screenings at an early stage, most young patients tend to be exposed to CRC earlier than the accepted age for the average risk person [16]. Research conducted in New Jersey has shown that, of all the yearly diagnosed CRC cases, about 10% are young adults. [17].

Age and colorectal cancer are associated in significant ways. Approximately 90% of patients diagnosed with colorectal cancer are aged 50 and above. Notably, smalls cancers are difficult and challenging to recognize. Therefore, most of the cancers are identified at an advanced age. The later diagnosis of the condition contributes to a poor prognosis [18]. This is because late diagnosis implies delayed evaluation of the most appropriate intervention, increasing the likelihood of complications. The American College of Gastroenterology recommends that African Americans be screened for colon cancer at the age of 45 rather than 50, which is the approved age for ordinary risky person of the general population[19]. Different studies have evaluated the relationship between age and colorectal cancer. People growing older are highly likely to be diagnosed with this type of cancer [20]. Essentially, non-concourses polyps are likely to divide to form cancer cells. Therefore, older adults should remain vigilant and cautious to recognize early signs for cancer development to minimize further complications.

Study reveal that approximately 50,000 adults are diagnosed with colorectal cancer [20]. Over the decades, the rates of colorectal cancer have dropped. The drop is associated with increased testing and diagnosis, including screening. Multiple treatment modalities for the

condition also exist and contribute to better outcomes that have led to a decline in the incidences of colorectal cancer among the groups [21].

Overall, advancement in age is linked to increased predisposition to diverse conditions—notably, the prevalence of cancer and non-cancer. Some researchers have found that as individuals grow older, they are at higher risk of suffering from colorectal cancer while other researchers have found the opposite. The current diagnostic strategies have been beneficial towards ensuring the rates of deaths associated with colorectal cancer become minimal. The plans remain effective in ensuring individuals' lifespan are enhanced and that individuals typically live without their comfortability and dignity of life interfered.

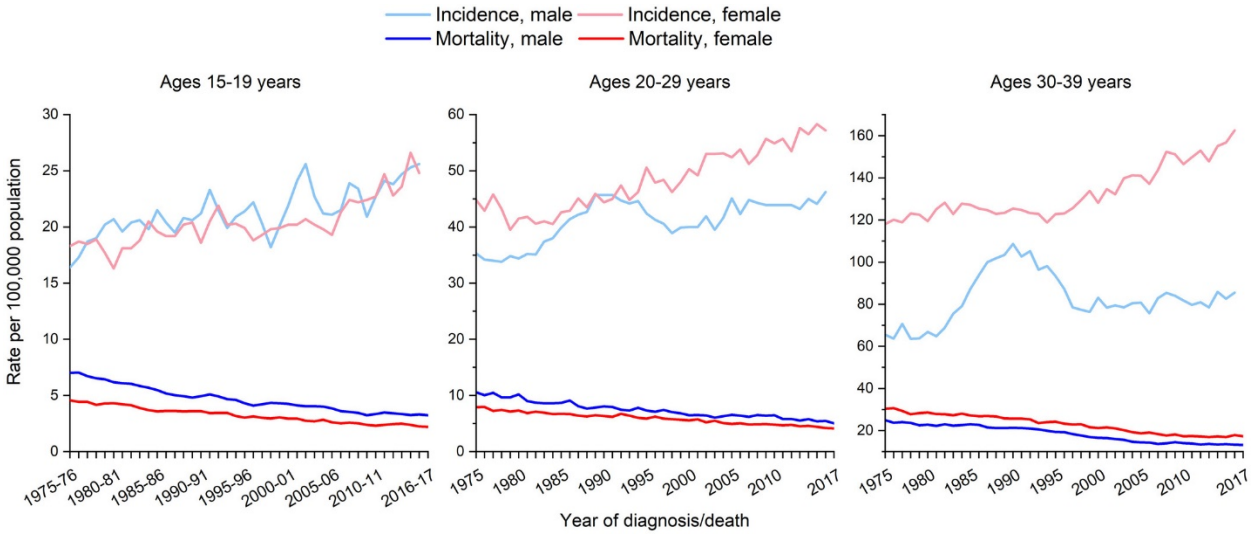

Figure 3. Trends in Adolescent and Young Adult Cancer Incidence and Mortality Rates for All Cancers Combined by Age and Sex, 1975 to 2017. Rates are age adjusted to the 2000 US standard population, and incidence rates are adjusted for reporting delays. Rates for those aged 15 to 19 years are 2-year moving averages.

4.1 Relation effect of age on CRC with Obesity

Growing epidemiological data indicated a strong positive correlation between obesity and colorectal carcinogenesis [23]. There is undeniable relationship between obesity and CRC, but the seriousness of it has different outcome on different genders. obesity causes a higher risk of colon cancer in males compared to females, and it has a stronger connection with colon cancer than it does to rectal cancer in both females and males. Obesity is also believed to impose a greater risk of colon cancer for premenopausal women than it does for postmenopausal women[24]. Answers to why obesity increase the risk of colon cancer and why does it impose greater risk of colon cancer for premenopausal women than it does for postmenopausal women are not definitive , but obesity and menopausal status are strong determinants of concentrations for various that may be critical for colon carcinogenesis. Some hormonal axes such as estrogen, insulin, and Insulin-like growth factors (IGFs) may be linked to the issue[25]. Obesity is one of the risk factors that increase colorectal cancer among adults aged less than 45.

Dose-response meta-analysis reported that body weight gain of 10 kg was accompanied by approximately 8% increased risk of CRC [23]. Individuals who suffer early life obesity are at greater risk of developing CRC in their adulthood. Obesity and overweight was found to be responsible for around 11% of colorectal cancer (CRC) cases in Europe alone [26]. According to epidemiological data, obese men have 30-70% increased risk of colon cancer compared to women whose relation is less consistent.

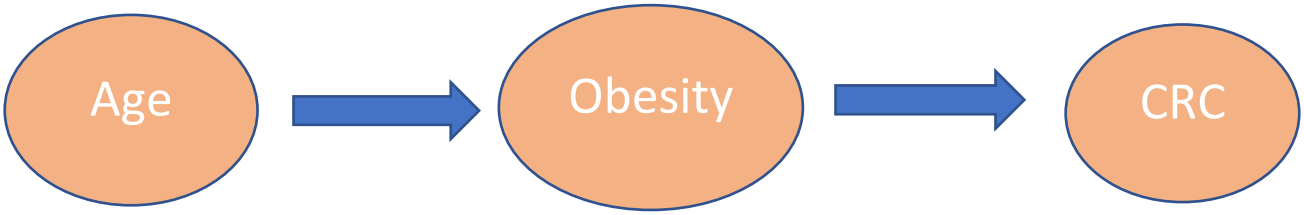

Fig. 4 relation of age with CRC

As expected, body weight loss by bariatric surgery reduces about 27% risk of CRC [23]. Regular exercise plays a massive role in reducing the risk of developing colon cancer and the risk of death from colon cancer should it develop. When it comes to assessing obesity risk of developing colon cancer, wait circumference (WC) and body mass index (BMI) measurements are recommended. Visceral abdominal fat radiographic assessment is believed to be the best technique to evaluate if the patients colon cancer development is related to the persons obesity [24].

Table 1. Obesity and risk of developing colon cancer

Study	Study type	Population	N	CRC risk obese versus nonobese	conclusion
Dai et al. 2007	Meta-analysis	International	6,458	RR 1.37 for males	Obese men have increased risk of CRC
Polednak 2008	Meta-analysis	American	153,760	RR 1.4 for males RR 1.1 for females	Obese men have greater risk of CRC
Harriss et al. 2009	Meta-analysis	International	67,361	RR 1.24 for males RR 1.09 for females	Higher BMI increases risk of colon cancer. Men have greater risk than women.
Pischon et al. 2006	Prospective cohort	European	368,272	RR 1.55 for males RR 1.06 for females	Obese men have greater risk of CRC
Rapp et al. 2005	Prospective cohort	Austrian	145,000	HR 1.56 for males and colon cancer HR 1.11 for females and colon cancer HR 1.66 for cancer. males and rectal cancer HR 0.66 for females and rectal cancer	Obese men have greater risk of CRC. Obese women's have greater risk of colon cancer relative to rectal

A meta-analysis of 153,760 Americans conducted by Polednak revealed that the relative risk for developing CRC was 1.4 for obese men and 1.1 for obese women. Another meta-analysis performed by Harris et al. that included 28 studies and international population of

67,361 in search of relationship to determine the association between obesity and CRC, obese men had a relative risk of 1.24 for developing colon cancer compared to obese women with a relative risk of 1.09. [27]

5. Association Between Sex and Colorectal Cancer Prevalence

The prevalence and morbidity associated with colorectal cancer are not uniform across all genders. Females have a lower rate of death than males statistically [28]. Hormone replacement therapy is one factor that affects the regulation of hormones, especially at the menopausal stage. This decreases development and differentiation of colorectal cancer in women[28]. The outcome of external and internal pre-diagnosis factors lead to an increase in the number of cases, and screening uptake reduces the risk in men compared to women [29].

Age and sex are regarded as predictive aspects among patients diagnosed with colorectal cancer for receiving immune checkpoint inhibitors. Sex impacts diverse elements among patients diagnosed with colorectal cancer. Researchers sought to evaluate the influence of sex on chemotherapy intervention toxicity and its efficacy. They pooled distinct data sets that emanated from selected clinical trials, evaluates the prevalence of CRC by sex [30] . From the research, the participants (both male and female) were identified and distinguished into two groups when they were compared. The study found that from the identified subjects, the chemotherapy regimen gave higher incidences of side effects [31]. Despite this, it did not offer vital information regarding the adverse effects observed among the female and the male categories of patients. Given this, future studies should explore the concern to identify the impact of sex on colorectal cancer. The study concluded that males and females possess divergent patterns through which colorectal cancer can manifest. Notably, women have a higher risk of diabetes and other

comorbid conditions, which increases their predisposition. Despite this, there is an increased association of colorectal cancer in men when compared to women [32].

Cancers of any type are considered dangerous ailments given their rapid growth and metastasis to other tissues, making them challenging to control. Notably, the development of appropriate treatment strategies necessitates careful assessment. This involves evaluating the myriad influences, including gender, on the desired patients' outcomes. Different type of studies have been explored to gain a better understanding of the association between gender and colorectal cancer [33]. A meta-analysis study by (Yang et al., 2017), examined the influence of gender on different health outcomes, i.e., general and cancer-specific survival.

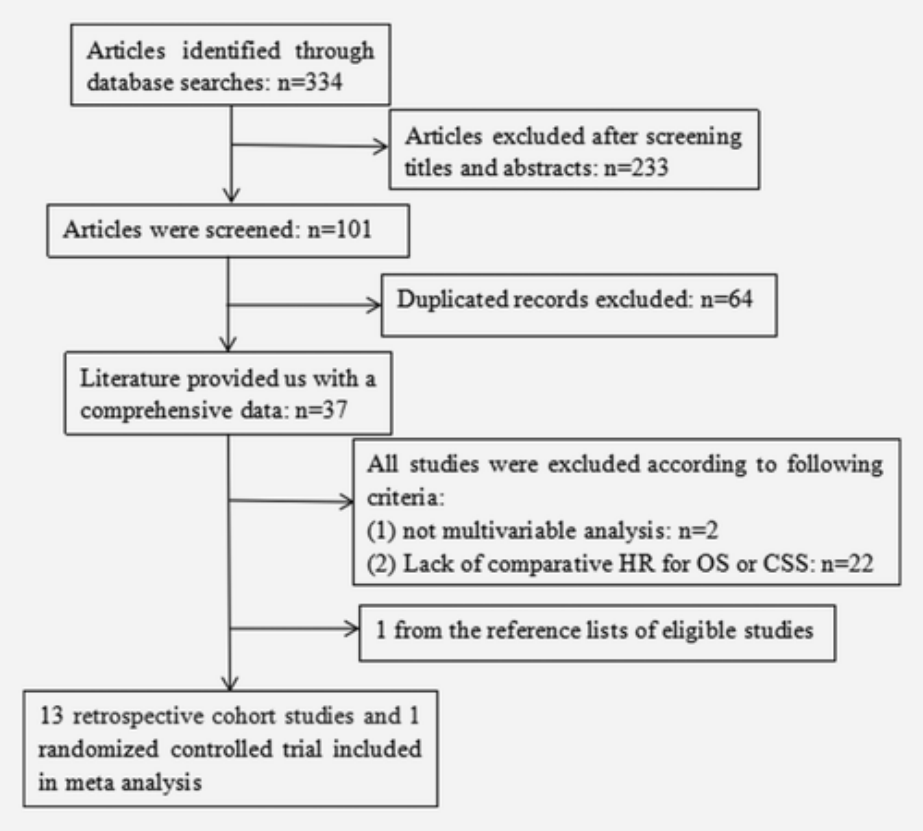

Figure 5. Flowchart of the literature search

The information included in the study was gathered from diverse online databases, and the documented clinical trials were compared, including the difference diagnosis obtained from the male and the female forms of gender. The identified study enrolled a group of participants diagnosed with colorectal cancer [34]. The males and females evaluated for the study were obtained from varying listed traits that were documented. From the study, the results from the overall survival and cancer-specific survival were established and compared. From the study, the females exhibited better outcomes compared to males. It was concluded that the male population has a higher risk for colorectal cancer compared to their female counterparts. Overall, the study concludes the existence of gender influence on the survival rates of those diagnosed with colorectal cancer.

Gender differences influence the quality of life among diverse patients under the medical and other procedures in managing colorectal cancer [35]. Cross-sectional study was completed to evaluate the distinct gender representations and their influence on the quality of life for patients receiving treatment for colorectal cancer [36]. The study incorporated 144 patients from which 72 were males, and the other 72 made up the female gender set who were on treatment interventions for colorectal cancer. The data included for the study entailed a combination of clinical and sociodemographic factors, which provided information on the health-related life quality with the treatment strategies for individuals diagnosed with colorectal cancer. The article reveals that colorectal cancer is a significant public health concern across the region.

Table 2. Comparison of men and women in relation to general quality of life (EORTC-QLQ-Q30)

EORTC QLQ-C30	Male (n=72)		Female (n=72)		
	Mean	Standard deviation	Mean	Standard deviation	p Value
Functional scale					
Physical Function	82.78	18.70	76.53	23.68	0.082
Role Performance	83.80	22.50	78.17	22.54	0.191
Cognitive Function	88.89	16.80	78.64	22.39	0.002
Emotional Function	78.01	21.95	70.19	26.78	0.058
Social Function	81.94	27.79	73.94	29.64	0.098
Scale of symptoms					
Fatigue	21.60	25.35	22.85	27.53	0.779
Pain	9.95	18.27	11.97	23.60	0.568
Nausea/ Vomiting	12.04	18.60	17.37	25.57	0.156
Dyspnea	7.87	20.55	7.98	19.89	0.974
Insomnia	20.37	30.92	26.29	35.14	0.287
Lack of appetite /Anorexia	14.35	28.97	21.60	34.31	0.175
Constipation	7.41	22.53	12.21	26.57	0.246
Diarrhea	18.52	30.58	16.90	25.11	0.730
Financial problems	22.54	32.745	27.70	36.07	0.373
General health status	73.96	22.68	78.05	21.39	0.269

On the other hand, females depicted a higher incidence of colorectal cancer of 8.6% from their male counterparts. Hereditary factors contribute to the rise in the predisposing factors to the condition. Therefore, numerous studies directly examine the association between gender and the adverse effects of the disease process on the victim's quality of life. According to Trinquinato et al. (2017)) gender differences are associated with colorectal cancer and they should be evaluated to identify whether each gender can protect themselves from the colorectal cancer. The study presents the gender difference among males and females to include social, individual, cognitive and physical. The identified variables play a pivotal role in investigating gender differences since they reflect unique coping strategies and the influence of the identified condition's treatment process. Adverse impacts of colorectal cancer lower the overall quality of life. As indicated in

the study, males are at advanced level risk of getting colorectal cancer compared to their female counterparts [36]. Therefore, among the patients diagnosed with colorectal cancer, males are more likely to have their cognition significantly impacted by the condition. Given this, men depict a more significant impact of cognitive impairment on the situation, reflecting on the lower quality of life. Essentially, cognitive function among patients diagnosed with colorectal cancer contributes to a drop in the quality of life among the male population cohorts compared to the females. The male gender diagnosed with the condition have a reduced quality of life due to the prevalence of the symptoms such as fecal incontinence, and other features.

A study that explores this topic presents influences of gender in an individuals' lifestyle choices and contributes to the high mortality rates associated with the condition. Notably, research patterns reveal the influence of western lifestyle practices and their association with obesity, hypertension, and other diseases. Particularly, females are the victim of poor dietary patterns and lack of physical activities compared to males, who are often involved in heavy tasks [37]. These risk factors, i.e., sedentary lifestyles and other unhealthy behavioral patterns, increase the likelihood of colorectal cancer among females. Despite females being highly predisposed, males exhibiting sedentary lifestyles should also alter their ways and evaluate their ability to prevent the development of neoplastic ailments and other complications. According to Conti et al. (2020), gender disparities contribute to neglecting management issues and providing the best treatment approaches for the condition. Therefore, the article aimed to reevaluate lifestyle factors and the risks of colorectal cancer from a gender perspective. Overall, appropriate dietary and lifestyle practices should be designed to limit the predisposition to neoplastic conditions for both men and women [38]. Modification of the lifestyle practices will reduce the adverse effects associated with the development of cancer. Adapting these strategies would help

generate a healthier community whereby one gender is never overburdened with the actual neoplastic disease process and other adverse consequences of unique practices.

6. Limitations

The study's main limitation is the lack of individual indicators of hormonal status, including detailed information on the menopause state. This resulted to getting different results compared to those gotten by previous researchers. However, this limitation is common among registry-based studies, and it may be impossible to include information if it is unavailable in population-based registries. The identified sampling method does not facilitate the identification of subjects but aids in evaluating variables that affect the quality of life in both genders diagnosed with colorectal cancer. Some studies found men to have higher colorectal incidence over women and some studies proved otherwise. The etiology of gender differences in CRC is complex, and many factors may require further investigation. Moreover, the study does not warrant the combination of clinical features and demographic factors that facilitate a reliable comparison of a patient's quality of life. Therefore, future studies should evaluate both randomized and empirical aspects to facilitate robust comprehension of the association between gender and colorectal cancer.

The study about obesity having stronger connection to colon cancer compared to rectal cancer and why it impose a greater risk of colon cancer for premenopausal women than it does for postmenopausal women has a interest of conflict and more studies need to be conducted on the subject for better findings.

7. Conclusion

Colorectal cancer is a significant cause of death in both the United States and the world, and its prevalence depends on different factors, including race, age, and sex. As much as colorectal cancer incidence has reduced over the years, it still causes many deaths. With technology changes, enhanced screening and treatments have led to the decrease in the prevalence and death of CRC in people less than 55 years old. Males aged below 45 years are advised to exercise as this reduces their chances of presenting with colorectal cancer, and more people are doing that every day. Both men and women are also advised to avoid alcohol and smoking, reduce the consumption of red meats, and more people are switching to vegetarian diets, contributing to the decreasing numbers.

Males should adopt the aforementioned CRC risk reducing recommendations since they are at higher risk of getting colorectal cancer compared to women. Studies about racial disparity have shown that African Americans are more susceptible to colorectal cancer, and have higher rate of mortality than other races. Fatalities have been simultaneously decreasing among whites Americans while increasing among African-Americans. One contributing factor to this is that the socioeconomic status in African-America is lower, though other factors also play a role in this disparity. In terms of age, younger people are more frequently diagnosed with CRC compared to older people (over 50 years) since they follow up with a colonoscopy. People are advised to take up regular screening so that treatment can happen at an early stage to control CRC. Poor eating habits among young people have caused obesity, which increases the risk of colorectal cancer.

All individuals are at risk of suffering from colorectal cancer. everyone needs to take care of the of the illness and always seek medical care if they have signs and symptoms related to

cancer. People should take all the necessary precautions to protect themselves from colorectal cancer since it has become killer disease. Even though people of certain ages, races and sex are at a higher risk than others, almost everyone is at a risk of getting CRC. Therefore, following the risk mitigation recommendations like early screening and lifestyle changes are necessary reduce the prevalence and death of CRC worldwide.

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