gastrointestinal disorders

MDPI

Brief Report

Food Insecurity Is Associated with a Higher Risk of Mortality among Colorectal Cancer Survivors

Jagdish Khubchandani [1,*], Srikanta Banerjee [2], Rafael Gonzales-Lagos [2] and Karen Kopera-Frye [1]

1 College of Health, Education, and Social Transformation, New Mexico State University, Las Cruces, NM 88003, USA; kfrye@nmsu.edu
2 College of Health Sciences, Walden University, Minneapolis, MN 55401, USA; srikanta.banerjee2@mail.waldenu.edu (S.B.); rafael.gonzales-lagos@waldenu.edu (R.G.-L.)
* Correspondence: jagdish@nmsu.edu

Abstract: *Purpose:* Food insecurity and colorectal cancer (CRC) are widely prevalent problems in the U.S. However, the long-term effects of food insecurity among people living with CRC are not well explored (e.g., risk of mortality). *Methods:* Data from the U.S. National Health and Nutrition Examination Survey (years 1999–2010) were linked with mortality data from the National Death Index up to 31 December 2019. *Results:* A total of 30,752 adults comprised the analytic sample; 222 were living with CRC and more than a tenth were food-insecure (11.6%). In our adjusted analysis, individuals who were food insecure and had CRC were 4.13 times more likely to die of any cause and 9.57 times more likely to die of cardiovascular diseases (compared to those without CRC and food insecurity). *Conclusions:* Colorectal cancer is among the top cancers diagnosed in American adults and more than a tenth of adult Americans with CRC live with food insecurity. Given the higher risk of mortality with co-occurring CRC and food insecurity, collaborative healthcare models can help address food insecurity and other social needs of people with CRC, and surveillance measures for food insecurity should be widely implemented across health systems.

Keywords: cancer; food insecurity; colorectal; mortality; prevention; risk

check for updates

Citation: Khubchandani, J.; Banerjee, S.; Gonzales-Lagos, R.; Kopera-Frye, K. Food Insecurity Is Associated with a Higher Risk of Mortality among Colorectal Cancer Survivors. *Gastrointest. Disord.* **2024**, *6*, 461–467. https://doi.org/10.3390/gidisord6020031

Academic Editor: Tamara Čačev

Received: 20 March 2024
Revised: 7 May 2024
Accepted: 16 May 2024
Published: 17 May 2024

1. Introduction

Colorectal cancers (CRCs) are among the leading causes of cancer-related deaths and the most common types of cancers in adult Americans. On average, the 5-year survival rate for these cancers is less than 70%, claiming more than 50,000 lives in the U.S. every year [1,2]. The prevalence varies by race, gender, age, and region in the U.S., with African Americans, males, older individuals, and those living in the South having the highest rates [2–4]. The risk factors for CRC, including smoking, alcohol use, obesity, lack of physical activity, and unhealthy diets (e.g., processed meats; low fiber and high fat; and inadequate fruit/vegetable consumption), have been well explored [3–5].

Despite the well-known risk factors for CRC, little is known about the risk factors for mortality among those with CRC beyond a few demographic determinants (i.e., higher mortality among males, older individuals, African Americans, those with a delayed diagnosis or lack of periodic screenings, and those with lower income or education) [3,4,6,7]. For example, in a study of more than 45,000 adults in the U.S., higher age and body mass index (BMI), and male sex were associated with higher mortality risk among those with colorectal cancer, but alcohol, medication, and other dietary items were not related to mortality risk [7]. Similarly, the Melbourne Collaborative Cohort Study data found that BMI, smoking, and tumor characteristics were associated with mortality risk, but alcohol consumption was not [8]. In contrast, a study of more than 11,000 adults from the Taiwan Cancer Registry found that higher mortality risk was associated with early cancer stage, radiotherapy, male sex, an age of less than 50 years, and a history of cerebrovascular or chronic kidney disease [9]. However, in another cohort study of more than 56,000 Danish adults with colorectal cancer, comorbidities had limited influence on mortality beyond the first year after diagnosis [10].

Among the factors associated with a greater risk of mortality in those with CRC, diet is probably the most examined determinant [11–14]. For example, in a study of more than 1200 American nurses, the risk of mortality was 29% lower with a higher Alternate Healthy Eating Index 2010 score among those with CRC, but no effect of Western or Mediterranean diets was observed [13]. In contrast, in a cohort study of more than 2800 Americans, the American Cancer Society nutrition guidelines score was associated with a 38% lower risk of mortality, and the DASH score was associated with a 21% lower risk of mortality, but no significant association was found with Western diets [14]. One specific study suggested that only Mediterranean diets could alter CRC survival but only for African American women [11]. Overall, these diet-related studies on mortality among those with CRC provide clues about the role of diet quality [15]. However, the role of food security has not been explored in relation to mortality among those with CRC. Thus, our purpose in this investigation was to prospectively assess mortality risk among a national random sample of American adults based on CRC diagnosis and food insecurity.

2. Results

In total, 30,752 adults comprised the final study sample, with more than a tenth of them reporting food insecurity in the last year (11.6%). Individuals with CRC (n = 222) were statistically significantly more likely to be older, White, and with less than high school education or a history of cardiovascular and chronic kidney disease (Table 1). With regards to food insecurity based on CRC diagnosis, individuals without CRC were significantly more likely to be food insecure compared to those with CRC (11.7% vs. 6.9%, $p < 0.05$). In the total population, 6910 deaths were observed upon follow-up with 1098 deaths related to cardiovascular diseases. Total deaths (145/222 vs. 6765/30,530; $p < 0.01$) and deaths related to cardiovascular diseases (23/222 vs. 1075/30,530; $p < 0.01$) were statistically significantly higher among those with CRC compared to those without CRC (Table 1).

Table 1. The characteristics of study participants are stratified by colorectal cancer diagnosis.

Characteristics	*Total Population (n = 30,752)*	*Colorectal Cancer (+) (n = 222)*	*No Colorectal Cancer (−)(n = 30,530)*
Average Age (years, 95% CI) **	46.5 (46.1–46.9)	70.2 (68.2–72.3)	46.4 (45.9–46.8)
Female Participants (%, 95% CI)	52.0 (51.5–52.5)	53.2 (46.6–59.8)	52.0 (51.5–52.5)
Education Level (%, 95% CI) **			
Less than high school	19.9 (18.7–21.1)	32.3 (25.0–40.0)	19.8 (18.6–21.0)
High school	25.0 (23.9–26.1)	24.1 (17.4–30.8)	25.0 (23.9–26.1)
College or higher	55.1 (53.4–56.9)	43.6 (34.7–52.5)	55.2 (53.4–56.9)
Ethnicity (%, 95% CI) **			
Non-Hispanic White	0.42 (0.30–0.50)	84.3 (80.0–89.2)	70.4 (67.9–73.0)
Non-Hispanic Black	0.05 (0.03–0.07)	9.7 (6.60–14.)	11.2 (9.8–12.5)
Hispanic	0.02 (0.01–0.05)	5.0 (2.70–9.1)	13.0 (11.0–14.9)
Other	0.01 (0.001–0.95)	0.7 (0.23–3.8)	5.50 (3.8–6.3)
Family Poverty Income Ratio (%) * (PIR < 1)	13.6 (12.7–14.5)	11.4 (6.6–16.2)	13.6 (12.7–14.5)
Food Insecurity * (yes %, 95% CI)	11.6 (10.6–12.70)	6.9 (3.5–13.1)	11.7 (10.6–12.7)
Obesity > 30 BMI (yes %, 95% CI)	66.9 (66.0–67.9)	74.1 (66.5–81.7)	66.9 (66.0–67.8)
Stroke (yes %, 95% CI) **	2.7 (2.5–3.0)	13.3 (9.0–17.7)	2.7 (2.4–3.0)
Hypertension (yes %, 95% CI) **	25.5 (22.5–24.4)	63.7 (55.8–71.5)	23.3 (22.3–24.2)
Coronary Heart Disease (yes %, 95% CI) **	2.6 (2.3–2.9)	9.2 (5.7–14.7)	2.6 (2.3–2.9)

Table 1. *Cont.*

Characteristics	*Total Population (n = 30,752)*	*Colorectal Cancer (+) (n = 222)*	*No Colorectal Cancer (−)(n = 30,530)*
Myocardial Infarction (yes %, 95% CI) **	3.4 (3.2–3.8)	17.6 (13.5–21.8)	3.4 (3.1–3.7)
Chronic Kidney Disease (yes %, 95% CI) **	7.1 (6.7–7.6)	41.5 (34.7–48.4)	7.0 (6.6–7.4)
Hypercholesteremia (yes %, 95% CI) **	41.2 (40.1–42.3)	60.4 (51.9–69.0)	41.1 (40.0–42.2)
All deaths (N) **	6910	145	6765
Cardiovascular deaths (N) **	1098	23	1075

Note. * $p < 0.05$ ** $p < 0.01$. Numbers with 95CI indicate 95% confidence intervals for proportions.

In the total population, adults with CRC (irrespective of food security status), did not have a significantly higher risk for either all-cause (HR=0.84) or cardiovascular disease mortality (HR=0.35) [Table 2]. In stratified analysis, individuals with CRC and food insecurity were 4.13 times more likely to die of any cause (95% CI = 2.31–7.40, $p < 0.01$) compared to those without CRC or food insecurity. The relationship with mortality for this group was moderated by a history of stroke, CKD, current smoking status, and age. In contrast, compared to those without CRC or food insecurity, people with CRC only were not significantly more likely to die of any cause [HR=0.81 (95%CI = 0.57–1.17)]. Similarly, individuals with CRC and food insecurity were 9.57 times more likely (95% CI = 3.06–29.95, $p < 0.01$) to experience cardiovascular mortality compared to those without CRC or food insecurity. The relation with cardiovascular mortality in this group was moderated by current smoking and age. In contrast, people with CRC alone were not significantly more likely to experience cardiovascular mortality [HR=0.22 (95%CI = 0.06–1.01)] compared to those without CRC or food insecurity.

Table 2. Predictors of mortality among people with colorectal cancer based on food security.

Predictor Variables	**Full Sample HR (95%CI)**	**Colon Cancer + Food Insecurity + HR (95%CI)**	**Colon Cancer+ Food Insecurity- HR (95%CI)**	**Full Sample HR (95%CI)**	**Colon Cancer+ Food Insecurity +HR (95%CI)**	**Colon Cancer+ Food Insecurity- HR (95%CI)**
		All-Cause Mortality			*Cardiovascular Disease Mortality*	
Colorectal Cancer	0.84 (0.59–1.18)	4.13 (2.31–7.40) **	0.81 (0.57–1.17)	0.35 (0.10–1.17)	9.57 (3.06–29.95) **	0.22 (0.06–1.01)
Stroke	1.60 (1.42–2.04) *	1.71 (1.11–2.62) *	1.69 (1.35–2.11) *	1.97 (1.21–3.21) *	1.16 (0.54–2.52)	2.22 (1.24–3.99) **
Hypertension	1.35 (1.16–1.57) *	1.40 (0.71–2.76)	1.36 (1.18–1.56) *	1.72 (1.31–2.25) *	1.45 (0.62–3.40)	1.76 (1.34–2.30) *
Coronary Heart Disease	1.20 (0.99–1.50)	1.05 (0.66–1.67)	1.20 (0.96–1.50)	1.42 (0.89–2.27)	1.18 (0.53–2.63)	1.38 (0.83–2.29)
Myocardial Infarction	1.41 (1.17–1.70) *	1.55 (0.96–2.40)	1.39 (1.13–1.70) *	1.91 (1.32–2.77) *	2.15 (0.78–5.94)	1.83 (1.20–2.77) *
Smoking	1.67 (1.45–1.94) *	2.01 (1.39–2.91) **	1.64 (1.42–1.90) *	1.39 (1.04–1.87) *	2.06 (1.14–3.72) **	1.34 (1.01–1.78) *
CKD	1.57 (1.36–1.82) *	1.83 (1.11–3.03) *	1.52 (1.31–1.78) *	1.59 (1.13–2.23) *	1.28 (0.54–3.02)	1.56 (1.09–2.24) *
Obesity	1.02 (0.87–1.19)	1.06 (0.71–1.59)	1.04 (0.88–1.23)	0.95 (0.71–1.26)	0.95 (0.36–2.50)	1.01 (0.74–1.38)
Hypercholesteremia	0.88 (0.74–1.05)	0.82 (0.52–1.29)	0.88 (0.73–1.05)	0.92 (0.67–1.26)	0.64 (0.28–1.42)	0.98 (0.70–1.38)
Ethnicity (Ref White) Non-Hispanic Black Hispanic Other	Reference 1.20 (1.01–1.44) * 0.99 (0.77–1.21) 0.76 (0.48–1.18)	Reference 0.73 (0.46–1.16) 0.79 (0.45–1.39) 0.63 (0.17–2.25)	Reference 1.30 (1.09–1.56) 0.99 (0.77–1.27) 0.75 (0.46–1.23)	Reference 1.12 (0.93–1.52) 0.65 (0.33–1.27) 0.89 (0.39–2.02)	Reference 0.53 (0.21–1.34) 0.44 (0.16–1.19) 1.74 (0.25–11.10)	Reference 1.29 (0.96–1.74) 0.71 (0.33–1.51) 0.66 (0.30–1.47)
Age	1.09 (1.08–1.09) *	1.07 (1.05–1.09) *	1.09 (1.08–1.11) *	1.08 (1.06–1.10) *	1.09 (1.06–1.12) *	1.08 (1.06–1.11) *
Gender (Ref: Male)	0.85 (0.58–0.73) *	0.76 (0.55–1.03)	0.63 (0.56–0.71) *	0.52 (0.41–0.66) *	0.65 (0.36–1.17)	0.49 (0.37–0.64) *
FPIR (Ref: PIR ≥ 1)	1.31 (1.05–1.63) *	1.04 (0.74–1.46)	1.31 (1.01–1.71) *	1.31 (0.83–2.06)	0.73 (0.30–1.77)	1.51 (0.95–2.42)
Education Level						
≥Some college Less than high school High school graduate	Reference 1.33 (1.16–1.53) * 1.21 (1.08–1.49) *	Reference 1.12 (0.76–1.67) 1.07 (0.66–1.74)	Reference 1.30 (1.13–1.51) 1.27 (1.08–1.51)	Reference 1.36 (0.96–1.93) 1.16 (0.82–1.66)	Reference 1.07 (0.44–2.63) 0.50 (0.18–1.42)	Reference 1.26 (0.85–1.87) 1.24 (0.86–1.80)

Note. * $p < 0.05$ ** $p < 0.01$. HR (95CI) indicates hazard ratios with 95% confidence intervals for the outcome (i.e., mortality). Ref indicates the reference group among each variable for comparison with other groups. For the overall analysis, individuals without CRC or food insecurity served as the comparison group.

3. Methods

3.1. Study Sample and Measures

For our analysis, we used data from the National Health and Nutrition Examination Survey (NHANES) throughout the years 1999–2010 [16–19]. Data collection for NHANES consists of an in-home interview and a physical exam component at a mobile examination center. The survey interview consists of sociodemographic and health-related questions, and the physical exam components include medical, physiological, and laboratory measurements. Our random sample for this study is representative of noninstitutionalized American adults ages 20 years and older. Participants' survey data were linked with mortality data from the date of survey participation to 31 December 2019, using death certificate records from the National Death Index (NDI) [16–19].

The USDA Household Food Security Survey Module (HFSSM, a previously validated measure) was utilized to measure household food security. Briefly, for this analysis, we measured household food security over the prior 12 months and focused only on adult health outcomes. Responses to the ten household and adult items in the 18-item scale were included to run an analysis where food insecurity was classified into four categories—food security, marginal food security, low food security, and very low food security. Next, we dichotomized the HFSSM. Those referred to as marginal, low, and very low food security, or if $\geq$1 item(s) were answered affirmatively, were deemed to be in a state of food insecurity. When sensitivity analysis was run, we found that results were robust across the successive models when food insecurity was determined through two- or four-category classification systems [17,19]. The study participants were asked "Has a doctor or other health professional ever told you that you had cancer or malignancy?". The participants who answered "yes" were further asked, "Which kind of cancer was it?". Those who selected "colon cancer" or "rectal cancer" were considered to have CRC [18].

Study participants' characteristics such as age, sex, race/ethnicity, education, BMI, and income (via family income to poverty ratio variable) were also considered in our analysis. Cardiovascular disease was determined by the self-reported diagnosis of coronary heart disease, hypertension, stroke, or myocardial infarction. For hypercholesterolemia, the level of cholesterol was determined through laboratory tests and dichotomized according to previously validated standards. For this study, 240 mg/dL and above among participants was considered to be a positive diagnosis for hypercholesterolemia. For chronic kidney disease (CKD) diagnosis, the glomerular filtration rate was assessed using the Cockcroft–Gault equation. More details about NHANES data, variables, and analytic procedures have been published in prior studies [16–19]. Study protocols, procedures, and data collection were approved by the CDC's National Center for Health Statistics Research Ethics Review Board.

3.2. Analysis

In the final analysis, to enhance the generalizability of the study sample at the individual participant level, probability sampling weights were applied considering NHANES nonresponses, oversampling, poststratification, and sampling errors. Descriptive statistics were computed on study variables (e.g., frequencies and percentages) to describe the study participants and their health and sociodemographic characteristics. Subsequently, group differences were assessed between those with and without CRC by utilizing chi-square tests. Multivariate analysis was performed using regressions to determine the relationship between colorectal cancer and mortality. Finally, multiple Cox regression models were constructed to examine differences in mortality rates among people with CRC (based on whether or not they were food-insecure) after adjusting for health-related (e.g., comorbidities) and sociodemographic characteristics of participants (i.e., age, sex, income, education, race, and ethnicity). Those without food insecurity or CRC were used as a reference group. All variance calculations incorporated the sample weights and accounted for the complex design of samples using Taylor series linearization. Statistical significance was assumed *a* *priori* at an alpha level of $p < 0.05$. Statistical analyses were conducted using the SAS System (Release 9.1; SAS Institute Inc., Cary, NC, USA).

4. Discussion

In this investigation of more than 30,000 Americans (aged 20 years and older), we found that CRC alone did not statistically significantly increase the risk of cardiovascular or all-cause mortality among study participants. However, among those with both CRC and food insecurity, the risk significantly increased by 4.13 times for all-cause mortality and 9.57 times for cardiovascular mortality. Across all the comparison groups and analyses (e.g., for cardiovascular or all-cause mortality), age and smoking were the two factors that consistently influenced the relationship between CRC, food insecurity, and mortality.

The novel aspect of this study is the understanding of the influence of food insecurity on mortality among those with CRC. Only a few previous studies have explored the impact of food access on CRC-related outcomes, but most of these studies assessed the community-level determinants of food access and quality [20–23]. For example, a study of 48,666 colorectal cancer patients from California found that five-year survival ratings were 60% for food desert residents and 64% for non-desert residents [20]. Another nationwide study found that a better Food Environment Index was associated with lower colorectal cancer incidence and mortality [21]. Two recent reviews also found that neighborhood availability of various foods (e.g., meat vs. grains) could potentially influence CRC outcomes [22,23]. The limitation of these studies is the portrayal of a broader picture of neighborhood deprivation and its relationship with CRC outcomes. Also, factors such as education, race, age, lifestyle risk factors, and a history of comorbidities were not explored in the aforementioned studies. Based on our findings, individuals with CRC have higher mortality if they are food insecure, and smoking, age, and comorbidities play a role in this relationship. Interventions to reduce mortality risk among those with CRC should be designed keeping these factors in consideration [12–14,21–24].

Food insecurity and CRC are prevalent problems in the U.S. The concurrence of CRC and food insecurity was found to increase the risk of both all-cause and cardiovascular mortality. Healthcare practitioners should screen for indicators of food insecurity, lifestyle risk factors (e.g., unhealthy diet and smoking), and comorbidities and include them in medical records (not only for individuals with CRC but for other types of cancer as well) [8–12]. Specifically, for food insecurity, there are clinic and community-based interventions that are beneficial. Clinic- or healthcare-setting-based interventions of three broader categories have been found to have a positive impact (i.e., food referrals, voucher programs, or direct food provision) [23–26]. In addition, as previous studies related to diet quality and mortality risk among individuals with CRC have found an association between certain foods and higher mortality risk, patient education initiatives should be implemented in specialty and primary care for individuals with CRC [11–15]. Treatment for comorbidities and smoking cessation program offerings should be increased across health systems, specifically for those with CRC and higher socioeconomic needs [5,8,10,18,27].

Limitations

The results of this analysis suffer from a few potential limitations. Health risk factors (e.g., smoking and food insecurity) were assessed based on self-reports from individuals which could lead to bias. The results could also be limited due to the cross-sectional NHANES data utilized for analysis, posing threats to internal and external validity. While this is the first study on this topic that uses NHANES-NDI data, a longer duration of follow-up could have helped further delineate the impact of food insecurity among those with CRC. A major limitation was the number of people with CRC in the database and the inability to ascertain deaths directly attributed to CRC. Also, mortality risk and health status are influenced by a variety of factors, and we may not have accounted for other contributing factors due to the limitations of existing data. Finally, further exploration is needed on certain findings of this study. For example, people with CRC were less likely to be food-insecure, whereas some studies suggest that living around better food environments is related to a lower incidence of CRC [20–22]. Despite these limitations, to our knowledge, this is the first major analysis of the impact of food insecurity on mortality among those living with CRC. We utilized a national random sample of adults in the U.S. that is highly representative ensuring external validity. Also, we utilized complex sample survey analysis procedures to ensure precision. Finally, we adjusted for numerous sociodemographic and health-related variables in our analysis, contributing uniquely to the literature on CRC-related outcomes and the factors influencing these outcomes.

5. Conclusions

In this analysis of a large national random sample of community-dwelling American adults, food insecurity was associated with a significantly higher risk of mortality among those with CRC. In contrast, CRC alone did not significantly increase the risk of mortality after adjusting for health and demographic factors. Given these findings, extensive surveillance, and screening for food insecurity among CRC patients is warranted in healthcare facilities. Furthermore, clinic and community-based interventions that are beneficial should be widely implemented. Clinicians should be sensitized to the prevalence of food insecurity among cancer patients and informed on how to be resourceful in helping these patients. Reducing food insecurity among cancer patients has the potential to improve quality of life, reduce healthcare costs, and reduce mortality risk.

Author Contributions: Conceptualization, J.K., S.B. and K.K.-F.; methodology, J.K. and S.B.; software, S.B. and R.G.-L.; validation, J.K. and K.K.-F.; formal analysis, S.B. and J.K.; investigation, R.G.-L. and K.K-F.; data curation, R.G.-L. and K.K.-F.; writing—original draft preparation, J.K., R.G.-L. and K.K.-F.; writing—review and editing, J.K. and S.B.; visualization, S.B. and R.G.-L.; supervision, S.B. and K.K-F. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Study protocols, procedures, and data collection were approved by the CDC's National Center for Health Statistics Research Ethics Review Board. Additional approvals were sought from the Walden University IRB.

Informed Consent Statement: Informed consent was not required as publicly available deidentified data sources were utilized in this investigation.

Data Availability Statement: Data are publicly available at the U.S. Centers for Disease Control and Prevention website (https://www.cdc.gov/nchs/nhanes/index.htm) (accessed on 30 October 2023).

Conflicts of Interest: The authors declare no conflicts of interest.

References

1. Centers for Disease Control and Prevention. Colorectal Cancer Statistics. 2023. Available online: https://www.cdc.gov/cancer/colorectal/statistics/ (accessed on 20 March 2024).
2. American Cancer Society. Cancer Types: Colorectal Cancer. 2023. Available online: https://www.cancer.org/cancer/types/colon-rectal-cancer.html (accessed on 6 March 2024).
3. McClelland, P.H.T.; Liu, T.; Ozuner, G. Early-onset colorectal cancer in patients under 50 years of age: Demographics, disease characteristics, and survival. *Clin. Color. Cancer* **2022**, *21*, e135–e144. [CrossRef] [PubMed]
4. American Cancer Society. Colorectal Cancer, Facts & Figures, 2020–2022. 2023. Available online: https://www.cancer.org/content/dam/cancer-org/research/cancer-facts-and-statistics/colorectal-cancer-facts-and-figures/colorectal-cancer-facts-and-figures-2020-2022.pdf (accessed on 6 December 2023).
5. Sawicki, T.; Ruszkowska, M.; Danielewicz, A.; Niedźwiedzka, E.; Arłukowicz, T.; Przybyłowicz, K.E. A review of colorectal cancer in terms of epidemiology, risk factors, development, symptoms and diagnosis. *Cancers* **2021**, *13*, 2025. [CrossRef] [PubMed]
6. Siegel, R.L.; Miller, K.D.; Goding Sauer, A.; Fedewa, S.A.; Butterly, L.F.; Anderson, J.C.; Cercek, A.; Smith, R.A.; Jemal, A. Colorectal cancer statistics, 2020. *CA Cancer J. Clin.* **2020**, *70*, 145–164. [CrossRef] [PubMed]
7. Shaukat, A.; Dostal, A.; Menk, J.; Church, T.R. BMI is a risk factor for colorectal cancer mortality. *Dig. Dis. Sci.* **2017**, *62*, 2511–2517. [CrossRef] [PubMed]
8. Yu, S.C.; Shiue, Y.L.; Wu, Y.C.; Wang, J.J.; Liao, K.M.; Ho, C.H. The mortality risk in patients with early onset colorectal cancer: The role of comorbidities. *Front. Oncol.* **2023**, *13*, 1139925. [CrossRef] [PubMed]

9. Jayasekara, H.; English, D.R.; Haydon, A.; Hodge, A.M.; Lynch, B.M.; Rosty, C.; Williamson, E.J.; Clendenning, M.; Southey, M.C.; Jenkins, M.A.; et al. Associations of alcohol intake, smoking, physical activity and obesity with survival following colorectal cancer diagnosis by stage, anatomic site and tumor molecular subtype. *Int. J. Cancer* **2018**, *142*, 238–250. [CrossRef] [PubMed]
10. Erichsen, R.; Horváth-Puhó, E.; H Iversen, L.; Lash, T.L.; Sørensen, H.T. Does comorbidity interact with colorectal cancer to increase mortality? A nationwide population-based cohort study. *Br. J. Cancer* **2013**, *109*, 2005–2013. [CrossRef] [PubMed]
11. Jacobs, S.; Harmon, B.E.; Ollberding, N.J.; Wilkens, L.R.; Monroe, K.R.; Kolonel, L.N.; Le Marchand, L.; Boushey, C.J.; Maskarinec, G. Among 4 diet quality indexes, only the alternate Mediterranean diet score is associated with better colorectal cancer survival and only in African American women in the multiethnic cohort. *J. Nutr.* **2016**, *146*, 1746–1755. [CrossRef] [PubMed]
12. Pelser, C.; Arem, H.; Pfeiffer, R.M.; Elena, J.W.; Alfano, C.M.; Hollenbeck, A.R.; Park, Y. Prediagnostic lifestyle factors and survival after colon and rectal cancer diagnosis in the National Institutes of Health (NIH)-AARP Diet and Health Study. *Cancer* **2014**, *120*, 1540–1547. [CrossRef]
13. Fung, T.T.; Kashambwa, R.; Sato, K.; Chiuve, S.E.; Fuchs, C.S.; Wu, K.; Giovannucci, E.; Ogino, S.; Hu, F.B.; Meyerhardt, J.A. Post diagnosis diet quality and colorectal cancer survival in women. *PLoS ONE* **2014**, *9*, e115377. [CrossRef]
14. Guinter, M.A.; McCullough, M.L.; Gapstur, S.M.; Campbell, P.T. Associations of pre-and postdiagnosis diet quality with risk of mortality among men and women with colorectal cancer. *J. Clin. Oncol.* **2018**, *36*, 3404. [CrossRef] [PubMed]
15. Hoang, T.; Kim, H.; Kim, J. Dietary intake in association with all-cause mortality and colorectal cancer mortality among colorectal cancer survivors: A systematic review and meta-analysis of prospective studies. *Cancers* **2020**, *12*, 3391. [CrossRef] [PubMed]
16. Centers for Disease Control and Prevention. National Health and Nutrition Examination Survey. 2023. Available online: https://www.cdc.gov/nchs/nhanes/index.htm (accessed on 30 October 2023).
17. Banerjee, S.; Radak, T.; Khubchandani, J.; Dunn, P. Food insecurity and mortality in American adults: Results from the NHANES-linked mortality study. *Health Promot. Pract.* **2021**, *22*, 204–214. [CrossRef] [PubMed]
18. Restifo, D.; Williams, J.S.; Garacci, E.; Walker, R.J.; Ozieh, M.N.; Egede, L.E. Differential relationship between colorectal cancer and diabetes in a nationally representative sample of adults. *J. Diabetes Its Complicat.* **2018**, *32*, 819–823. [CrossRef] [PubMed]
19. Banerjee, S.; Khubchandani, J.; Davis, W.S. Smoking increases mortality risk among African Americans with chronic kidney disease. *Am. J. Med. Open* **2024**, *11*, 100066. [CrossRef]
20. Fong, A.J.; Lafaro, K.; Ituarte, P.H.; Fong, Y. Association of living in urban food deserts with mortality from breast and colorectal cancer. *Ann. Surg. Oncol.* **2021**, *28*, 1311–1319. [CrossRef] [PubMed]
21. Mo, J.; Luo, J.; Hendryx, M. Food Environment and Colorectal Cancer Incidence and Mortality Rates. *J. Hunger Environ. Nutr.* **2022**, *17*, 397–408. [CrossRef]
22. Namin, S.; Zhou, Y.; Neuner, J.; Beyer, K. Neighborhood characteristics and cancer survivorship: An overview of the current literature on neighborhood landscapes and cancer care. *Int. J. Environ. Res. Public Health* **2021**, *18*, 7192. [CrossRef] [PubMed]
23. Masdor, N.A.; Mohammed Nawi, A.; Hod, R.; Wong, Z.; Makpol, S.; Chin, S.F. The link between food environment and colorectal cancer: A systematic review. *Nutrients* **2022**, *14*, 3954. [CrossRef]
24. Gany, F.; Melnic, I.; Wu, M.; Li, Y.; Finik, J.; Ramirez, J.; Blinder, V.; Kemeny, M.; Guevara, E.; Hwang, C.; et al. Food to overcome outcomes disparities: A randomized controlled trial of food insecurity interventions to improve cancer outcomes. *J. Clin. Oncol.* **2022**, *40*, 3603–3612. [CrossRef]
25. Patel, K.G.; Borno, H.T.; Seligman, H.K. Food insecurity screening: A missing piece in cancer management. *Cancer* **2019**, *125*, 3494–3501. [CrossRef] [PubMed]
26. Raber, M.; Jackson, A.; Basen-Engquist, K.; Bradley, C.; Chambers, S.; Gany, F.M.; Halbert, C.H.; Lindau, S.T.; Pérez-Escamilla, R.; Seligman, H. Food insecurity among people with cancer: Nutritional needs as an essential component of care. *JNCI J. Natl. Cancer Inst.* **2022**, *114*, 1577–1583. [CrossRef] [PubMed]
27. Sheeran, P.; Jones, K.; Avishai, A.; Symes, Y.R.; Abraham, C.; Miles, E.; Wright, C.E.; Mayer, D.K.; Ribisl, K.M. What works in smoking cessation interventions for cancer survivors? A meta-analysis. *Health Psychol.* **2019**, *38*, 855. [CrossRef]