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Original Research

Receptivity and Preferences in Cancer Risk Reduction Lifestyle Programs: A Survey of Colorectal Cancer Family Members

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Abstract

Background: Cancer is a shared family experience, and thus the purpose of this study was to assess receptivity and preferences for cancer risk reduction programs among at-risk family members with two or more relatives affected with colorectal cancer (CRC).

Methods: The sample comprised 401 at-risk family members with two or more relatives affected with CRC from the Colon Cancer Family Registry. In March 2009, respondents completed a mailed survey assessing receptivity and preferences for participating in cancer risk reduction programs and evaluated their relationship to demographic, medical, and psychosocial variables. Multivariable generalized estimating equation approaches were used to model preferences.

Results: Overall, 81% of respondents were receptive to a lifestyle cancer risk reduction program; of these, about half (54%) preferred to participate with their family. Program preferences included: weight management (36%) and nutrition (31%); delivered through the internet (41%) or mail (39%). In a multivariate model, a greater level of concern about cancer ($p<0.001$), female gender ($p=0.002$), and higher education ($p=0.016$) were significantly correlated with willingness to participate in lifestyle programs.

Conclusions: Family members of those with CRC are receptive to cancer risk reduction programs that focus on weight management and nutrition delivered via the internet or mail. Future research is needed to determine how best to incorporate a family-based approach that addresses the cancer experience when designing lifestyle intervention programs.

INTRODUCTION

Cancer is a shared experience, affecting both the patient and the family[1] . The family cancer experience is significant because a family history not only increases cancer risk[1, 2] , but it also may cause cancer-specific [3, 4] and general distress[5, 6] . Some family members may even experience serious mental health issues such as major depression or anxiety [4] . A diagnosis of cancer in the family may therefore serve as a teachable moment [7-9] for families, motivating them to engage in cancer-related health behavior change, either individually or collectively.

Research has explored how caregiving duties, coping, and psychosocial distress affect families[10] , but there is limited exploration on how the family cancer experience affects family members' cancer-prevention behaviors. Garces et al [11] found that 54% of lung cancer patients expressed interest in helping a friend or family member to quit smoking. Another study by Kristeller et al [12] found that family members were receptive to discussing cancer risk reduction interventions, but that spontaneous behavior change was low [12] . Manne and colleagues[13] , found siblings of colorectal cancer (CRC) patients were likely to have colonoscopies as a screening measure if they understood the health benefits of the screening, and believed that the screening would reduce their risk of CRC.

While family members may be receptive to behavior change efforts, more information is needed on intervention preferences (exercise, weight management), program format (family versus individual), and delivery channels (web-based versus face-to-face). Also, investigations into aspects of the family cancer experience (e.g., timing of diagnosis to program recruitment) are needed.

As the first logical step in this line of research, we sought to explore receptivity to cancer prevention lifestyle programs among those biologically related to CRC patients. CRC is a common, preventable cancer affecting both men and women with an estimated 142,820 new cases in the United States in 2013 [14] . Individuals with a first-degree relative with CRC are twice as likely to develop CRC and are at higher risk to develop it at an earlier age [12, 15, 16] . Lifestyle factors (inactivity, obesity, poor diet, and cigarette smoking) are also associated with the development of CRC[17] . The two largest predictors of CRC are obesity and a sedentary lifestyle [11, 18, 19] , and a higher body mass index (BMI > 35), especially among men [20, 21] .

The aims of this study were to: 1) assess receptivity and preferences for participating in cancer risk reduction lifestyle programs among CRC family members; and 2) identify demographic, medical, behavioral, and psychosocial characteristics associated with receptivity to participate in a lifestyle program. We hypothesized that concern about cancer risk is associated with willingness to engage in lifestyle interventions to reduce risk. Assessing receptivity to lifestyle interventions is important because about one-third of all cancers could be prevented if programs targeted smoking cessation, increasing exercise, improving diet, limiting alcohol, and having a lower body weight [22] .

METHODS

Participants and Procedure

The study was approved by the Mayo Institutional Review Boards. Participants included at-risk unaffected family members related to a patient (proband) who was recruited into the Colon Cooperative Family Registry (C-CFR). The C-CFR is a multinational comprehensive collaborative infrastructure for interdisciplinary studies in the genetic epidemiology of CRC (see http://epi.grants.cancer.gov/CFR/). Eligibility for at-risk unaffected family members included CRC family history (two or more relatives affected with CRC), age 18+, able to provide written informed consent, and not incarcerated. We restricted participation to those without an identified genetic mutation that would increase their CRC risk (i.e. Lynch Syndrome), as motivations in this group might differ from those with nonsyndromic family history.

In March 2009, 840 C-CFR family members were mailed: 1) a cover letter explaining the research study; 2) a consent form; 3) a survey with a pre-addressed stamped envelope. A second packet was mailed to non-responders within 6 weeks of the first mailing. No remuneration was offered. A total of 401 (49%) eligible respondents completed and returned the survey and form the basis of this report.

Measures

Demographic and medical data were collected through the C-CFR registry records, including: age, gender, ethnicity, education, number of first degree relatives with colorectal cancer, time since cancer diagnosis for affected family member(s), body mass index, and smoking status.

The survey was developed to address the content areas described below by an expert panel and then pilot-tested on 22 adults with cancer family history and then revised accordingly. Many of the measures used were derived from studies that have proven to be reliable and valid tools of assessing physical activity, nutrition, perceived cancer risk, degree of cancer worry/concern, and self-efficacy for behavioral change as well as for nutrition and exercise.

Health behaviors assessed were participants' current levels of physical activity (PA)[23] , nutrition [24] , and alcohol consumption. PA was measured via the Godin Leisure Time Exercise Questionnaire (GLTEQ) that has been shown to be a reliable and valid self-report measure [25] , a three-item opened ended measure of the frequency of strenuous, moderate or mild exercises for a period of at least 15 minutes over the last 7 days. Scores higher than 24 units indicate

moderate to strenuous PA which meets the public health recommendations for PA[23] . Nutritional habits were assessed with a well-established, 23-item, Likert style measure (ranging from "never" (1) to "almost always" (5)) that asks over the past month how often they had eaten certain foods such as butter, meat, or salad, with the option to respond that they did not eat a particular food. The 7 items that reflected negative eating habits (i.e., fast food, fried foods, red meat) were reverse scored. Mean scores were calculated for all 23 items. Higher scores indicated better nutritional habits while lower scores indicated poorer nutritional habits[24] . Alcohol use was assessed using a two part question modified from items originally on the Behavioral Risk Factor Surveillance System [26] that asked whether the participant had consumed at least 12 drinks of alcohol during their entire life. If they answered "yes," then they were asked "on average, how many drinks do you usually have?" Six response categories were provided that ranged from "Less than one each month" (1) to "3 or more each day" (6).

Psychosocial characteristics were assessed via a combination of standardized scales with published psychometric properties and investigator-derived items from studies that have proven to be reliable and valid. Perceived cancer risk and degree of cancer worry/concern were single-item questions modified from items originally constructed by Lerman et al [27] . On a 5-point Likert scale, respondents were asked, "How likely do you think it is that you will get cancer?" from "very likely" (1) to "very unlikely" (5) and on a 4-point Likert scale, "How concerned are you about getting cancer?" from "extremely concerned" (1) to "not at all concerned" (4). Degree of emotional closeness to affected family member(s) was measured by the question "How close is (or was) your relationship with this family member diagnosed with (colorectal) cancer?" adopted from the Texas Revised Inventory of Grief [28] shown to be reliable among family members. Structured on a 5-point Likert scale with responses from "closer than any other relationship I've had before or since" (1) to "Not very close at all" (5).

Self-efficacy for behavior change in general was measured via the General Self-Efficacy scale [29] , a 9-item measure to assess one's perceived ability to handle unforeseen situations, e.g., "I can always manage to solve difficult problems if I try hard enough". The measure was scored on a 4-point Likert scale, with 1 being "strongly disagree" to 4 "strongly agree". Scores range from 9-36; higher scores indicated more confidence while lower scores indicated lower confidence [29]. Nutritional self-efficacy was assessed via the Nutrition Self-efficacy scale [30] measuring confidence to overcome barriers to making changes in eating habits. The measure was scored on a 4-point Likert scale, with 1 being "not at all confident" to 4 "extremely confident". Scores range from 5 to 20; higher scores indicated more confidence while lower scores indicated poorer confidence [30] . Exercise self-efficacy was measured by a five-item measure designed by Marcus et al [31] assessing confidence in one's ability to engage in regular exercise in various situations, such as negative affect and making time for exercise (e.g., "When I am tired"). The measure was scored on a 10-point Likert scale, with 1 being "not at all confident" to 10 "extremely confident." Scores range from 5-50; higher scores indicated more confidence while lower scores indicated poorer confidence [31] .

Respondents were asked investigator generated questions assessing receptivity and preferences in cancer risk reduction lifestyle programs. Receptivity to participate in a cancer risk reduction lifestyle program was measured by the question, "How willing would you be to take part in a lifestyle program (i.e. exercise, nutrition, smoking cessation) to help reduce your risk of getting cancer if we were to create one?" Response categories included, "not at all," "somewhat," and "definitely".

Those responding "Somewhat" or "Definitely" to interest in a health promoting lifestyle program were asked five additional questions to assess program preferences. The first question was "Would you want a program that was just for you or one that includes you and your family or others?" Categories of response were "Just me," "Me and my family," and "Me and others (i.e., people outside family like friends or coworkers)." The second question was "What type of lifestyle program(s) would be of interest?" with instructions to "Mark ALL that apply." Choices included: Exercise, Weight management, Nutrition, Tobacco cessation (to quit smoking), Stress reduction, and Other (specify). The third question asked subjects to select their top choice from the types of lifestyle program(s) listed above. The fourth question was "How likely would you be to take part if the program was delivered by phone, by mail, in person, by internet?" Categories of response were on a 3-point Likert scale ranging from "Very likely" to "Not at all likely." The fifth question invited participants to select their top choice of the four ways to deliver the program.

Statistical Analysis

Descriptive data are presented as frequencies (N), percentages, means, and standard deviations (SD). Predictors of willingness to participate ("Definitely" or "Somewhat" willing *versus* "Not" willing) in a health promoting lifestyle program among family members

was assessed using a generalized estimating equation approach to account for multiple family members who might participate from a given kindred [32] . "Longitudinal data analysis using generalized linear models" [33] . For each variable of interest a univariable model was fit and then a final multivariable model was fit including variables that were significant in the univariable analyses. In all cases, p-values <0.05 were considered statistically significant.

RESULTS

Respondent characteristics

Demographic, behavioral, and psychosocial characteristics of the 401 respondents are shown in Table 1.

Table 1. Colon-CRF Family Member Respondent Characteristics (N=401)

Age, years	
N	399
Mean (SD)	63.4 (13.0)
Range	25.0-100.0
Gender	
Female	247 (61.9%)
Male	152 (38.1%)
Missing	2
Caucasian	393 (98.3%)
Missing	1
Education level	
Elementary school or junior high	22 (5.6%)
High school/GED	89 (22.5%)
Some college or university	76 (19.2%)
Vocational or technical	51 (12.9%)
College degree	91 (23.0%)
Postgraduate degree	66 (16.7%)
Missing	6
Number of first degree relatives with colorectal cancer	
0-1	275 (68.9%)
2	99 (24.8%)
3 or more	25 (6.3%)
Missing	2
Time from Colorectal Diagnosis of Proband to Survey completion by Relative (years)	
N	399
Mean (SD)	10.4 (4.9)
Range	0.9-32.7
Body Mass Index, kg/m^2	
N	380
Mean (SD)	27.9 (5.4)
Range	14.1-56.2
<25	115 (30.3%)
25-30	148 (39.0%)
>30	117 (30.8%)
Smoke cigarettes	
Never	210 (52.4%)
Former Smoker	152 (38.3%)
Current smoker	35 (8.8%)
Missing	4
Godin Score for physical activity	
N	380
Mean (SD)	33.1 (41.9)
Range	0.0-495.0
<=24	190 (50.0%)
>24	190 (50.0%)

Table 1. Resume

Nutrition Score	
N	390
Mean (SD)	3.3 (0.5)
Range	2.1-4.6
Alcohol Consumption:	
During your entire life, have you had 12 drinks or more of any kind of alcoholic drink?	
No	53 (13.5%)
Yes	339 (86.5%)
Missing	9
Average drinks of alcohol	
None	53 (13.7%)
Less than one each month	92 (23.8%)
1 to 3 each month	58 (15%)
1 to 2 each week	48 (12.4%)
3 to 6 each week	72 (18.7%)
1 to 2 each day	54 (14%)
3 or more each day	9 (2.3%)
Missing	15
Overall health:	
Compared to other people your age, how would you describe your state of health?	
Excellent	47 (12%)
Very good	161 (41.2%)
Good	125 (32%)
Fair	49 (12.5%)
Poor	9 (2.3%)
Missing	10
Do you consider yourself:	
Overweight	244 (62.4%)
Underweight	6 (1.5%)
Just about right	141 (36.1%)
Missing	10
Cancer risk:	
How likely do you think it is that you will get cancer?	
Very likely	21 (7%)
Somewhat likely	170 (56.3%)
Somewhat unlikely	79 (26.2%)
Very unlikely	14 (4.6%)
I have no feeling or opinion on my chances of getting cancer	18 (6%)
Missing	99
Cancer concern:	
How concerned are you about getting cancer?	
Extremely concerned	25 (8.2%)
Moderately concerned	96 (31.4%)
Mildly Concerned	155 (50.7%)
Not at all concerned	30 (9.8%)
Missing	95
Emotional Closeness:	
How close is (or was) your relationship with the family member diagnosed with (colorectal) cancer?	
Closer than any relationship I've had before or since	75 (19.6%)
Closer than most relationships I've had with other people	157 (41.1%)
About as close as most relationships with others	121 (31.7%)
Not as close as most relationships	22 (5.8%)
Not very close at all	7 (1.8%)
Missing	19

Table 1. Resume

Caregiver:	
Have you ever been directly involved as a caregiver for a loved one with cancer?	
Yes	208 (53.1%)
No	184 (46.9%)
Missing	9
General Self Efficacy Score	
N	395
Mean (SD)	27.5 (4.3)
Range	9.0-36.0
Nutrition Self Efficacy Score	
N	390
Mean (SD)	14.8 (3.1)
Range	5.0-20.0
Exercise Self Efficacy Score	
N	386
Mean (SD)	26.3 (10.5)
Range	5.0-50.0

Receptivity and preferences to participate in a lifestyle program

The majority of respondents (81%) were "Somewhat" to "Definitely" willing to take part in a lifestyle program to reduce cancer risks (Table 2). Fifty-four percent preferred to engage in a program with their family members, while 34% preferred a program by themselves. Preferred programs included weight management (36%) and nutrition (31%). The preferred delivery channels were Web/Internet (41%) and mail (39%).

Table 2. Cancer Risk-Reduction Program Receptivity among Colorectal-CRF Family Members (N=401)

How willing would you be to take part in a lifestyle program (i.e., exercise, nutrition, smoking cessation) to help reduce your risk of getting cancer if we were to create one?	
Not at all	75 (18.7%)
Somewhat	208 (51.9%)
Definitely	118 (29.4%)
Missing	0
If you answered somewhat or definitely, would you want a program that was just for you or one that includes you and your family or others?	
Just me	103 (34.0%)
Me and my family	164 (54.1%)
Me and others (i.e., friends or coworkers)	36 (11.8%)
Missing	23
Which of the programs listed above would be your <u>top</u> choice?	
Exercise	55 (18.8%)
Weight management	104 (35.6%)
Nutrition	90 (30.8%)
Tobacco cessation	13 (4.5%)
Stress reduction	30 (10.3%)
Missing	34
Of the four ways to deliver the program, which one would be your top choice?	
Telephone	13 (3.9%)
Web/Internet	128 (41.3%)
In person	49 (15.8%)
Mail	121 (39.0%)
Missing	16

Correlates of receptivity to participate in a lifestyle program

Univariable correlates among respondents willing to take part in a lifestyle program were younger (p< 0.001), female (p<0.001), more educated (p<0.001), had a shorter time since diagnosis of the most recently affected family member (p=0.011), and reported higher levels of concern about developing cancer (p<0.001) (Table 3). Additionally, they reported higher levels of physical activity (p=0.028) and average alcohol use (p=0.037).

In a multivariable model of "definitely/somewhat willing to participate" versus "not," the following variables were included in the model as potential predictors: age, gender, education, physical activity, alcohol consumption, concern of getting cancer, and time since diagnosis. From this model female gender (p=0.002), higher education (p=0.016), and higher cancer concern (p<0.001) was significantly correlated with interest.

Table 3. Comparison of Demographic, Psychosocial and Health Behavior Characteristics By Colorectal Cancer Family Members Receptiveness to Participate in Lifestyle Interventions

	Not Interested (N=75)	Somewhat or Definitely Interested (N=326)	p value†
Age, years			<0.001
N	74	325	
Mean (SD)	69.7 (13.9)	61.9 (12.3)	
Range	41.0-100.0	25.0-91.0	
Gender			<0.001
Female	33 (13.4%)	214 (86.6%)	
Male	41 (27%)	111 (73%)	
Missing	1	1	
Education level			<0.001[a]
No formal schooling	1 (50%)	1 (50%)	
Elementary school or junior high	5 (41.7%)	7 (58.3%)	
High school/GED	30 (32.3%)	63 (67.7%)	
Some college/trade school	14 (11.4%)	109 (88.6%)	
College degree	13 (13.3%)	85 (86.7%)	
Postgraduate degree	11 (15.9%)	58 (84.1%)	
Missing	1	3	
Body Mass Index (kg/m^2)			0.35
N	65	315	
Mean (SD)	27.3 (5.8)	28.0 (5.4)	
Range	14.1-40.3	16.2-56.2	
<25	26 (22.6%)	89 (77.4%)	
25-30	18 (12.2%)	130 (87.8%)	
>30	21 (17.8%)	97 (82.2%)	
Smoke cigarettes			0.34
Never	39 (18.6%)	171 (81.4%)	
Quit	31 (20.4%)	121 (79.6%)	
Current Smoker	4 (11.4%)	31 (88.6%)	
Missing	1	3	
Godin Score for physical activity			0.028
N	68	312	
Mean (SD)	26.2 (22.2)	34.6 (45.0)	
Range	0.0-98.0	0.0-495.0	
<=24	35 (18.4%)	155 (81.6%)	
>24	33 (17.3%)	158 (82.7%)	
Nutrition Score			0.49
N	71	319	
Mean (SD)	3.3 (0.6)	3.4 (0.5)	
Range	2.1-4.2	2.1-4.6	
Alcohol Consumption:			

Table 3. Resume

During your entire life, have you had 12 drinks or more of any kind of alcoholic drink?			0.037
No	16 (30.2%)	37 (69.8%)	
Yes	55 (16.2%)	284 (83.8%)	
Missing	4	5	
On average, how many drinks of alcohol do you usually have?			0.30*
None	16 (30.2%)	37 (69.8%)	
Less than one each month	14 (15.2%)	78 (84.8%)	
1 to 3 each month	8 (13.8%)	50 (86.2%)	
1 to 2 each week	9 (18.8%)	39 (81.3%)	
3 to 6 each week	10 (13.9%)	62 (86.1%)	
1 to 2 each day	11 (20.4%)	43 (79.6%)	
3 or more each day	2 (22.2%)	7 (77.8%)	
Missing	5	10	
General Self Efficacy Score			0.64
N	75	320	
Mean (SD)	27.3 (4.1)	27.6 (4.3)	
Range	14.0-36.0	9.0-36.0	
Nutrition Self Efficacy Score			0.14
N	71	319	
Mean (SD)	14.3 (3.3)	14.9 (3.0)	
Range	5.0-20.0	5.0-20.0	
Exercise Self Efficacy Score			0.13
N	72	314	
Mean (SD)	24.5 (11.3)	26.7 (10.3)	
Range	5.0-50.0	5.0-50.0	
Overall health:			
Compared to other people your age, how would you describe your state of health?			0.67**
Excellent	9 (19.1%)	38 (80.9%)	
Very good	33 (20.5%)	128 (79.5%)	
Good	21 (16.8%)	104 (83.2%)	
Fair	6 (12.2%)	43 (87.8%)	
Poor	2 (22.2%)	7 (77.8%)	
Missing	4	6	
Do you consider yourself			0.053
Overweight	35 (14.3%)	209 (85.7%)	
Underweight	1 (16.7%)	5 (83.3%)	
Just right	35 (24.8%)	106 (75.2%)	
Cancer risk:			
How likely do you think it is that you will get cancer?			0.14
Very likely	4 (19%)	17 (81%)	
Somewhat likely	26 (15.3%)	144 (84.7%)	
Somewhat unlikely	19 (24.1%)	60 (75.9%)	
Very unlikely	8 (57.1%)	6 (42.9%)	
I have no feeling or opinion on my chances of getting cancer	4 (22.2%)	14 (77.8%)	
Missing	14	85	
Concern:			
How concerned are you about getting cancer?			**<0.001**
Extremely concerned	1 (4%)	24 (96%)	
Moderately concerned	9 (9.4%)	87 (90.6%)	
Mildly Concerned	39 (25.2%)	116 (74.8%)	
Not at all concerned	14 (46.7%)	16 (53.3%)	
Missing	12	83	

Table 3. Resume

Number of first degree relatives with colorectal cancer			0.18
0-1	45 (16.4%)	230 (83.6%)	
2	25 (25.3%)	74 (74.7%)	
3 or more	4 (16%)	21 (84%)	
Missing	1	1	
Emotional Closeness:			
How close is (or was) your relationship with the family member diagnosed with colorectal cancer?			0.51‡
Closer than any relationship I've had before or since	15 (20%)	60 (80%)	
Closer than most relationships I've had with other people	26 (16.6%)	131 (83.4%)	
About as close as most relationships with others	23 (19%)	98 (81%)	
Not as close as most relationships	4 (18.2%)	18 (81.8%)	
Not very close at all	4 (57.1%)	3 (42.9%)	
Missing	3	16	
Caregiver:			
Have you ever been directly involved as a caregiver for a loved one with cancer?			0.77
Yes	38 (18.3%)	170 (81.7%)	
No	36 (19.6%)	148 (80.4%)	
Missing	1	8	
Time from colon cancer diagnosis of proband to survey completion by relative (years)			0.011
N	74	325	
Mean (SD)	11.6 (5.0)	10.1 (4.8)	
Range	1.6-28.4	0.9-32.7	

† Adjusted P-value from Generalized Estimating Equations model for related family members.
* P-value obtained is from combining 1 to 2 drinks each day and 3 or more drinks each day.
** P-value obtained from combining fair and poor.
‡ P-value obtained is from combining responses "Closer than any relationship I've had before" and "Closer than most relationships I've had with other people" versus "About as close as most relationships with others" versus "Not as close as most relationships" and "Not very close at all".
a Comparing subjects with some college education versus others.

DISCUSSION

Adding a new level of insight to this area of research, our results indicate high levels of receptivity (81%) toward participation in cancer risk reduction lifestyle programs among CRC family members, with program preferences focusing on weight management (36%) and nutrition (31%). These areas are related and shown in the literature to be linked to reducing cancer risk, especially in the context of CRC [34, 35] . As hypothesized, concern about cancer risk was positively associated with willingness to engage in lifestyle interventions to reduce risk.

A large portion (66%) of our study respondents reported a stronger preference for participating in group-based risk reduction programs with their family members and friends. This novel finding suggests a new avenue for intervention development incorporating natural sources of support [36]. A benefit of a natural source of support is that it can have a positive effect on one's self-esteem which in turn can increase motivation and retention to changes in behavior. Additionally, a social network can provide coping resources such as emotional, informational, and instrumental support. At-risk family members and cancer survivors should be studied as an integrated family unit to better understand and conceptualize a family or group-based cancer prevention program. Future studies could use a multi-dimensional assessment tool (e.g., Cancer Risk Belief Scale [37] to explore individuals' ideas about the role of family in cancer risk or employ qualitative methods to achieve a more in-depth understanding.

In this study, receptive respondents to participating in cancer risk reduction lifestyle programs reported unhealthy behaviors (i.e., poor diets, inadequate levels of physical activity and weight control). Several recent studies have reported similar findings among cancer survivors and preventive health behaviors [38, 39] . Martinez-Ochoa and colleagues [39] found family members of CRC patients had increased their CRC screening tests, but did not make changes in their health behaviors (i.e.), weight control, more physical activity and decrease in alcohol use to reduce cancer risk. Although our study respondents retained unhealthy behaviors, their expressed interest in lifestyle programs paired with their reports of higher levels in general and nutritional self-efficacy reflects that this group may be more motivated and confident in their ability to start

making behavioral changes (e.g. initiate weight loss programs and nutritional information sessions). Similar findings by Cooley and colleagues [38] found that lung cancer patients and their family members retained unhealthy behaviors (high rates of continued smoking, diets low in fruit and vegetables, and low levels of physical), but expressed interest and motivation in lifestyle programs geared toward improving exercise, diet, and stress management to reduce their risk of cancer over the next six months. This indicates there may be conflicts between intentions to change and making an actual change in lifestyle behavior, which may explain why approximately two-thirds (n=208) of our study respondents reported being "somewhat" rather than "definitely" receptive. Schnoll et al (2013) found that family members of lung cancer patients were more likely than orthopedic relatives to sign up for a smoking cessation program; however they had higher rates of discontinuation. Their finding highlights that while family members may understand increased risk for cancer, there still is a gap in actual behavioral change [40] . Some evidence suggests that patient's often feel like behavioral modification will have little impact on their prognosis, and therefore are less likely to put forth effort to make change [41] . It has been found that patient perceptions of the effectiveness of positive lifestyle changes (dietary changes, exercise, weight loss) and medical recommendations (following recommendations for screenings) are a key part in the decision-making process used to determine the extent of their medical recommendation adherence [42] . It would be valuable to explore these topics in this population to assess if intentions match actual behavioral change.

With respect to program delivery, family members preferred web/internet (41%) and mail (39%) over other options. This preference could be attributed to many of the respondents being geographically dispersed and slightly younger. This suggests that younger individuals may be more open to interventions, especially if they can anticipate benefits from the programs that decrease cancer risk.

Heightened cancer awareness among family members may be a catalyst for lifestyle changes given the high level of concerns reported in our study respondents regarding their own personal cancer risk. Additional work is needed to understand the impact of CRC on family members' perceived vulnerability and willingness to confront the potential relationships between their own behavior and their cancer risk. Future studies should explore further not only interest in participating in cancer risk-reduction programs, but also timing of the intervention or behavior change efforts based on increased interest being found closer to time of diagnosis. In addition, the degree of connection to the family cancer experience such as emotional and cognitive involvement and perceived similarity to the affected person [43] could be assessed in subsequent work.

Strengths of this study include the use of validated measures, the large sample, and availability of data from the C-CFR registry that delineated degree of relationship to members affected with CRC. We statistically accounted for the interdependence of the family members, and assessed current lifestyle behaviors and psychosocial measures in assessing interest. However, our results should be interpreted with caution since it may not replicate to families in other cancers. Our sample was primarily Caucasian and highly educated, limiting our ability to generalize our findings to other racial or ethnic groups.

In conclusion, our data suggest that cancer concern is associated with willingness to engage in lifestyle interventions to reduce cancer risk. Family-based cancer risk reduction programs may be a promising addition to cancer prevention efforts. Utilizing Web/Internet-based technology or newsletters will expand the reach of such programs and may be more cost-effective than in-person interventions, although each of these must be carefully evaluated. Our findings provide important preliminary data that investigators can use to translate lifestyle research to care among cancer survivor communities.

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