Health Behavior Correlates Among Colon Cancer Survivors: NC STRIDES Baseline Results

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***Objective*: To examine health behaviors (fruit/vegetable intake and physical activity) and their association with social cognitive theory (SCT) constructs among colorectal cancer (CRC) survivors (n=304) and comparable non-CRC-affected participants (n=521). *Methods*: Baseline data were analyzed bivariately and modeled with linear regression. Participants were 48% female, 36% African American (mean age = 67). *Results*: Behaviors were comparable between groups, but survivors perceived more social support for behaviors (P<.05). Lack of employment was associated with greater frequency of healthy behaviors (P<.05) as were more modifiable factors including higher self-efficacy and lower barriers. *Conclusions*: SCT constructs were associated with behavior and may be targets for future interventions, but other variables may be important as well.**

***Key words*: health behavior, cancer survivors, diet, physical activity, colon cancer**

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Unhealthy lifestyle behaviors, such as a poor diet and low physical activity, are underlying factors in the leading causes of morbidity and mortality among American adults. Diets low in fruits and vegetables are associated with increased risk for cardiovascular disease,[1-3] type II diabetes,[4] and an increasing number of cancer types.[5] Similar evidence exists for the association of sedentary behavior and lack of physical activity and disease.[6-10] However, less than half of all American adults meet nationally-set guidelines for fruit and vegetable consumption or physical activity.[11] Understanding unhealthy lifestyle

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behaviors and identifying optimal intervention strategies are key to reducing morbidity, disability, and death in the United States.

The targets of health promotion efforts often are "healthy" (nondisease diagnosed) persons or those who are under treatment for certain conditions, such as diabetes. Cancer survivors are a growing population who also are in need of health promotion efforts. Having survived one cancer, they remain at increased risk for recurrence, metastases, second cancers, and chronic diseases. Cancer survivors' increased risk may be attributable to their cancer history, age, genetic disposition, late treatment effects, or lifestyle,[12-14] and improvements in health behaviors may be beneficial in reducing future disease risk.[15] Yet, this population is relatively understudied. Nearly one million colorectal cancer (CRC) survivors are now alive in the United States, making them one of the largest subgroups (11%) of cancer survivors. Improving survival rates and an aging US population predict future increases in the number of CRC survivors.

Risk for CRC begins to increase after age 50 (the age when screening is recommended for average-risk adults). The lifetime risk for CRC is approximately 6%, and risk is similar in men and women. African American adults have higher rates of CRC and lower survival from the disease.[16, 17] Although one of the most effective means of controlling CRC is screening and early detection, dietary and physical activity factors have been linked to CRC rates as well.[5,10,18-20] All-stage 5-year survival from CRC is estimated around 62%, though survival rates are markedly higher (~90%) for cancers detected at early stages. The potentially unique needs of CRC survivors and their growing numbers make it important to understand their health behaviors posttreatment and whether they have different intervention needs. Existing research suggests that cancer patients and survivors express interest in making positive lifestyle changes[21,22] or have already made changes in their health habits postdiagnosis,[23-28] but research does not indicate whether, or in what way, the health information needs of cancer survivors are the same as, or different from, those of a noncancer population.

Using social cognitive theory[29] (SCT) to guide variable selection, we investigated correlates of fruit and vegetable consumption and of physical activity among CRC survivors and a comparable sample of non-CRC-affected individuals. We chose to use SCT because it has been used successfully to study and intervene on health behaviors, including physical activity among cancer survivors,[30] nutrition behavior,[31] and multiple other health behaviors.[32] Our purpose was first to assess factors associated with 2 health behaviors, fruit and vegetable (FV) consumption and physical activity (PA) and then to evaluate whether such variables were similar between CRC survivor and the comparison groups. Specifically, we wanted to examine environmental and situational factors, such as employment status and social support, in addition to demographics (eg, ethnicity, age, education, gender), and personal factors, such as perceived barriers, knowledge, and self-efficacy. Selected variables were rooted in both the theoretical and the empirical literature.

Our sample was diverse – including African Americans and whites, and men and women from both rural and urban areas of North Carolina. This report will contribute to the growing body of literature on health behaviors with an emphasis on potentially unique needs of CRC survivors for health promotion efforts.

METHODS

Study Design

NC STRIDES (Strategies for Improving Diet, Exercise, and Screening) was a 2x2 factorial intervention design, testing 2 different methods of communicating and promoting health behavior change (tailored print messages and telephone-based motivational interviewing) among CRC survivors and a general population group. A pre-intervention survey was conducted at baseline, with follow-up at 6- and 12-months. Trained research assistants conducted all surveys over the telephone and entered responses on scannable forms, which were then scanned into a database program and imported into Microsoft Access. The primary aims of the present study were to examine whether there were differences in health behavior levels (FV, PA) and behavioral determinants (knowledge, self-efficacy, barriers, social support) between survivor and comparison respondents, and to investigate

whether these determinants were differentially associated with health behaviors by survivorship status.

Participants

NC STRIDES participants were recruited from the North Carolina Colon Cancer Study (NCCCS) a population-based case-control study of incident colon and rectal cancer in 33 counties across North Carolina that include rural, suburban, and urban areas with a diverse socioeconomic mix of African Americans and whites. The details of NCCCS' recruitment have been described elsewhere.[33] Briefly, cases were identified through the rapid ascertainment component of the North Carolina Central Cancer Registry. Controls under the age of 65 were identified using records from the North Carolina Division of Motor Vehicles; controls age 65 or older were identified from the Center for Medicare and Medicaid records. NCCCS randomly selected controls from similar age, sex, and race/ethnicity strata as cases.

The university's institutional review board approved all procedures. NCCCS participants were recruited to NC STRIDES between January 2001 and June 2002. Using a rolling recruitment, NCCCS participants were mailed a letter about the study and were contacted by NCCCS, which then forwarded names of consenting participants to NC STRIDES. Cases with advanced stage disease were considered for recruitment if they self-reported being healthy enough to make lifestyle changes and to participate over the course of the year. NC STRIDES successfully recruited 50% of the entire NCCCS sample (N=1850). Of those recruited (n=922), 825 (89.5%) completed the baseline survey. Survey response rates were similar among cases and controls. We report here on the results of that baseline survey.

Measures and Procedures

The baseline assessment was a 30- to 40-minute telephone administered survey. Trained research assistants at the University of North Carolina conducted all telephone surveys. Data were collected regarding sociodemographics, health information, behaviors including diet and physical activity, and related psychosocial factors.

Demographic and health variables. Age, race/ethnicity (African American, white), sex, and CRC status (case/control) were collected during NCCCS. Additional self-reported information collected as part of the NC STRIDES included education, employment, annual income, marital status, height and weight, self-rated health, and presence of chronic conditions that might affect diet or physical activity (heart disease, hypertension, diabetes, arthritis, other cancers).

Fruit and vegetable intake. Average daily fruit and vegetable intake was measured using a 36-item food frequency questionnaire (FFQ) based on a FFQ validated by Resnicow and colleagues.[34] Our slightly modified measure used a time reference of the past *month* rather than past *week*, and omitted food items that were not fruits or vegetables. For analysis, "French fries, fried potatoes, and home fries" were not included in our calculations of total fruit and vegetable intake. The 35-item FFQ may overestimate intake but should provide accurate ranking.[35] The 35-item FFQ was moderately correlated with a 2-item self-rated screener ($r = 0.46$, $P<0.001$).

Physical activity. Weekly physical activity was measured using a modified version of a validated 7-day physical-activity recall,[36,37] selected to be consistent with that of the parent NCCCS study. Hours per week spent in very hard, hard, and moderate-intensity activity were assessed, multiplied by a metabolic equivalent (MET) factor[38] to adjust for energy expenditure, and summed to form a physical activity score. The square root of this value was then taken to account for nonnormality of the data. Unless otherwise stated, analyses and p-values reflect this transformed physical activity score. The 7-day PAR has been validated against other physical activity measures.[33]

Psychosocial variables. *Stage of change* for meeting guidelines (ie, eating 5 or more servings of FV a day, being physically active for at least 30 minutes 5 days per week) was measured using 2 questions. The first question asked participants to report whether they were engaging (action/maintenance), planning (preparation), thinking (contemplation), or not thinking (precontemplation) of engaging in the behavior. The second question asked participants who reported engaging in the behavior how long they had been doing so, to differentiate between action and maintenance stages). The 2-

stage question set is similar to that recommended by Prochaska and Diclemente[39] and by the National Institutes of Health Behavior Change Consortium (http://www1.od.nih.gov/behaviorchange/). *Self-efficacy* for eating 5 or more servings of FV each day and for being physically active 5 or more days per week were each measured using a single standard question ("If you decided to, how sure are you that you have the ability to succeed..."). Response options used a 5-point Likert-type scale ranging from very sure (5) to very unsure (1). *Perceived social support* was measured using a 4-item scale for each behavior: (eg, "If you tried to eat healthier foods, how much could you count on the people close to you to encourage you, tell you about healthier foods and how to prepare them, prepare healthier foods with or for you, and eat healthier foods with you?").[40] Physical activity items were similarly phrased. The 3-point response option ranged from not at all, some, to a lot. Each 4-item scale demonstrated good internal consistency as indicated by Cronbach's alpha (α_{FV} = .84, α_{PA}= .82). *Perceived barriers* to behavior were measured with a series of statements for each behavior (eg, "It would be hard for me to eat more fruits and vegetables than I do now because...."). Barrier statements were based on items previously developed and tested by the authors[41,42] and modified based on responses from presurvey focus groups.[43] Four-point response options ranged from disagree a lot (1) to agree a lot. (4) Sample barrier items included, "I'm not in the habit of eating them" for FV and "I don't have more time" for PA. The 6-item barriers scales demonstrated adequate internal consistency (α_{FV} = .66; α_{PA} = .62). *Knowledge* of recommendations was measured with one multiple-choice question per behavior (eg, "How many fruits and vegetables should a person eat each day for good health?"). Similar knowledge questions have been used by other researchers and shown to be associated with dietary consumption.[44,45]

Analysis

Completed surveys were checked for errors and stray marks that would affect scanning; batches of surveys were then scanned into Microsoft Access. The completed dataset was verified by hand-checking a random 10% subsample. Data were later imported into SPSS for statistical analysis. Linear regression was used to model the association of the SCT variables on health behavior. Participants were first analyzed together and then separated into the CRC-survivor and the comparison group. The subgroup regressions were then compared using a procedure described by Hardy in which standard deviations were pooled and regression weights compared.[46] The significance level was set at $P < 0.05$; adjustments for multiple tests were not made.

RESULTS

Participant Characteristics

The characteristics of the sample are summarized in Table 1. In the total baseline sample (N=825), nearly half (48%) of participants were female and over a third (36%) were African American. The average age was 67 years (range 39 to 82 years; SD=10.04). Only 36% were actively employed. Our seemingly low rate of employment is probably accounted for by the age of our sample – most were over age 65 and therefore likely retired. However we are unable to differentiate between participants who were retired and those who were unemployed or unable to work. Most respondents had at least a high school education; half had annual incomes at or above $30,000. The majority of participants' self-rated health was "pretty good" or better. Most CRC survivors (58%) were diagnosed between 2 and 5 years prior to entering the NC STRIDES study; 29% were between one and 2 years from their diagnosis. Thus, our sample reflects longer-term and likely healthier survivors.

Cases and controls in NCCCS, the source of our participants, were demographically similar.[33] Because our study (NC STRIDES) used a subsample from the case-control NCCCS study, we checked to ensure that the cases (survivors) and controls (comparison) remained equivalent. Survivors (n=304) and comparison (n=521) participants were alike on most demographic factors except for age and education. Comparison-group participants were significantly older ($P<.001$) and more likely to have a high school diploma, GED, or higher schooling ($P=.003$). Approximately 40% of each group rated their health as "very good" or "excellent," but survivors were slightly more likely to report a concurrent diagnosis of diabetes than were comparison participants (22%

Table 1
Health and Health Behavior Levels by Group

	CRC survivors N=304	Comparison N=521	Total N=825
Sociodemographic Variables			
Age in Years (Mean, SD)*	65.2 (10.6)	67.2 (9.6)	66.47 (10.1)
Gender (Male)	53.9%	50.5%	51.8%
African American	37.8%	35.1%	36.1%
≥ High School Degree*	72.9%	81.7%	78.5%
Employed Full or Part-time	35.3%	36.9%	36.3%
Annual Income ≥$30 000	51.1%	54.2%	53.1%
Health-related Variables			
Self-rated health, very good or excellent	42.2%	39.7%	40.7%
Comorbidities			
Diabetes	22.1	17.1	19.0
Heart Disease	17.8	17.9	17.9
Hypertension	48.0	50.2	49.4
Arthritis	36.9	42.4	40.4
Other Cancers (ie, not CRC)	18.5	14.2	15.8
None reported	21.1	22.8	22.2
Fruit /Vegetable (FV) Variables			
Daily Mean (Median)	5.46 (4.80)	5.48 (5.21)	5.47 (5.04)
Brief screener (Mean)	4.05	4.24	4.17
Meeting "5-a-day" (%)	47.0	52.6	50.6
Self-efficacy (Mean, SD)	3.44 (1.37)	3.49 (1.36)	3.47 (1.37)
Social Support (Mean, SD)[a]	1.37 (.618)	1.27 (.654)	1.31 (.642)
Knowledge of "5-a-day"	0.29 (.453)	0.29 (.456)	0.29 (.453)
Barriers (Mean, SD) [a]	1.88 (.663)	1.81 (.625)	1.84 (.640)
Action/Maintenance stage (%)	30.4	32.9	32.0
Physical Activity Variables			
Weekly Minutes Mean (Median)	282.7 (181.0)	299.1 (182.0)	293.0 (182.0)
Meeting recommendation (%)	53.9	57.0	55.8%
Self-efficacy (Mean, SD)	4.12 (1.21)	4.15 (1.10)	4.14 (1.14)
Social Support (Mean, SD)[a]	1.08 (.646)	0.982 (.653)	1.02 (.651)
Knowledge of "5-a-day"	0.691 (.463)	0.739 (.439)	0.721 (.449)
Barriers (Mean, SD) [a]	1.84 (1.67)	1.79 (1.598)	1.81 (1.67)
Action/Maintenance stage (%)	64.1	66.6	65.0

Note.
a Average response across several variables.
***P<.05 for difference between groups.**

versus 17%, P=.087). It is possible that this finding is due to detection bias among cancer survivors because of the extensive medical care and monitoring during and after treatment. Alternatively, there is growing evidence of associations between diabetes, insulin, and colon cancers.[20,47]

One important finding emerged from the analysis of sociodemographic factors: 19% of CRC survivors reported another cancer (it is unclear whether these cancers reflect prior history, metastases, or second cancers). Additionally, 14% of our comparison group reported a past cancer (non-CRC) diagnosis. Because of the research design and the case/control nature of the NCCCS study from which participants were drawn, as well as the intent to study CRC, we have maintained the CRC-survivor/comparison categories. However, it is important to recognize that the comparisons presented here are not between cancer survivors and non-can-

Table 2
Multiple Regression Results and Between-Group Comparisons Predicting Fruit and Vegetable Consumption

Variable	Within-Group Results				Between-Group
	Survivors		Comparison		
	B (SE)	P-value	B(SE)	P-value	t-value (P-value)
Age in years	**.007 (.002)**	**.008**	**.008(.002)**	**<.001**	-.355 *(.722)*
≥ High school	-0.021(.061)	.731	**.134 (.048)**	**.006**	**-2.03 *(.043)***
Employed	**-0.122 (.057)**	**.034**	**-.081 (.039)**	**.037**	-.605 *(.545)*
Male	**-0.100 (.048)**	**.036**	-.031 (.036)	.390	-1.16 8 *(.243)*
African American	-.017 (.050)	.739	**.157 (.038)**	**<.001**	**-2.814 *(.005)***
Self-efficacy	**0.074 (.018)**	**<.001**	**.067 (.014)**	**<.001**	0.312 *(.756)*
Social support	-0.007 (.010)	.476	.006 (.007)	.399	-1.084 *(.279)*
Knowledge	0.055 (.054)	.315	**.128 (.039)**	**.001**	-1.115 *(.265)*
Barriers	-0.010 (.06)	.097	**-.018 (.005)**	**<.001**	1.037 *(.300)*
Model R Square	.187	——	.253	——	

Note.
Values that were significant (P<0.05) in the subgroup are bolded.

cer-affected persons *per se*. Rather, this reflects a CRC-survivor sample compared to a group of adults drawn from the general population who may, and do, have health issues and diagnoses other than CRC, including other types of cancer.

Fruit and Vegetable Consumption

The average daily servings of FV was 5.47 (Median = 5.04) using the 35-item measure (Table 1). No significant differences were evident between the survivor and comparison groups in terms of reported fruit and vegetable consumption. Forty-seven percent of the survivors and 53% of the comparison respondents reported at least 5 servings of fruits and/or vegetables per day, thereby meeting the "5-A-Day" guideline that was the national recommendation during the study period (most recently the recommendation has increased to 5-13 daily servings). Using self-report to classify stages of change according to the transtheoretical model,[48,49] 32% of the whole sample (both groups) were classified as action/maintenance, 13% as preparation, 21% as contemplation, and 33% as precontemplation. Stage distribution was similar between the 2 groups. In both groups, self-efficacy to eat 5 or more servings of fruits and vegetables per day was, on average, between somewhat sure and sure (mean = 3.4 (SD = 1.37)). Perceived barriers were generally low, the average response in both groups was between disagree a little and disagree a lot (mean = 1.31 (SD = 2.57)). Neither self-efficacy nor perceived barriers for fruits and vegetables varied significantly between survivors and comparison participants (P>.05). Overall perceived social support for a healthier diet was significantly higher for survivors compared to the comparison group (P=.036). Specifically, survivors' support scores averaged 5.47 (SD = 2.47) compared to 5.08 (SD = 2.6) among comparison-group members.

Next, linear regression models were compiled to assess variables' associations with the health behavior (Table 2). In the total sample, variables that were significantly related to higher fruit/vegetable scores included African American ethnicity, female gender, older age, and not being employed. Psychosocial factors significantly associated with higher FV scores included higher self-efficacy for eating FV, correct knowledge of the 5-A-Day recommendations, and lower perceived barriers. Education level and dietary social support were not significant. The sample was then stratified by case status, and regression models were recalculated. Among the survivor subsample, nonemployment, female gen-

Table 3
Multiple Regression Results and Between-Group Comparisons Predicting Physical Activity

Variable	Within-Group Results				Between-Group
	Survivors		Comparison		
	B (SE)	P-value	B(SE)	P-value	t-value (P-value)
Age in years	-.008 (.016)	.613	-.012 (.014)	.370	0.188 *(.851)*
H.S.. degree or more	.381 (.386)	.325	.371 (.333)	.265	0.020 *(.984)*
African American	-.149 (.321)	.642	-.380 (.258)	.142	0.559 *(.577)*
Employed	**-.960 (.368)**	**.010**	**-.870 (.268)**	**.001**	-0.197 *(.844)*
Male	**.870 (.312)**	**.006**	**.894 (.243)**	**<.001**	-.060 *(.262)*
Self-efficacy	**.748 (.130)**	**<.001**	**.551 (.117)**	**<.001**	1.123 *(.262)*
Barriers	-.074 (.042)	.076	**-.085 (.036)**	**.019**	0.198 *(.843)*
Support	-.079 (.058)	.176	.041 (.046)	.377	-1.615 *(.107)*
Knowledge	-.083 (.330)	.802	**.605 (.270)**	**.026**	-1.608 *(.108)*
Model R-Square	.223		.189		

der, older age, and higher self-efficacy were associated with higher FV intake whereas in the comparison sample, employment, ethnicity, education, age, self-efficacy, perceived barriers, and knowledge were significantly associated with FV scores. Post hoc analyses demonstrated that African American race/ethnicity (P=.005) and education (P=.04) had significantly different associations with behavior by subgroup. Specifically, both variables were associated with higher FV intake in the comparison group but not the survivor group.

Physical Activity

Although 21.6% of participants reported no leisure-time physical activity, on average our participants were fairly active. Slightly more than half of participants met the CDC guidelines of at least 150 minutes of moderate physical activity per week (30 minutes, 5 days a week; Table 1). The mean number of physical activity hours per week was 4.88 (Median = 2.03; SD = 6.16). Our sample was skewed by a small percentage of participants (~2%) who reported in excess of 24 hours of activity per week. Mean minutes were similar between survivors and the general sample. When staged according to the transtheoretical model, there were no significant differences between the 2 groups. Overall, 64% were in action/maintenance, 13% in preparation, 13% in contemplation, and only 8% were precontemplators. Self-efficacy for meeting the physical activity guidelines of being active most days of the week was high in both groups; perceived barriers were low in both groups. Social support for physical activity was significantly higher among survivors (P=.036) than among comparison individuals.

Physical activity minutes were transformed for use in the regression model (Table 3) by multiplying minutes by metabolic equivalents (METs) to adjust for exercise intensity. In the total sample, not being employed, being male, and having higher self-efficacy and lower perceived barriers were significantly related to high PA scores (all P<.05). Among CRC survivors, only employment, gender, and self-efficacy were significantly associated (P<.05) with PA scores. The association of perceived barriers with PA was suggestive but not statistically significant (P=.076). In the comparison sample, employment, gender, self-efficacy, perceived barriers, and knowledge of PA recommendations were significantly associated with PA. Post hoc analyses did not indicate that any of the variables were differently associated with PA score among survivors compared to the comparison population.

DISCUSSION

We surveyed a population-based sample of colorectal cancer survivors and a simi-

lar comparison group regarding dietary and physical activity behaviors and associated factors. Respondents in both groups typically reported at least one other chronic condition (besides CRC), but perceived health was relatively high. For our 2 health behaviors of interest (FV and PA), we detected no significant behavioral differences between CRC survivor and our general population group. In fact, both groups reported levels of health behavior consistent with some of the literature but decidedly above rates reported by national surveys such as the Behavioral Risk Factor Surveillance System (BRFSS). Previously, we reported that during the time interval between the parent NCCCS study and the NC STRIDES baseline assessment (approximately 2.5 years on average), survivors had reported significant increase in vegetable intake and both groups had increased physical activity.[28] At the original NCCCS assessment, however, survivors had lower mean minutes of physical activity and slightly lower consumption of fruits and vegetables than did the comparison group.[33] Therefore, it is possible that the CRC diagnosis and subsequent participation in a CRC case-control study may have prompted health behavior changes that rendered the groups similar by the time of our study. In addition, selective attrition due to illness, death, and/or refusal may have resulted in a study sample of CRC survivors that represented healthier individuals who were physically able to make the requisite behavior changes. However, half of our sample was still not meeting national recommendations for physical activity and/or fruit and vegetable consumption at the time of our baseline assessment.

Supporting our social cognitive[29] approach, both social/environmental and personal factors were associated with health behavior. Ethnicity, gender, age, and employment status, self-efficacy, barriers, and knowledge were associated with fruit and vegetable consumption; ethnicity, gender, employment, self-efficacy, and barriers were associated with physical activity. These results are consistent with other studies that have shown demographic differences in health behavior, as well as theoretical and empirical support for the impact of self-efficacy and perceived barriers on these 2 behaviors.[50-53] As we will discuss below, several of our findings are intriguing and warrant further investigation.

The consistent association between lack of employment and higher rates of healthy behaviors was unexpected. Not being employed was associated with higher consumption of fruits and vegetables and higher scores for physical activity, even when the model was adjusted for age. Whether those in our study who were not employed were retired as opposed to unemployed was not directly measured. However, the age of our sample (62% of the sample were age 65 or older) suggests that many of those who reported not working were, in fact, retired. It could be that participants who did not have a job simply had more time and flexibility in their schedule to engage in physical activity or prepare meals that included fruits and vegetables, or it could be that people who were retired were more health conscious and motivated to engage in healthy behavior. That employment was a significant correlate of both health behaviors when age, education, ethnicity, and gender were controlled for speaks to employment and possibly retirement as important and independent predictors of health behavior. The apparent scarcity of research on health behavior changes postretirement suggests that this area of research likely deserves consideration.

That there were few differences between the CRC survivors and general population may have been due to factors noted above, such as time since diagnosis, prior healthy changes, and selective attrition. Given the lack of detectable difference in FV and PA behaviors, it is not surprising that we did not detect any group differences in perceived barriers, self-efficacy, or stage (readiness) to change. However, we did notice significantly higher perceived social support for both health behaviors among survivors. The higher social support for health behaviors may reflect a stronger social network or simply an increased awareness of available support. Supportive relationships may have been enhanced as a result of coping with CRC and recovery. The lack of association between such greater perceived social support and increased healthier behaviors is difficult to interpret. It may be that awareness (rather than actual existence) of social support was higher among survivors due to their cancer experience or that the available social support was not helpful for facilitat-

ing health behavior. Although the majority of literature suggests social support can be helpful for health behavior, this may not always be the case.[54,55] Whereas social support is usually intended by the giver to be helpful, negative aspects of support may include nagging, unhelpful advice, tendency to treat the person as ~~an~~ ill or an invalid, or unwillingness to change one's own behavior.

The differential effects of sociodemographic factors (African American ethnicity and education) between the groups were interesting. Having at least a high school diploma and being African American were each associated with higher levels of fruits and vegetables in the comparison population but not the survivor group. We speculate that the CRC experience may have "leveled" out some of these sociodemographic differences in health behavior by motivating changes among people who previously had low levels of healthy behavior.

There are several limitations to this study. The cross-sectional study does not allow for assessing causal or temporal relationships. Further, the sample may be self-selected because participants had previously participated in an epidemiological study of CRC risk factors and volunteered to participate in a second, intervention study. We therefore may have recruited a group of more motivated and healthier participants. In addition, reliance on self-report measures of behavior may lead to biases.[34,56,57] Strengths of this study include the diversity of the sample and ability to compare a population-based sample of survivors to similar general population individuals.

Our findings suggest avenues for researchers investigating the external correlates of health behavior. Age, employment status, ethnicity, and gender were significantly associated with health behaviors, as were psychosocial factors such as self-efficacy. This is one of few studies to examine health behaviors of CRC survivors posttreatment in comparison to non-CRC-diagnosed individuals from similar geographic and demographic strata. Findings suggest that interpersonal factors such as social support may be enhanced among CRC survivors, and this may be useful information for intervention development if the support is deemed helpful and can be linked to behavior. Health communications and interventions aimed at improving behavior among cancer survivors may need to be tailored to different psychosocial constructs to promote behavior change. However, overall our findings suggests that approximately 2 or more years post diagnosis, the survivor and comparison groups are not very different. Further, the optimal time for making healthy changes among survivors may be closer to the time of diagnosis since changes were observed between the NCCCS original survey and the NC STRIDES baseline assessment.

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