



The role of a social determinants of health summary measure on the association between cancer history status and colorectal cancer screening utilization among screening eligible adults

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ABSTRACT

Objective: We sought to examine the influence of social needs on the relationship between cancer history and colorectal cancer (CRC) screening utilization among adults in the United States.

Methods: We conducted a cross-sectional analysis using data from the 2022 Behavioral Risk Factor Surveillance System. Our outcome of interest was utilization of guideline-concordant CRC screening and exposures of interest were cancer history/levels of social needs. Multivariable logistic regression was performed to examine the association.

Results: Among 74,743 eligible adults, a majority did not have a personal history of cancer (87.9%), had at least one social need (58.4%), and had undergone CRC screening (72.2%). In multivariable analysis, a history of cancer was positively associated with use of CRC screening (OR = 1.59, 95%CI, 1.35 – 1.87). Having at least one social need was associated with lower likelihood of being screened (one social need: OR = 0.85 95%CI, 0.76 – 0.95; two + social needs: OR = 0.77, 95% CI, 0.69 – 0.87). When exploring the effects of social needs, adults without a history of cancer who reported at least one need were 12–20% less likely to be screened for CRC.

Conclusions: A personal history of cancer was associated with greater utilization of CRC screening, whilst having at least one social need had lower screening use. Having social needs plays an important role in reducing screening uptake among adults without a history of cancer. Integrated care that considers both cancer history and social needs may have implications for improved adherence of CRC screening recommendations.

1. Introduction

Colorectal cancer (CRC) incidence and mortality rates have been declining the United States (U.S.) in recent years (National Cancer Institute, n.d.). Between 2010 and 2019, age-adjusted incidence rates for CRC decreased by approximately 1.8% per year. Further, age-adjusted mortality rates decreased by about 2.0% every year between 2011 and 2020 (National Cancer Institute, n.d.). CRC screening utilization has played an important role in improving these rates. A prior study concluded colonoscopies alone are associated with a 52% and 62%

relative risk reduction for CRC risk and mortality, respectively (Zhang et al., 2020). Other studies suggest fecal occult blood tests (FOBT) may also reduce CRC mortality by up to 32% (Shaukat et al., 2013). CRC testing may be especially important for cancer survivors as they have an increased risk of developing recurrent or secondary CRC due to shared risk factors, such as lifestyle factors (e.g., smoking, dietary pattern, physical activity), chemotherapy, and radiation exposure (Desautels et al., 2016; Donin et al., 2016; Dracham, Shankar and Madan, 2018; Key et al., 2020; McTiernan et al., 2019; Morton et al., 2014; Tiwari, Roy and Lynch, 2015; United States Department of Health and Human

Abbreviations: CRC, colorectal cancer; U.S., United States; BRFSS, Behavioral Risk Factor Surveillance System; CDC, Centers for Disease Control and Prevention; IRB, Institutional Review Board; SDOH, social determinants of health; ACS, American Cancer Society; USPSTF, United States Preventive Services Taskforce; CHD, coronary heart disease; MI, myocardial infarction; COPD, chronic obstructive pulmonary disease; ORs, odds ratios.

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Services, 2018). Therefore, it is important to be cognizant of the influence cancer history status has on CRC screening utilization.

Further, evidence regarding CRC screening has indicated that there is a relationship between social determinants of health (SDOH) and CRC screening behaviors. More specifically, having social needs (sometimes used interchangeably with SDOH) are associated with a lower likelihood of being screened for CRC. For example, having a higher annual household income, being insured, and attending routine healthcare visits are associated with a higher likelihood of undergoing CRC screening (Kane et al., 2023; Lozano et al., 2023). In contrast, housing insecurity and community disadvantage are associated with lower adherence to CRC screening recommendations (Lozano et al., 2023; Stone, Gates and Monteiro, 2023). Similar patterns are observed when accounting for whether individuals have had a personal history of cancer. Food insecurity, housing insecurity, and being disabled are associated with a lower likelihood of undergoing CRC screening among people without a history of cancer (Markus et al., 2023; Santiago-Rodríguez et al., 2022). Higher household income and educational attainment are associated with an increased likelihood of CRC screening regardless of cancer history (Boehmer et al., 2010; Huang et al., 2019; Santiago-Rodríguez et al., 2022). Overall, cancer survivors are more likely to be screened for CRC due to a regular doctor visit and screening recommendations (Corkum et al., 2013; El-Shami et al., 2015; Hudson et al., 2009). Studies comparing cancer survivors to non-cancer survivors indicate that cancer survivors may have an increased likelihood of being screened for CRC despite having social needs (MacDonald et al., 2022).

Although prior studies examined the association between cancer history, social needs, and CRC screening use, they either focused on cancer history or social needs on screening use (Boehmer et al., 2010; Ford et al., 2019; Huang et al., 2019; Kane et al., 2023; Lozano et al., 2023; Markus et al., 2023; Santiago-Rodríguez et al., 2022). None of these studies have examined integrated relationships between personal cancer history and screening behavior while accounting for various types of social needs (Boehmer et al., 2010; Ford et al., 2019; Huang et al., 2019; Santiago-Rodríguez et al., 2022). Research examining this integrated relationship by using a composite measure is critical because several social needs are highly correlated. Therefore, we aimed to address this gap by utilizing the data from a recent, large, cross-sectional national survey and examining the relationship between history of cancer and CRC screening utilization, whilst considering the influence of various types of social needs.

2. Methods

2.1. Study design

We utilized the data from the Behavioral Risk Factor Surveillance System (BRFSS), which is a large cross-sectional survey administered annually by the Centers for Disease Control and Prevention (CDC) to about 400,000 adults, across all 50 states, the District of Columbia, Guam, and Puerto Rico. BRFSS utilizes a multistage cluster sampling technique to produce estimates representative of U.S. population. The data includes self-reported information on mental and physical health, multiple chronic diseases, sociodemographic characteristics, cancer history, health behaviors, from noninstitutionalized adults aged ≥ 18 years residing in the U.S. The respective health departments from each state grant Institutional Review Board (IRB) approval for the distribution and collection of data using the BRFSS, and verbal consent of participants as directed by the CDC survey. Data extracted for this study was publicly available and de-identified. Thus, it was considered exempt from Augusta University IRB review.

2.2. Study participants

The 2022 BRFSS had 445,132 respondents aged ≥ 18 years. The SDOH and health equity module includes several factors of social needs;

we excluded states that did not collect this data in the 2022 BRFSS ($n = 137,928$). To obtain an eligible study sample, we excluded respondents with missing information on age ($n = 9,079$), cancer history status ($n = 601$), social needs measure ($n = 46,039$), and at least one covariate (e.g., gender, age, race/ethnicity, education, income, insurance, provider, current smoker, exercise, number of chronic diseases, and mental/physical health, $n = 67,681$). According to the American Cancer Society (ACS) and United States Preventive Services Taskforce (USPSTF) screening recommendations (Davidson et al., 2021; Wolf et al., 2018), we also excluded respondents who were not eligible for routine CRC screening (aged < 45 or ≥ 75 years, $n = 108,564$) and missing information on CRC screening use ($n = 497$). As a result, 74,743 eligible cancer survivors were included for the full analysis (Fig. 1).

2.3. Guideline-concordant CRC screening: Outcome of interest

Our primary outcome of interest was receipt of guideline-concordant CRC screening (yes or no). We defined guideline-concordant CRC screening (yes) based on the ACS and USPSTF recommendations for average-risk individuals: 1) had a colonoscopy within 10 years, 2) sigmoidoscopy within 5 years, or 3) fecal occult blood test (FOBT) within a year (Davidson et al., 2021; Wolf et al., 2018). Respondents categorized as having *no* guideline-concordant CRC screening included those who received a colonoscopy more than 10 years, sigmoidoscopy more than 5 years, FOBT more than a year, or never used any of these three CRC screening options.

2.4. Cancer history and social needs measure: Exposures of interest

Our primary exposure of interest was a history of cancer. A BRFSS question, “(Ever told) you had any other types of cancer?”, was used to define whether participants had a history of cancer (yes or no). Our secondary exposure of interest was a social needs measure. The questions on social needs measure were based on the Center for Medicare and Medicaid Innovation Social Needs Assessment Tool, and asked about employment/economic stability, housing stability and quality, food security, transportation access, utilities security, loneliness, social and emotional support, life satisfaction, and mental stress (De Marchis et al., 2020; Holcomb et al., 2022; Thomas-Henkel and Schulman, 2023). We used ten questions from the SDOH/ health equity module to calculate the summarizing score of social needs measure based on the BRFSS statistical brief report (Supplementary Table S1)(Centers for Disease Control and Prevention, 2023b). The summarized social needs score ranges from 0 to 10 and was categorized into a three-level variable: 1) none, 2) one, 3) two or more social needs. Such definitions will enable the explanation of whether levels of social needs influence CRC screening utilization.

2.5. Covariates

Covariates of interest included sociodemographic characteristics, health-related factors, and quality of life. In sociodemographic characteristics, we included gender (male or female), age (45–49, 50–59, 60–69, 70–74 years), race/ethnicity (non-Hispanic White, non-Hispanic Black, non-Hispanic Other, Hispanic), education (high school graduate or lower, some college, college graduate), and annual household income (less than \$50,000 or \$50,000 or more). In health-related factors, insurance (yes or no), having a health care provider (yes or no), current smoker (yes or no), having exercised in past 30 days (yes or no), and number of chronic diseases were included. Chronic disease conditions were selected based on the prior 2018/2019 BRFSS study, including diabetes, coronary heart disease (CHD) or myocardial infarction (MI), stroke, chronic obstructive pulmonary disease (COPD), emphysema or chronic bronchitis, arthritis, depressive disorder, or kidney diseases (not including kidney stones, bladder infection or incontinence)(Greiner et al., 2021). Further, we calculated the number of

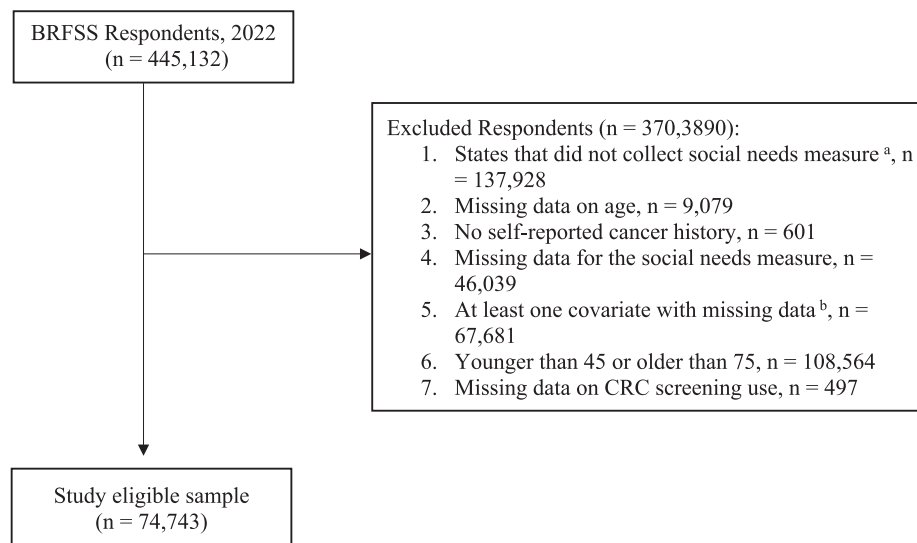


Fig. 1. Sample Selection Flowchart of Screening Eligible Adults in the United States, BRFSS 2022. Abbreviations: BRFSS, Behavioral Risk Factor Surveillance System; SDOH, social determinants of health; CRC, colorectal cancer. ^a States include Alabama, Alaska, Arizona, California, Connecticut, Delaware, District of Columbia, Florida, Georgia, Idaho, Indiana, Iowa, Kansas, Kentucky, Maine, Massachusetts, Minnesota, Mississippi, Missouri, Montana, Nevada, New Hampshire, New Jersey, New Mexico, North Carolina, Puerto Rico, Rhode Island, South Carolina, Tennessee, Texas, Utah, Vermont, Virgin Islands, Washington, West Virginia, Wisconsin, and Wyoming. ^b Variables include gender, age, race/ethnicity, education, income, insurance, provider, current smoker, exercise, number of chronic diseases, quality of life (self-reported physical and mental health).

chronic diseases and categorized them into a three-level variable: (1) none, (2) one to two, and (3) three or more diseases.

Finally, we included self-rated physical and mental health as quality of life. Both measures of health status were evaluated by asking the respondents to self-rate their health in the past 30 days. Mental and physical health-related questions with continuous answers (i.e., number of days) were then categorized as 0–13 days (termed as fewer days) and 14–30 days (termed as several days) of poor health. This cut-off point has been used by providers and/or researchers as a marker for unhealthy physical days and depression/ anxiety disorders (Ford et al., 2001; Zahran et al., 2004).

2.6. Statistical analysis

Weighted analyses were performed per the CDC recommendations for analysis of the 2022 BRFSS samples (Centers for Disease Control and Prevention, 2023a). Cross-tabulation of frequencies and weighted percentages were conducted to describe the difference between cancer history and social needs measures on CRC screening utilization. Bivariate differences in sociodemographic characteristics, health related factors, and quality of life related to screening uptake were also examined by using weighted Rao-Scott Chi-square tests. Further, we performed multivariable logistic regression models to assess the impact of cancer history and social needs measure on screening uptake, adjusting for sociodemographic characteristics, health related factors, and quality of life. Five sequential models were performed. The crude model included cancer history status only; model 1 was further adjusted for social needs measure; model 2 was further adjusted for sociodemographic characteristics; model 3 was further adjusted for health-related factor; and model 4 was adjusted for all factors (including quality of life). Further, we examined the interaction between cancer history and social needs measure on CRC screening utilization adjusting for all covariates. Such effect modification enables the explanation of the impact of the levels of social needs on the association between cancer history and CRC screening utilization. All results were reported as odds ratios (ORs) and the associated 95 % confidence intervals (CIs). Differences were considered significant at p -value < 0.05 using two-sided probability tests. SAS Version 9.4, SAS Institute Inc., Cary, North Carolina was used for all analyses.

3. Results

3.1. Study participants

As shown in Table 1, the majority of respondents had received CRC screening (72.2 %), did not have a history of cancer (87.9 %), had at least one social need (58.4 %), were females (53.3 %), were aged 60–69 years (38.1 %), were non-Hispanic White (61.2 %), earned high school diploma or lower (43.0 %), earned less than \$50,000 annually (57.3 %), had health insurance (92.8 %), had a health care provider (88.9 %), were non-current smoker (82.9 %), had exercise in the past 30 days (68.6 %), had at least one chronic disease (66.2 %), and had fewer days of poor physical (80.0 %)/ mental health (84.4 %). When exploring CRC screening utilization, we found a significantly higher percentage of those with a cancer history were screened for CRC than those without a history of cancer (81.9 % vs 64.6 %, p -value < 0.001). A higher proportion of those who reported no social needs were screened for CRC compared to those who reported one or two or more social needs (72.8 % vs 66.7 % vs 59.5 %, p -value < 0.001).

3.2. Determinants of CRC screening utilization

In Table 2, we found that adults with a history of cancer had 1.59–2.45-fold increased odds of having CRC screening utilization compared with adults without cancer history regardless of covariate adjustment. Similarly, having at least one social need was negatively associated with CRC screening uptake (all p -values < 0.05). In the full model (model 4), adults with one and two or more social needs were 15 % (OR, 0.85; 95 % CI: 0.76–0.95) and 23 % (OR, 0.77; 95 % CI: 0.69–0.87) reduced odds of having CRC screening uptake than adults without social needs, respectively.

Overall, the influence of the levels of social needs were negatively associated with CRC screening uptake among cancer survivors and those without a history of cancer (all p -values < 0.05) (Table 3). Among adults without social needs, cancer survivors had 2.10-fold increased odds of having guideline-concordant CRC screening utilization in comparison to adults without a history of cancer (OR, 2.10; 95 % CI: 1.68–2.62). Among adults with at least one social need, having no history of cancer were 12 % for one need (OR, 0.88; 95 % CI: 0.78–0.99) and 20 % for two

Table 1
Distribution of characteristics of screening eligible adults by colorectal cancer screening utilization in the United States, 2022 (n = 74,743).

	Total (N = 74,743)	CRC screening Yes (n = 53,988, 72.2 %)	CRC screening No (n = 20,755, 27.8 %)	P- value
	n(%)			
Cancer history				<0.001
No	64,664 (87.9 %)	45,391(64.6 %)	19,273(35.4 %)	
Yes	10,079 (12.1 %)	8,597(81.9 %)	1,482(18.1 %)	
Social needs measure				<0.001
None	33,970 (41.6 %)	26,346(72.8 %)	7,624(27.2 %)	
One	16,659 (22.6 %)	12,060(66.7 %)	4,599(33.3 %)	
Two or more	24,114 (35.8 %)	15,582(59.5 %)	8,532(40.5 %)	
Sociodemographic characteristics				
Gender				<0.001
Male	33,014 (46.7 %)	23,335(64.3 %)	9,659(35.7 %)	
Female	41,729 (53.3 %)	30,633(68.7 %)	11,096(31.3 %)	
Age				<0.001
45—49	7,659(12.8 %)	2,331(29.5 %)	5,328(70.5 %)	
50—59	20,003 (32.2 %)	12,486(57.7 %)	7,517(42.3 %)	
60—69	31,235 (38.1 %)	25,435(78.6 %)	5,800(21.4 %)	
70—74	15,846 (16.8 %)	13,736(85.2 %)	2,110(14.8 %)	
Race/Ethnicity				<0.001
NHW	57,850 (61.2 %)	43,265(72.2 %)	14,585(27.8 %)	
NHB	6,234(12.1 %)	4,398(66.4 %)	1,836(33.6 %)	
NHO ^a	3,280(7.7 %)	2,054(58.5 %)	1,226(41.5 %)	
Hispanic	7,379(19.1 %)	4,271(52.5 %)	3,108(47.5 %)	
Education				<0.001
≤ High school	24,671 (43.0 %)	16,244(60.6 %)	8,427(39.4 %)	
Some college	23,843 (34.3 %)	17,512(70.4 %)	6,331(29.6 %)	
College graduate	26,229 (22.7 %)	20,232(72.6 %)	5,997(27.4 %)	
Income				<0.001
Less than \$50,000	40,584 (57.3 %)	28,041(63.2 %)	12,543(36.8 %)	
\$50,000 or more	34,159 (42.7 %)	25,947(71.3 %)	8,212(28.7 %)	
Health related factors				
Insurance Status				<0.001
No	3,658(7.2 %)	1,102(26.6 %)	2,556(73.4 %)	
Yes	71,085 (92.8 %)	52,886(69.8 %)	18,199(30.2 %)	
Healthcare Provider				<0.001
No	6,674(11.1 %)	2,539(34.2 %)	4,135(65.8 %)	
Yes	68,069 (88.9 %)	51,449(70.7 %)	16,620(29.3 %)	
Smoke				<0.001
No	62,445 (82.9 %)	46,460(68.6 %)	15,985(31.4 %)	
Yes	12,298 (17.1 %)	7,528(57.4 %)	4,770(42.6 %)	
Exercise				<0.001
No	21,548 (31.4 %)	14,811(62.5 %)	6,737(37.5 %)	

Table 1 (continued)

	Total (N = 74,743)	CRC screening Yes (n = 53,988, 72.2 %)	CRC screening No (n = 20,755, 27.8 %)	P- value
Yes	53,195 (68.6 %)	39,177(68.6 %)	14,018(31.4 %)	
# of chronic diseases				<0.001
0	24,065 (33.8 %)	15,180(56.3 %)	8,885(43.7 %)	
1–2	39,179 (50.6 %)	29,674(70.5 %)	9,505(29.5 %)	
3+	1,1499 (15.6 %)	9,134(76.9 %)	2,365(23.1 %)	
Quality of life				
Poor Physical Health				0.035
0 – 13 days	60,724 (80.0 %)	43,749(66.2 %)	16,975(33.8 %)	
14 – 30 days	14,019 (20.0 %)	10,239(68.4 %)	3,780(31.6 %)	
Poor mental health				0.031
0 – 13 days	63,779 (84.4 %)	46,490(67.0 %)	17,289(33.0 %)	
14 – 30 days	10,964 (15.6 %)	7,498(64.7 %)	3,466(35.3 ^a)	

Abbreviations: CRC, colorectal cancer; NHW, non-Hispanic White; NHB, non-Hispanic Black; NHO, non-Hispanic Other; #, number.

Notes: Data shown as frequency and weighted percentages. All weighted percentages are based on column total. Weighted Chi-square test was used to examine differences.

^a Non-Hispanic other includes Asian, American Indian/Alaskan Native, and others.

or more needs (OR, 0.80; 95 % CI: 0.71–0.90) less likely to be screened for CRC than those without a history of cancer and social needs. However, there is no significant difference in CRC screening use across different levels of social needs among cancer survivors (all p-values > 0.05).

4. Discussion

In this first of its kind integrated study, we examined the association between cancer history and guideline-concordant CRC screening utilization, while considering the effects of the levels of social needs using a nationally representative sample. We found that having at least one social need had a significant impact among adults without a history of cancer, with a 12 %-20 % reduced odds of having CRC screening utilization. This finding highlights the importance of patient centered communication through primary care initiatives considering the various social needs of adults and could improve adherence to CRC screening recommendations.

Overall, our multivariable analysis when adjusted for all covariates showed that adults with a personal history of cancer had 1.6-fold increased odds of having CRC screening utilization compared with adults without a history of cancer. However, in crude model and model 1, the influence of cancer history was more strongly associated with screening uptake when without adjusting for other covariates. In line with prior literature, a prior 2020 BRFSS study also reported the greater CRC screening use was observed among breast, cervical, prostate, skin, and lung cancer survivors (Tsai et al., 2022). Further, a single center study demonstrated that the increased uptake of colonoscopy was observed among prostate cancer survivors in comparison to breast cancer survivors (Dash et al., 2021). This may be because of greater awareness of CRC risk among those with a history of cancer. Adults with a history of cancer may be more likely to have initial screening discussions with their providers because of their greater risk of CRC, in part due to their typically receiving survivorship care plans after diagnosis

Table 2

Association between cancer history status, social needs measure, and colorectal cancer screening utilization among screening eligible adults in the United States, 2022.

	Crude ^a OR (95 %CI)	P- value	Model 1 ^a OR (95 %CI)	P- value	Model 2 ^a OR (95 %CI)	P- value	Model 3 ^a OR (95 %CI)	P- value	Model 4 ^a OR (95 %CI)	P- value
Cancer history		<0.001		<0.001		<0.001		<0.001		<0.001
No	Reference		Reference		Reference		Reference		Reference	
Yes	2.45 (2.12–2.84)		2.45 (2.12–2.84)		1.78 (1.52–2.09)		1.60 (1.36–1.89)		1.59 (1.35–1.87)	
Social needs measure						0.001		<0.001		<0.001
None	NA		Reference	<0.001	Reference		Reference		Reference	
One	NA		0.75 (0.68–0.83)		0.89 (0.80–0.99)		0.85 (0.76–0.96)		0.85 (0.76–0.95)	
Two or more	NA		0.55 (0.50–0.60)		0.84 (0.76–0.92)		0.79 (0.70–0.88)		0.77 (0.69–0.87)	

Abbreviations: OR, odd ratio; CI, confidence interval; NA, not-applicable.

Bold texts indicate statistically significant result.

Notes: Weighted logistic regression was used. Crude model included cancer history status only; model 1 was further adjusted for social needs measure; model 2 was further adjusted for sociodemographic characteristics; model 3 was further adjusted for health-related factors; model 4 was further adjusted for quality of life.

(Antalis et al., 2019; Huang et al., 2019). These plans generally include information on possible late effects of treatment, referrals to specific follow-care providers as well as recommendations for preventative screening (e.g., cancer screening) (American Society of Clinical Oncology, 2023). Such evidence highlights the importance of patient centered communication on CRC screening recommendations. Our results from effect modification also confirm this association. Among adults without social needs, cancer survivors had 2.1-fold increased odds of having guideline-concordant CRC screening utilization.

Another important finding is that we observed adults with one and two or more social needs were 15 % and 23 % less likely to have guideline-concordant CRC screening utilization, respectively, which is consistent with prior literature (Beyer et al., 2016; Layne et al., 2023; Lozano et al., 2023; Stone, Gates and Monteiro, 2023). Stone and colleagues found that patients who reported having housing insecurity have a significant increase in colonoscopy noncompletion (Stone, Gates and Monteiro, 2023). A Chicago study using community factors as SDOH measures also found that higher levels of community disadvantage were associated with lower CRC screening use, such as community unemployment, low food access, and poverty (Lozano et al., 2023). Similarly, a cross-sectional study found that having a safe and clean neighborhood was associated with increased adherence to cancer screening recommendations (e.g., CRC screening) (Beyer et al., 2016). Therefore, these findings support the negative association between social needs and CRC screening utilization.

When exploring the impact of the levels of social needs, we observed that adults without a history of cancer were 12 % to 20% less likely to be screened for CRC. Findings from our study suggest that the levels of social needs seem to be more important for explaining the difference in CRC screening use among those without a history of cancer. Because no study has examined CRC screening uptake while considering social needs by using a composite measure, it is impossible to directly compare and contrast our results with prior literature. Yet, several studies reported consistent findings on the negative association between social needs and CRC screening use but without considering cancer history status (Beyer et al., 2016; Lozano et al., 2023; Stone, Gates and Monteiro, 2023). Despite these consistent findings, our study suggests that using an individual need (e.g., housing insecurity) or neighborhood disadvantage measure may not comprehensively explain the effects of social needs on the association between cancer history and CRC screening utilization (Beyer et al., 2016; Lozano et al., 2023; Stone, Gates and Monteiro, 2023). Other factors, such as lack of social/emotional support, social isolation, or transportation barriers, may also be attributed to screening behaviors (Dominic et al., 2020; Honda and Kagawa-Singer, 2006; Muthukrishnan, Arnold and James, 2019; Sifri et al., 2010; Ye, Williams and Xu, 2009). More research examining

mediating effects of various social needs on this association may also be helpful.

A major strength of this study is to examine the integrated relationship of cancer history, social needs, and CRC screening uptake. By using a composite score of social needs, it will provide a comprehensive measure of CRC screening use, which not only includes multifaceted needs but also considers interrelated relationships of various social needs. The results from this study have clinical implications for improving adherence to CRC screening, according to social needs. Our results suggest that adults without a history of cancer may experience lack of regular access to primary care services when compared to cancer survivors (Lafata et al., 2015; Robin Yabroff et al., 2013). Therefore, use of interventions/programs, such as patient navigation programs, may assist in referring patients on the basis of specific needs and thereby improving adherence to CRC screening recommendations (Dougherty et al., 2018; Honeycutt et al., 2013; Muliira and D'Souza, 2016). Effectively implementing such programs through primary care initiatives may particularly benefit those without a history of cancer but having barriers to care (Valaitis et al., 2017).

Despite its strengths, our study has some limitations. First, a cross-sectional analysis was performed, so a temporal relationship between cancer history status, social needs, and guideline-concordant CRC screening utilization could not be established. Second, cancer history was self-reported, and this could potentially lead to underreporting of medical conditions due to recall bias. Similarly, recall bias may also have affected the accuracy of responses on CRC screening uptake. Therefore, guideline-concordant CRC screening utilization might be either overestimated or underestimated. In addition, we lack information about CRC characteristics (e.g., tumor features) among those with a personal history of colorectal cancer as well as information about survivors' family history of CRC. Further, we were also unable to identify the time since cancer diagnosis for cancer survivors because BRFSS survey is not a cancer surveillance database and does not collect information regarding cancer prognosis and progression. The influence of various social needs on screening behaviors may be different across various phases of survivorship periods. Finally, our study used logistic regression to examine the association between social need measure and CRC screening uptake, which may have potential overestimating this association in comparison to Poisson regression analysis. However, logistic regression has been widely used in many CRC screening research as well as BRFSS survey. More research comparing these two approaches on CRC/cancer screening use may be helpful.

5. Conclusions

We found that having a history of cancer was positively associated

Table 3
Effect modification of social needs measure on the association between cancer history status and CRC screening utilization among screening eligible adults in the United States, 2022.

	Social needs		Social needs		Social needs		Social needs	
	None CRC screening n (%) no/yes	OR (95 % CI) ^a	One CRC screening n (%) no/yes	OR (95 % CI) ^a	Two or More CRC screening n (%) no/yes	OR (95 % CI) ^a	OR (95 %CI) for social needs strata of cancer history/p-value	OR (95 % CI) ^a
Cancer History								
No (n = 64,664)	7,135(24.4 %) /22,140(75.6 %)	Reference	4,267(29.6 %) /10,135(70.4 %)	0.88 (0.78-0.99)	7,871(37.5 %) /13,116(63.5 %)	0.80 (0.71-0.90)	0.80 (0.71-0.90)/ <0.001	
Yes (n = 10,079)	489(10.4 %)/4,206 (89.6 %)	2.10 (1.68-2.62)	332(14.7 %)/1,925 (85.3 %)	1.20 (0.83-1.75)	661(21.1 %)/2,466 (78.9 %)	1.09 (0.83-1.42)	0.52 (0.37-0.72)/ <0.001	

Abbreviations: CRC, colorectal cancer; OR, odds ratio.

Bold texts indicate statistically significant result.

^a Models were adjusted for sociodemographic characteristics, health related factors, and quality of life.

with CRC screening uptake, while having at least one social need was negatively associated with screening use. Adults without a history of cancer reported at least one social need were less likely to be screened for CRC. Effective implementation of integrated care that includes patient-centered communication and referral infrastructures using patient navigation programs may reduce barriers to care and improve adherence to CRC screening recommendations, especially in adults without a history of cancer. More research with a longitudinal study design is needed to further elucidate this relationship.

CRedit authorship contribution statement

Meng-Han Tsai: Writing – review & editing, Writing – original draft, Methodology, Formal analysis, Data curation, Conceptualization. **Elinita Pollard:** Writing – review & editing, Writing – original draft, Project administration. **Steven S. Coughlin:** Writing – review & editing, Supervision. **Marlo Vernon:** Writing – review & editing. **Satish S.C. Rao:** .

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

The datasets generated during the current study are available in the Center for Disease Control, and Prevention repository, <https://www.cdc.gov/brfss/>.

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Author Contributions

All authors contributed to the study conception. Material preparation and data analysis were performed by Meng-Han Tsai. The first draft of the manuscript was written by Meng-Han Tsai and Elinita Pollard. All authors commented on previous versions of the manuscript and read/approved the final manuscript.

Consent to participate

Verbal informed consent was obtained from all individual participants included in the study as per the BRFSS process for data collection.

Consent to publish

This study does not include any individual person’s data in any form (including any individual details, images, or v ideos).

Ethical approval

The respective health departments from each state grant Institutional Review Board (IRB) approval for the distribution and collection of data using the BRFSS. Data extracted for this study was publicly available and de-identified, and thus considered exempt from IRB review at Augusta University. This article does not include any studies with animals performed by any of the authors.

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Appendix A. Supplementary data

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