Racial differences in dietary changes and quality of life after a colorectal cancer diagnosis: a follow-up of the Study of Outcomes in Colorectal Cancer Survivors cohort[1,2]

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ABSTRACT

Background: Substantial racial disparities exist in colorectal cancer (CRC) survival.

Objective: This was an exploratory study to assess the racial differences in dietary changes in relation to quality of life (QoL), recurrence, and survival after a CRC diagnosis.

Design: Four hundred fifty-three stage II CRC patients were enrolled in the cohort study through the North Carolina Central Cancer Registry. Self-reported diet, physical activity, treatment, comorbidities, demographic characteristics, and QoL were collected at diagnosis and 12 and 24 mo after diagnosis. QoL was assessed with the Functional Assessment of Cancer Therapy—Colorectal (FACT-C) and the Medical Outcomes 12-Item Short Form Health Survey (SF-12) inventories. An overall dietary index score was calculated. Generalized estimating equations and logistic regression models were used to explore potential associations. Statistical power for this study was ~50%.

Results: African Americans (n = 81) were more likely to increase intakes of reduced-fat milk, vegetables, and fruit and decrease intakes of regular cheese, red meat, fried food, fast food, and fat ($P < 0.05$) than were Caucasians (n = 184) 24 mo after diagnosis. The least-squares means ± SEs for changes in dietary index were 6.05 ± 0.40 and 4.07 ± 0.27 for African Americans and Caucasians, respectively ($P < 0.001$). African Americans exhibited higher scores on portions of the FACT-C (colorectal cancer subscale: β = 1.04; 95% CI: 0.26, 1.82) and the SF-12 (Physical Component Summary: β = 2.49; 95% CI: 0.51, 4.48). Those who improved their dietary quality over 24 mo had lower risk of recurrence and mortality combined (OR: 0.42; 95% CI: 0.25, 0.72).

Conclusions: African Americans made more healthful changes in diet and had a higher QoL than did Caucasians in this underpowered study that used self-reported dietary data. No racial differences in recurrence or survival were evident, although improvements in dietary quality did reveal survival benefits overall. More prospective research on racial disparities in health behavior changes after diagnosis is desperately needed. *Am J Clin Nutr* 2016;103:1523–30.

Keywords: race, diet, quality of life, colorectal cancer, survivors

INTRODUCTION

Colorectal cancer (CRC)[5] is the fourth most prevalent cancer in the United States (1). Evidence strongly suggests that making healthful dietary changes may influence the risk of recurrence and/or the development of second primary tumors in CRC survivors (2). Although evidence indicates that cancer survivors are motivated to make positive changes in diet (3, 4), little work has been done to address race and ethnic differences in the types of lifestyle changes made. This may be of particular interest because the age-adjusted incidence and mortality of CRC in Caucasians was 37.8 (per 100,000) and 14.5, respectively, compared with 47.8 and 21.1 in African Americans (1). A large body of literature attributes these disparities to socioeconomic status (SES) and argues that SES is driving variation in the lifestyles, treatments, and prevention behaviors (e.g., screening) related to CRC (5–10).

Although several studies have reported on the prevalence of health behaviors in cancer survivors (11, 12), to our knowledge, only 2 studies have prospectively focused on changes in health behaviors after a CRC diagnosis; these studies report conflicting findings (13, 14). Studies addressing racial and ethnic differences in postdiagnosis behavioral changes in CRC patients are similarly sparse (14, 15). These studies are limited by either relatively small sample sizes of African Americans or nonprospective study designs. To address these issues, this exploratory study assessed the race and ethnic differences between Caucasians and African Americans in changes in dietary choices and quality of life (QoL) 24 mo after stage II CRC diagnosis. In addition, risk of recurrence and survival was explored in relation to race and dietary quality.

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[5] Abbreviations used: CCS, colorectal cancer subscale; CRC, colorectal cancer; FACT-C, Functional Assessment of Cancer Therapy—Colorectal; FWB, functional well-being; GEE, generalized estimating equation; PCS, Physical Component Summary; QoL, quality of life; SES, socioeconomic status; SF-12, Medical Outcomes 12-Item Short Form Health Survey.

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METHODS

Study participants

This study was of a cohort design. Patients with incident stage II adenocarcinoma of the colorectum diagnosed between September 2009 and March 2011 from all 100 counties of North Carolina were recruited through the Rapid Case Ascertainment division of the North Carolina Central Cancer Registry. For enrollment details, see **Figure 1**.

Data collection

Telephone interviews

Data were collected at 3 time points: baseline (within 120 d of diagnosis), and 12 and 24 mo after diagnosis. Self-reported information was collected via computer-assisted telephone interviews by trained research staff. Of 722 eligible stage II CRC survivors, 459 responded to the study invitation and completed the baseline interview, resulting in an initial response rate of 64%. Of these, 6 records were excluded because of missing identification numbers. Therefore, the final size at baseline was 453. The characteristics of the final sample did not differ significantly from the sample at baseline.

Participant questionnaires

Participants were interviewed with the use of a closed-ended questionnaire detailing self-reported demographic characteristics, health behaviors (e.g., diet, physical activity, tobacco use, and alcohol intake), QoL, receipt of treatment, and health comorbidities. At baseline, participants were asked to provide information relevant to the period during the 12 mo before diagnosis; at follow-up time points (12 and 24 mo), the period of relevance was the 12 mo since the last interview. Race was self-identified in this study.

Follow-up assessments

Follow-up assessments at 12 and 24 mo after diagnosis were performed via telephone by the same trained research staff. If participants could not be reached for the follow-up interview, we investigated whether they had moved out of the area (via the National Change of Address system) or died (via the National Death Index). The most common reasons for attrition included the fact that no recontact could be established and study withdrawal by the participant. Data collection ceased at 24 mo for all remaining participants.

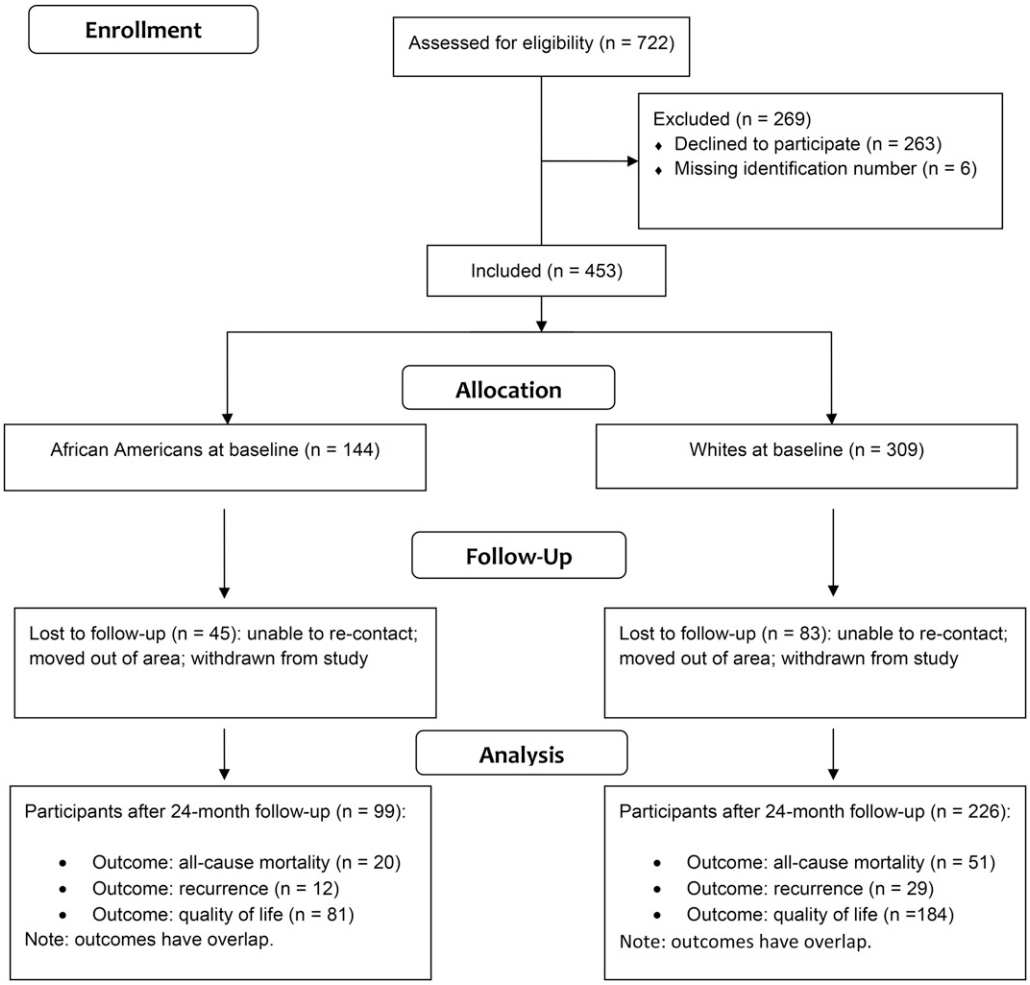

FIGURE 1 Study of Outcomes in Colorectal Cancer Survivors enrollment flow diagram.

Exposure: dietary assessment

Diet was assessed with the use of a modified, validated version of the Diet History Questionnaire developed by the National Cancer Institute (16, 17). For each beverage/food item, participants were asked to choose ≤10 frequencies based on consumption and serving size. For 44 food items, additional questions were asked about seasonal intake, fat uses or additions in food preparation, and type of food. In addition, the questionnaire included adjustment questions about restaurant-eating frequency. Percentage of energy from fat was estimated with the use of the National Cancer Institute's Quick Food Scan questionnaire (17).

The dietary index used in this study was defined at follow-ups based on dietary changes in 15 items, as shown in **Table 1**. For beneficial items, we coded the score for "decreased a lot," "decreased a little," "no change," "increased a little," and "increased a lot" as −2, −1, 0, 1, and 2, respectively. For harmful items, we coded the 5 change levels described above reversely as 2, 1, 0, −1, and −2. The scores were then summarized. The theoretical range for the overall dietary index was from −30 to 30. Because there is no "gold standard" for measuring dietary changes for cancer prevention development, we based our index on recommendations from the American Cancer Society (18). Considering the limitation of giving each dietary item an equal weight in this definition of dietary quality index, we also defined a weighted index by using principal component analysis in the sensitivity analysis.

Outcomes: QoL and recurrence/mortality

QoL was evaluated by using the Functional Assessment of Cancer Therapy—Colorectal (FACT-C) (19, 20) and the Medical Outcomes 12-Item Short Form Health Survey (SF-12) (21, 22). The FACT-C includes physical, social, emotional, and functional well-being subscales, and the colorectal cancer subscale (CCS) (FACT-C total score = Functional Assessment of Cancer Therapy—General total + CCS score). A Trial Outcome Index—Physical/Functional/Colorectal score was also calculated from the FACT-C [physical well-being + functional well-being (FWB) + CCS]. The SF-12 includes 2 summary scores, i.e., the Physical Component Summary (PCS) and the Mental Component Summary.

Information was collected on CRC recurrence and/or the appearance of additional forms of cancer 12 and 24 mo after diagnosis via telephone interview with the use of a questionnaire designed for and validated by the VITamins And Lifestyle cohort study (23). Investigators ascertained the participant mortality status by repeatedly obtaining information from the National Death Index.

TABLE 1
Beneficial and harmful food items included in the dietary quality index[1]

Beneficial food items	Harmful food items
Reduced-fat milk	Whole-milk products
Reduced-fat cheese	Red meat
Fish	Fried foods
Vegetables	Hamburgers and other fast foods
Fruit (including juices)	Full-fat/full-sugar ice cream
Soy products	Cakes and sweet dessert
Whole grains	Fat added to cooked food (e.g., butter, margarine, vegetable oil)
Nuts	

[1]Based on recommendations from the American Cancer Society.

Ethics

The institutional review boards of all participating institutions approved this research, and all subjects provided consent for their participation in this study.

Statistics

Means ± SDs were used to describe continuous characteristics, whereas percentages were used for categorical factors at baseline. A *t* test, chi-square test, or Wilcoxon's rank-sum test was used to compare baseline characteristics between African Americans and Caucasians, as appropriate.

The change in diet was calculated from baseline to 24 mo. The difference in dietary change over 24 mo of follow-up between African Americans and Caucasians was compared by using Wilcoxon's rank-sum test.

Generalized estimating equations (GEEs) for repeat measures, which take the within-subject correlation between the outcomes at multiple occasions into account, were used to explore the association between race and QoL. The exchangeable correlation structure specified for simplicity because the results from the GEE were robust to the assumption of the within-person correlation matrix structure. This means that the correlation of a specific score for QoL between 3 repeated measures (i.e., baseline, follow-up 1, and follow-up 2) was assumed to be the same (24). The outcome of interest was included in the model as a time-dependent variable. The repeated occasions (i.e., time points) entered the model as a categorical variable. The initial analysis (model I) was adjusted for age (continuous) and sex. Model II was adjusted in addition for education (some college and above compared with high school and below), ratio of income to poverty (<100%, 100–199%, 200–399%, or ≥400%), BMI (continuous), smoking (0, 0.1–9.9, 10–19.9, or ≥20.0 pack-years), alcohol consumption (<1 drink/wk, 1–6 drinks/wk, or ≥7 drinks/wk), physical activity (metabolic equivalent task hours/wk; continuous), fruit and vegetable consumption (servings/d; continuous), percent energy from fat, supplement use (yes or no) and chemotherapy (with or without). To ensure that comparison groups were comparable after multivariable adjustment, propensity scores were calculated and adjusted for rather than multiple covariates (25). In addition, to determine whether missing data significantly biased our results, a multiple imputation procedure that used regression switching (multiple imputation by chain equations) was performed, assuming missing data were random (26). *P* values for linear trend were calculated with the use of continuous variables while excluding values above the 98th percentile for each exposure in multivariable linear models. Multivariable-adjusted β coefficients and 95% CIs were reported.

In addition, the dietary score defined at follow-ups was also modeled by using GEEs with the same strategy, except that fruit and vegetable consumption, percentage of energy from fat, and supplement use were excluded, and coverage of private health insurance (yes or no) and Medicaid (yes or no) were included in model 2.

We examined race and ethnic disparity in relation to survival or recurrence of CRC by using a multiple logistic regression model with the same strategy as that in modeling QoL. Multivariable-adjusted ORs and 95% CIs were calculated.

All analyses were performed with the use of SAS 9.3. $P \leq 0.05$ was considered to be statistically significant.

RESULTS

A total of 453 newly diagnosed stage II CRC patients (144 African Americans and 309 Caucasians) were enrolled in the study. There were 325 participants (72%) who were included in the analysis at the end of the 24-mo follow-up period, including deaths; the rate did not differ significantly between African Americans (71%) and Caucasians (76%). During 24 mo of follow-up, 71 participants died (20 African Americans and 51 Caucasians), with 265 (81 African Americans and 184 Caucasians) completing the 24-mo follow-up interview. Baseline characteristics did not differ significantly between baseline and follow-up samples.

Demographic characteristics and other baseline variables stratified by race are presented in **Table 2**. Compared with Caucasian patients, African Americans tended to be younger, had higher BMIs, and were more likely to be single, live below the poverty line, and have no health insurance.

The percentage of change in diet over a 24-mo follow-up after diagnosis stratified by race across a number of dietary components is shown in **Table 3**. Compared with Caucasians, African Americans were significantly more likely to have increased their intake of reduced-fat milk, vegetables, and fruit, and decreased their intake of regular cheese, red meat, fried food, fast food, and fat over a 24-mo follow-up after CRC diagnosis. No difference was found in the consumption of 12 dietary items, as noted in Table 3.

The multivariable-adjusted associations between race and QoL are presented in **Table 4**. African Americans exhibited significantly higher scores on portions of the FACT-C (physical well-being: $\beta = 0.94$; 95% CI: 0.03, 1.85; CCS: $\beta = 1.04$; 95% CI: 0.26, 1.82; Trial Outcome Index—Physical/Functional/Colorectal: $\beta = 2.50$; 95% CI: 0.05, 4.94) and the SF-12 (PCS: $\beta = 2.49$; 95% CI: 0.51, 4.48) after adjusting for multiple confounders than did Caucasians. No significant associations between race and 2 subdomains of the FACT-C, the total FACT-C score, or one subscale of the SF-12 were found.

TABLE 2
Demographic and other characteristics at baseline stratified by race, Study of Outcomes in Colorectal Cancer Survivors[1]

	Caucasian (n = 309)	African American (n = 144)	P
Age, y	64.5 ± 10.3	60.7 ± 10.2	<0.01
Female	60.1	58.3	0.71
Marital status			<0.01
Married/living as married	63.4	43.8	
Widowed/separated/divorced	31.7	43.1	
Single/never married	4.9	13.2	
Education			0.33
High school and below	48.5	53.5	
Some college and above	51.5	46.5	
Ratio of income to poverty[2]			<0.01
<100%	9.9	32.1	
100–199%	32.2	33.6	
200–399%	36.6	25.4	
≥400%	21.2	9.0	
Smoking			0.04
0 pack-years	48.9	53.5	
0.1–9.9 pack-years	12.3	19.4	
10–19.9 pack-years	5.5	9.0	
≥20 pack-years	33.3	18.1	
Alcohol			0.30
<1 drink/wk	71.8	77.1	
1–6 drinks/wk	16.8	11.8	
≥7 drinks/wk	11.3	11.1	
BMI, kg/m^2	28.0 ± 7.0	30.0 ± 6.2	<0.01
Physical activity, MET-h[3]/wk	13.2 ± 10.9	13.3 ± 11.3	0.87
Fruit and vegetable, pyramid servings/d	2.1 ± 1.4	2.5 ± 1.9	0.03
Percentage of energy from fat	33.4 ± 3.7	34.1 ± 4.5	0.08
Health insurance coverage			
Overall	90.6	80.6	<0.01
Private insurance	74.6	55.6	<0.01
Medicare	56.8	49.6	0.19
Medicaid	4.6	21.4	<0.01

[1]Values are means ± SDs or percentages. P values were obtained by using a t test, chi-square test, or Wilcoxon's rank-sum test as appropriate.

[2]Poverty level was based on 2011 data from the US Census Bureau.

[3]MET-h, metabolic equivalent task hours.

TABLE 3
Dietary change by race over a 24-mo follow-up, Study of Outcomes in Colorectal Cancer Survivors[1]

	Caucasian (n = 184)			African American (n = 81)			
	Decreased	No change	Increased	Decreased	No change	Increased	P
Whole-milk products (not including cheese)	42.0	45.0	13.0	52.7	36.6	10.9	0.23
Reduced-fat milk products (not including cheese)	22.6	61.3	16.1	18.9	47.2	34.0	0.046
Cheese (not including reduced-fat)	29.7	64.6	5.7	48.9	44.7	6.6	0.01
Reduced-fat cheese	18.6	62.7	18.6	21.4	32.1	46.4	0.09
Red meat	52.7	45.7	1.6	67.5	32.5	0.0	0.02
Poultry	10.3	70.7	19.0	16.9	66.3	16.9	0.24
Fish (not including shellfish)	7.6	72.5	19.9	9.8	67.1	23.2	0.83
Vegetables	8.8	61.5	29.7	3.6	50.6	45.6	<0.01
Tomatoes and tomato products	13.6	80.0	6.5	15.2	74.7	10.1	0.77
Fruit (including juices)	10.9	55.2	33.9	4.9	46.3	48.8	0.01
Soy products	18.2	39.4	42.4	23.1	42.3	34.6	0.52
Whole grain	9.5	57.6	32.9	13.2	40.8	46.1	0.19
Fried foods	54.5	44.3	1.2	88.5	11.5	0.0	<0.01
Grilled foods	18.3	67.5	14.2	29.3	45.3	25.3	0.96
Hamburgers and other fast foods	59.9	39.5	0.6	84.5	14.1	1.4	<0.01
Nuts	20.9	55.8	23.3	26.6	48.1	25.3	0.70
Regular ice cream[2]	42.5	47.7	9.8	50.7	43.5	5.8	0.20
Cakes and sweet desserts	47.1	44.8	8.1	57.3	28.0	14.7	0.41
Wine	49.4	45.6	5.1	52.2	34.8	13.0	0.91
Beer	66.7	27.8	5.6	60.0	35.0	5.0	0.63
Spirits and hard liquor	73.5	26.5	0.0	81.3	18.8	0.0	0.55
Fat (butter, margarine, vegetable oil) added to cooked food	26.0	69.6	4.4	52.3	41.5	6.2	<0.01
Multivitamin supplements	15.2	61.6	23.2	16.0	54.0	30.0	0.55

[1]Values are percentages. P values were obtained by using Wilcoxon's rank-sum test.
[2]Not including low-fat, sugar-free, or no-added-sugar ice cream; sherbet; or sorbet.

The multivariable-adjusted associations between changes in dietary quality index scores and QoL are found in **Table 5**. Those who demonstrated an improvement in dietary quality over 24 mo were more likely to increase scores on several domains of the FACT-C (Functional Assessment of Cancer Therapy—General: $\beta = 0.19$; 95% CI: 0.01, 0.37; FWB: $\beta = 0.14$; 95% CI: 0.06, 0.23) and the SF-12 (PCS: $\beta = 0.23$; 95% CI: 0.05, 0.41) after adjusting for multiple confounders. No significant associations between changes in dietary quality index scores and 4 subscores of the FACT-C except the FWB, the total FACT-C score, and the Mental Component Summary (SF-12) were observed. Redefining a weighted dietary index score with the use of principal component analysis did not change the results substantially.

With adjustment for age, sex, and follow-up time, the least-squares means ± SEs for changes in dietary index were 6.05 ± 0.40 and 4.07 ± 0.27 for African Americans and Caucasians, respectively ($P < 0.001$). There was no significant difference in survival (adjusted OR: 0.94; 95% CI: 0.49, 1.78) or CRC recurrence (adjusted OR: 1.35; 95% CI: 0.59, 3.05) between Caucasian and African American CRC patients over 24 mo of follow-up. However, an overall negative association was demonstrated between changes in dietary quality and risk of recurrence or mortality combined (adjusted OR: 0.42; 95% CI: 0.25, 0.72).

DISCUSSION

In this exploratory prospective cohort study, we found that African American CRC patients were more likely to make healthful changes in dietary quality than were Caucasians in the 24 mo after diagnosis. A higher QoL for a number of subscales was also revealed in African Americans at the 24-mo follow-up interview after controlling for a number of potential confounding factors. When African Americans and Caucasians were pooled, those who improved dietary quality exhibited positive changes in QoL, as well as a lower risk of CRC recurrence or mortality after 24 mo of follow-up. No relation was found between race and recurrence or survival in this study.

Although several studies report on the prevalence of behaviors in survivors (27), to our knowledge, there were only 2 other studies with which to compare the prospective race and ethnic differences exhibited in this report. In a study by Satia et al. (14), African Americans also were found to have increased their fruit and vegetable intake to a greater extent in the 2 y after a colon cancer diagnosis than were Caucasians. Our results are also corroborated by a retrospective study of cancer survivors in which African Americans were more likely to decrease their intake of red meat and fat after diagnosis (15). These findings support the notion that African Americans are motivated to make healthful changes after a cancer diagnosis.

In this study, African Americans were more likely to have a higher intake of reduced-fat milk, vegetables, and fruit, as well as a decreased consumption of cheese, red meat, fried food, fast food, and overall dietary fat after 24 mo after CRC diagnosis than were Caucasians. Evidence suggests that these types of dietary changes may be clinically significant in the primary and secondary prevention of CRC (28–34). In addition to dietary changes, according to our results, African Americans also were significantly more likely to have higher scores on a variety of QoL domains 24 mo after diagnosis than were their Caucasian

TABLE 4
Multivariable-adjusted association between race (African Americans compared with Caucasians) and quality of life assessed by FACT-C and SF-12, Study of Outcomes in Colorectal Cancer Survivors[1]

	Model I[2]		Model II[3]	
	β (95% CI)	P	β (95% CI)	P
FACT-C				
FACT-G total	−1.94 (−4.83, 0.95)	0.19	1.20 (−1.81, 4.21)	0.43
PWB	0.01 (−0.86, 0.88)	0.98	0.94 (0.03, 1.85)	0.04
SWB	−1.48 (−2.34, −0.61)	<0.01	−0.84 (−1.79, 0.10)	0.08
EWB	0.19 (−0.48, 0.87)	0.58	0.55 (−0.14, 1.25)	0.12
FWB	−0.66 (−1.76, 0.44)	0.24	0.39 (−0.77, 1.55)	0.51
CCS	0.51 (−0.23, 1.26)	0.17	1.04 (0.26, 1.82)	<0.01
FACT-C total	−1.43 (−4.87, 2.01)	0.41	2.25 (−1.29, 5.79)	0.21
TOI-PFC	−0.14 (−2.51, 2.24)	0.91	2.50 (0.05, 4.94)	0.049
SF-12				
PCS	0.07 (−1.86, 1.99)	0.94	2.49 (0.51, 4.48)	0.01
MCS	−0.82 (−2.74, 1.09)	0.40	0.15 (−1.89, 2.19)	0.88

[1]African Americans: n = 81; Caucasians: n = 184. All models were constructed by using generalized estimating equations. The outcome was assessed at baseline and 2 follow-ups, and entered the model as time-dependent variables (African Americans were coded 1, and Caucasians were coded 0). CCS, colorectal cancer subscale; EWB, emotional well-being; FACT-C, Functional Assessment of Cancer Therapy—Colorectal (total score = FACT-G total + CCS); FACT-G, Functional Assessment of Cancer Therapy—General (total score = PWB + SWB + EWB + FWB); FWB, functional well-being; MCS, Mental Component Summary; PCS, Physical Component Summary; PWB, physical well-being; SF-12, Medical Outcomes 12-Item Short Form Health Survey; SWB, social well-being; TOI-PFC, Trial Outcome Index—Physical/Functional/Colorectal (PWB + FWB + CCS).

[2]Model I was adjusted for age (continuous) and sex.

[3]Model II was adjusted as for Model I, as well as for education (some college and above compared with high school and below), ratio of income to poverty (<100%, 100–199%, 200–399%, or ≥400%), BMI (continuous), smoking (0, 0.1–9.9, 10–19.9, or ≥20.0 pack-years), alcohol consumption (<1 drink/wk, 1–6 drinks/wk, or ≥7 drinks/wk), physical activity (metabolic equivalent task hours/wk; continuous), fruit and vegetable consumption (servings/d; continuous), percentage of energy from fat (continuous), supplement use (yes or no) and chemotherapy (with or without).

peers, on the basis of the use of a QoL tool commonly used in other CRC studies (35). This finding suggests that African Americans were more likely to report fewer feelings of discomfort, low body image, and loss of appetite, as well as feelings of being able to work, enjoy life, sleep well, and have energy 24 mo after diagnosis than were Caucasians. These findings are not necessarily mutually exclusive, because making dietary quality improvements can have a positive influence on QoL, as demonstrated in a report revealing a positive association between diet quality and physical functioning and feelings of vitality in breast cancer, pancreatic cancer, and CRC survivors (36). Taken together, healthful changes in the diet of African American survivors after a CRC diagnosis may impact functional QoL substantially over 24 mo.

Improvements in dietary quality were associated with a lower risk of recurrence and mortality in this study. To our knowledge, no research to date has demonstrated that dietary changes after CRC diagnosis can alter the disease course. Evidence, however, does show that healthful dietary changes in cancer survivors can alter the course of common comorbidities, such as the risk of second primary cancers (37), diabetes (38), cardiovascular disease (37), and obesity (39). Overall, the results of this study suggest that positive lifestyle changes, particularly in diet, after a CRC diagnosis should be recommended strongly.

In this exploratory study, we did not find that African Americans had a greater likelihood of survival than did Caucasians, despite their making healthful dietary changes after diagnosis. The sample size of our African American subgroup is a limitation in this study and may have precluded our ability to see a relation between race and recurrence and survival; power was ~50%. An alternative explanation could be that there is unequal access to quality health care. Because African Americans had lower SES and health care coverage at baseline, comparatively, the effect of low quality health care cannot be discounted fully.

This research has several strengths. This study provides valuable information on how health behaviors are affected by a cancer diagnosis, and, more importantly, how those changes are

TABLE 5
Multivariable-adjusted association between dietary quality index and quality of life assessed by FACT-C and SF-12, Study of Outcomes in Colorectal Cancer Survivors[1]

	Model I[2]		Model II[3]	
	β (95% CI)	P	β (95% CI)	P
FACT-C				
FACT-G total	0.13 (−0.05, 0.31)	0.15	0.19 (0.01, 0.37)	0.04
PWB	0.04 (−0.04, 0.12)	0.32	0.05 (−0.03, 0.13)	0.24
SWB	0.01 (−0.07, 0.08)	0.87	0.01 (−0.07, 0.09)	0.81
EWB	0.00 (−0.07, 0.06)	0.88	0.00 (−0.06, 0.07)	0.95
FWB	0.12 (0.04, 0.21)	<0.01	0.14 (0.06, 0.23)	<0.01
CCS	0.00 (−0.06, 0.07)	0.90	0.01 (−0.05, 0.07)	0.74
FACT-C total	0.13 (−0.08, 0.34)	0.24	0.19 (−0.03, 0.41)	0.09
TOI-PFC	0.10 (−0.06, 0.26)	0.21	0.15 (−0.01, 0.32)	0.07
SF-12				
PCS	0.20 (0.03, 0.36)	0.02	0.23 (0.05, 0.41)	0.01
MCS	−0.02 (−0.16, 0.11)	0.74	0.04 (−0.18, 0.17)	0.50

[1]All models were constructed by using generalized estimating equations. The outcome was assessed at 2 follow-ups, and entered the model as time-dependent variables. Dietary score was defined at follow-ups based on dietary changes in the following 15 items: whole-milk products, reduced-fat milk products, reduced-fat cheese, red meat, fish (not including shellfish), vegetables, fruit (including juices), soy products, whole grain, fried foods, hamburgers and other fast foods, nuts, regular ice cream (not including low-fat, sugar-free, or no-added-sugar ice cream; sherbet; or sorbet), cakes and sweet desserts, and fat (butter, margarine, vegetable oil) added to cooked food. CCS, colorectal cancer subscale; EWB, emotional well-being; FACT-C, Functional Assessment of Cancer Therapy—Colorectal (total score = FACT-G total + CCS); FACT-G, Functional Assessment of Cancer Therapy—General (total score = PWB + SWB + EWB + FWB); FWB, functional well-being; MCS, Mental Component Summary; PCS, Physical Component Summary; PWB, physical well-being; SF-12, Medical Outcomes 12-Item Short Form Health Survey; SWB, social well-being; TOI-PFC, Trial Outcome Index—Physical/Functional/Colorectal (PWB + FWB + CCS).

[2]Model I was adjusted for age (continuous), sex, race (African Americans compared with Caucasians) and baseline outcomes of interest.

[3]Model II was adjusted as for Model I, as well as for education (some college and above compared with high school and below), ratio of income to poverty (<100%, 100–199%, 200–399%, or ≥400%), BMI (continuous), smoking (0, 0.1–9.9, 10–19.9, or ≥20.0 pack-years), alcohol consumption (<1 drink/wk, 1–6 drinks/wk, or ≥7 drinks/wk), physical activity (metabolic equivalent task hours/wk; continuous), chemotherapy (with or without), coverage of private health insurance (yes or no), and Medicaid (yes or no).

associated with the disease course. Moreover, this study incorporated several validated techniques for measuring QoL (20, 21) and diet (17, 40). Another strength of this study was the inclusion of only stage II CRC patients, diminishing the variability in prognoses often evident in the various cancer stages. Finally, the linkage system used for this research has demonstrated high reliability and tends to report very few false positives (41).

Despite these strengths, this study also has some limitations. One limitation is that most variables included in this study were self-reported. Although evidence suggests that self-reporting is prone to bias (42), each inventory used in this study has been validated and is considered reliable (17, 20, 21, 23, 40). We also recognize the limitation of reporting percentage changes in dietary habits rather than changes in absolute amounts. However, we contend that no existing tool can quantify the absolute intake of diet, and the measurement we used at least would enable us to rank participants and create a dietary index. In addition, limiting our study sample to patients with a stage II diagnosis precludes our ability to make inferences about health behaviors changes in individuals with less or more advanced disease.

Finally, the limited sample size of African Americans compared with Caucasians in this study may have reduced the statistical power in some analyses, resulting in an incorrect null finding (i.e., a type II error). For example, the power for the multivariate analysis of racial differences on QoL, specifically the PCS measure of the SF-12, was 47%.

In conclusion, African Americans made more changes in diet that are considered to be healthful and had a higher QoL than did Caucasians in this exploratory study. No racial differences in recurrence or survival were evident, even though improvements in dietary quality did reveal survival benefits overall. More prospective research on racial disparities in health behavior after a CRC diagnosis are desperately needed.

The authors' responsibilities were as follows—PX and KH: designed the research; PX: analyzed the data and performed the statistical analyses; CML: edited the manuscript; KH: provided essential materials and had primary responsibility for the final content; and all authors: contributed to the critical revision of the manuscript for important intellectual content and read and approved the final manuscript. None of the authors reported a conflict of interest related to the study.

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