

Predictors of Perceived Risk for Colon Cancer in a National Probability Sample in the United States

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This study examines potential predictors of perceived risk for colon cancer in a U.S. sample of 2,949 individuals aged 45 and older with no colon cancer history. We examined perceived comparative risk for colon cancer as the outcome in ordinal regression analyses, and perceived absolute risk for colon cancer in linear regression analyses. Potential predictors included demographics, current risk behaviors, self-reported health, family and personal cancer history, emotion variables (colon cancer worry, general anxiety, and fear of positive screening findings), general cancer beliefs (causes, lack of preventability, information overload), and cancer information seeking. Those who had poorer self-reported health, a family cancer history, and increased colon cancer worry had higher perceived comparative and absolute colon cancer risk (all $ps < .05$). Those who were younger, interviewed in Spanish, had increased anxiety, and information overload had higher comparative risk; those with a personal history of cancer and fear that colon cancer screening would result in positive findings had higher absolute risk (all $ps < .05$). We determined that older individuals, those with risk factors, and those with good subjective health may not realize their colon cancer risk. Those distressed about colon cancer and who report cancer prevention information overload may require different messages.

Cancers of the colon and rectum are the third most frequent cancer diagnosis, and the second most frequent cause of mortality due to cancer in the United States (American Cancer Society [ACS], 2005). In 2005, it was estimated that 145,290 people would be diagnosed with colorectal cancer, and 56,290 people would die from it (ACS, 2005). Screening and behavioral risk reduction strategies are promising approaches to colorectal cancer prevention and control. Colorectal cancer screening presents an opportunity to diagnose malignancy in the earliest stage (stage I), and also to prevent the development of cancer through removal of precancerous adenomatous polyps (Rex, Johnson, Lieberman, Burt, & Sonnenberg, 2000; Smith et al.,

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2001). Screening for colorectal cancer is recommended for those individuals aged 50 and older in the general population, and includes either fecal occult blood testing (FOBT) annually, flexible sigmoidoscopy or double-contrast barium enema every 5 years, or colonoscopy every 10 years. Combined screening is recommended over FOBT alone (U.S. Preventive Services Task Force [USPSTF], 2002). Only half (40% to 50%) of the U.S. population, however, is adherent with these screening guidelines (Seeff et al., 2004; Subramanian, Klosterman, Amonkar, & Hunt, 2004; Vernon, McQueen, Meissner, Klabunde, & Rakowski, 2005), and currently only 39% of colorectal cancer cases are diagnosed at stage I (ACS, 2005).

The development of colorectal cancer is associated with a number of lifestyle behaviors. For example, risk for colorectal cancer is increased among those who smoke (Giovannucci, 2001), consume alcohol heavily (Su & Arab, 2004), have sedentary lifestyles (Colditz, Cannuscio, & Frazier, 1997; U.S. Department of Health and Human Services [USDHHS], 1996), and are obese (Calle, Rodriguez, Walker-Thurmond, & Thun, 2003). Dietary factors contribute to the development of colorectal cancer, such that individuals who consume large amounts of red meat (Chao et al., 2005) and not enough fruit, vegetables, and dietary fiber are at increased risk (McCullough et al., 2003; Terry, Hu, Hansen, & Wolk, 2001). Unfortunately, these risk behaviors are quite common among those diagnosed with colorectal polyps (Emmons et al., 2005), and in the general population (Cerin, Leslie, Bauman, & Owen, 2005; Fine, Philogene, Gramling, Coups, & Sinha, 2004). Strategies to change these risk behaviors, and increase colorectal cancer screening utilization, are promising approaches to reducing morbidity and mortality due to colorectal cancer (Tomeo et al., 1999).

Perceived illness risk involves an individual's belief about their risk of developing illness (Weinstein, 2000). Most theorists of health behavior change have proposed that heightened perceptions of illness risk encourage self-protective actions (Beck & Frankel, 1981; Cummings, Becker, & Maile, 1980; Janz & Becker, 1984; Leventhal & Cameron, 1987; Weinstein, 1988). Perceived risk for colorectal cancer may be an important common precursor to uptake of screening and risk reduction strategies for colorectal cancer. There is evidence that perceived risk for colorectal cancer prospectively increases colorectal cancer screening intentions and utilization (McCrae et al., 1984; Watts, Vernon, Myers, & Tilley, 2003). However, perceived risk for colorectal cancer is quite low in the general population. For example, a large percentage (79%) of middle-aged and older individuals without a history of polyps, and 40% to 59% with a history of polyps, reported feeling no risk for developing colorectal cancer, or that they were unlikely to get it (Clipp et al., 2004; Vernon, Myers, Tilley, & Li, 2001). In an older African American sample drawn from a low-income community health center, 37% said they did not know their risk for developing colorectal cancer, and 36% said that their risk was below average (Lipkus et al., 1996).

There are diverse measurement strategies to assess risk perceptions (Diefenbach, Weinstein, & O'Reilly, 1993), including some that bypass individuals' difficulties communicating their risk via numerical odds and percentages (Schwartz, Woloshin, Black, & Welch, 1997). These methods include comparative risk questions, which require respondents to compare their own risks of developing illness with that of their peers (Weinstein, 1980), as well as verbally anchored absolute risk questions ("very unlikely" to "very likely"; Diefenbach et al., 1993; Windschitl & Wells, 1996). These questions tend to be moderately correlated (r s from 0.22 to 0.75; Lipkus et al., 2000; Weinstein, 1984), indicating that they are not completely redundant. Comparative risk estimates,

which tend to clearly reflect individuals' optimistic bias toward their risk, may be a more important determinant of health behavior change processes (Klein & Weinstein, 1997), but there is no consensus on this in the area of colorectal cancer risk perceptions. For instance, in work that experimentally manipulated risk perceptions, Weinstein and colleagues (2004) found that knowledge of colorectal cancer risk factors is more strongly related to perceived comparative rather than absolute risk, but other experimental research has not confirmed this finding (Lipkus et al., 2004). Both comparative likelihood and verbally anchored questions assessing absolute colorectal cancer risk perceptions are related to intentions for colorectal cancer screening (Lipkus et al., 2000), and, at this point, continued research looking at multiple methods of risk perception for colorectal cancer is warranted.

Health communication strategies to increase colorectal cancer risk perceptions may usefully surmount the belief that colorectal cancer screening is unnecessary in the absence of symptoms (Janz, Wren, Schottenfeld, & Guire, 2003), galvanize patient inquiries and requests for screening, and increase receptivity to colorectal cancer risk reduction via health behavior change. The target populations and intervention content would be enhanced by knowledge of the predictors of perceived risk for colorectal cancer in the general population. Prior research has identified demographic, medical, lifestyle, emotional, and social support factors associated with risk perceptions for colorectal cancer. For instance, recent studies indicate that women, Caucasians, younger individuals, and those with a higher socioeconomic status feel that they are at higher risk for colorectal cancer; there is evidence that marital status does not relate to perceived risk (Clipp et al., 2004; Robb, Miles, & Wardle, 2004). Lower health literacy also has been associated with increased perceptions of risk for colorectal cancer (Dolan et al., 2004). Medical factors related to increased colorectal cancer risk perceptions include having a family history of colorectal cancer, poorer subjective health, and increased number and severity of physical symptoms (Blalock, DeVellis, Afifi, & Sandler, 1990; Lipkus et al., 1996; Robb, Miles, & Wardle, 2004; Vernon et al., 2001). In terms of lifestyle risk factors, smokers and those with lower levels of physical activity perceive increased risk (Lipkus et al., 1996; Robb et al., 2004; Vernon et al., 2001), as do those with more versus fewer behavioral risk factors (Emmons et al., 2005). General anxiety and colorectal cancer worry are positively associated with risk perceptions (Robb et al., 2004; Vernon et al., 2001). One study found that family support for colorectal cancer screening was positively related to colorectal cancer risk perceptions (Vernon et al., 2001) and one did not (Clipp et al., 2004).

In the current study, we utilize the Health Information National Trends Survey 2003 (HINTS) to confirm and expand this knowledge base by examining patterns and predictors of colon¹ cancer risk perceptions across racial/ethnic subgroups, and using a more diverse range of lifestyle risk behaviors as potential predictors than has been previously examined. This article will expand upon prior work in several ways. While one prior study (Robb et al., 2004) has shown that colorectal cancer risk perceptions are higher among Caucasians versus non-Caucasians and among those with higher socioeconomic status, we will examine possible differences in colon cancer risk perceptions among Caucasians, African Americans, and Hispanics separately, and among individuals with diverse educational and income attainments. This study will be the first to examine whether a prior personal history of any

¹Cancers originating in the colon make up 72% of all colorectal cancers (ACS, 2005).

noncolon cancer is related to risk perceptions for colon cancer. In terms of lifestyle risk behaviors, smokers and those who are more sedentary perceive increased risk for colon cancer (Lipkus et al., 1996; Robb et al., 2004; Vernon et al., 2001); we examine these factors and include additional factors that previously have not been examined in relationship to perceived risk for colon cancer, namely, fruit and vegetable consumption and body mass index (BMI). We will also attempt to confirm prior findings for gender, age, marital status, family history of colorectal cancer, overall subjective health, general anxiety, and worry about colon cancer (Clipp et al., 2004; Lipkus et al., 1996; Robb et al., 2004; Vernon et al., 2001). This study is the first to examine the extent to which beliefs about cancer causes, lack of preventability, and a belief that there are so many cancer prevention recommendations that it is hard to know what to do (i.e., information overload), as well as cancer information seeking, are related to perceived risk for colon cancer. Finally, this study will assess predictors of both comparative and absolute risk perceptions for colon cancer, the results of which will be useful in the development of future intervention trials to increase screening and risk reduction for colorectal cancer.

We advance the following predictions: First, colon cancer risk perceptions will be significantly related to *demographics* such that they will be higher among those who are female, younger, Caucasian, choose to be interviewed in English rather than in Spanish, are better educated, and have higher income, but will be unrelated to marital status. Second, colon cancer risk perceptions will be significantly related to *medical* factors such that they will be higher among those with poorer subjective health status, and those with a personal or a family history of cancer. Third, colon cancer risk perceptions will be significantly higher in those with *lifestyle risk factors*, including current cigarette smoking, low physical activity, lower fruit and vegetable consumption, and higher BMI. Fourth, we predict that *emotion variables* will be related to colon cancer risk perceptions such that those with higher general anxiety, colon cancer worry, and fears that screening would result in positive findings will feel more at risk. Finally, we investigate *general cancer beliefs and cancer information seeking* in relationship to colon cancer risk perceptions, but we do not propose predictions here because of the lack of prior work in this area.

Methods

Procedure

This study uses data from the HINTS 2003, a national probability survey of U.S. adults conducted by the National Cancer Institute (NCI). Random-digit dialing methods were used to select participants for a one-time telephone interview. The response rate for the screener interview was 55%, and the response rate for the extended interview was 62.8%. The HINTS used a complex sample survey design, with oversampling of African American and Hispanic populations, data weighting (including non-response and poststratification adjustments), and variance estimation using a jackknife technique. Additional details regarding the response rate, study design, and data collection procedures are available elsewhere (NCI, 2005; Nelson et al., 2004). All primary statistical analyses were conducted using SUDAAN (Research Triangle Institute, 2004) to take into account the complex sample survey design of the HINTS 2003. SAS (SAS Institute Inc., 2002) was used to conduct a Spearman correlation and for regression analyses used to identify potential collinearity among predictors.

Participants and Sample Selection

The full sample size for the HINTS was 6,369 individuals. For this study, we excluded the 2,988 participants who were under the age of 45, 49 participants who reported a personal history of colon cancer, 41 individuals who were missing data on age or personal cancer history, as well as an additional 342 individuals who were missing data for either criterion variable (perceived comparative risk and perceived absolute risk for developing colon cancer), leaving a sample size of 2,949. We utilized data on those participants who were at least 45 years old. We did this because at age 45 individuals are close to the recommended age for screening, so colon cancer risk perceptions should become salient foci for increasing screening intentions over this time period. Additionally, we thought that perceived risk for colon cancer would have diminished salience for those younger than 45, as most (90%) colon cancer is diagnosed in those over age 50 (ACS, 2005; National Institutes of Health [NIH], 1998). Varying amounts of data were missing for each predictor variable, as shown in Table 1.

Measures

Demographics

Participants reported their gender, age, education, annual household income, race/ethnicity, and marital status. A small proportion of participants (3.3%) chose to complete the survey in Spanish rather than in English, and we used this as an additional demographic variable.

Medical Factors

Participants completed a single item regarding their overall health status (using a Likert-type scale from *excellent* (1) to *poor* (5)). Two items assessed cancer history, one about their personal history, and another that asked whether anyone in their family had ever been diagnosed with cancer of any kind.

Lifestyle Risk Factors

The HINTS 2003 included assessment of multiple lifestyle risk factors, including smoking status, level of physical activity, fruit and vegetable consumption, and presence of obesity through BMI. Participants who reported smoking cigarettes every day or on some days were denoted as current smokers. We denoted individuals as former smokers if they were not a current smoker, but had smoked at least 100 lifetime cigarettes. Participants indicated whether they engaged in at least one physical activity session per week long enough to work up a sweat. Participants reported the frequency with which they consumed fruit, fruit juice, nonfried potatoes, and other vegetables in the past month. We summed responses across these items and categorized individuals as consuming fruits and vegetables less than five versus five or more servings per day. We calculated each participant's BMI based on self-reported height and weight. Individuals with a BMI under 25 were coded as having normal weight. Those with a BMI between 25.0 and 29.9 were denoted as overweight, and those with a BMI of 30 and above were coded as obese (NIH, 1998).

Emotion Variables

To assess general anxiety, we utilized a single item that measured the frequency with which the participant felt nervous in the past 30 days (using a Likert-type response

Table 1. Descriptive statistics for study variables

	Sample %
Gender	
Male	46.4
Female	53.6
Missing (<i>N</i>)	0
Age	
45–54	40.8
55–64	26.9
65–74	20.0
≥75	12.3
Missing (<i>N</i>)	0
Education	
≤High school 12th grade	16.9
High school graduate	33.9
Some college	23.7
College graduate	25.4
Missing (<i>N</i>)	71
Income	
<\$25,000	29.5
\$25,000–\$34,999	13.9
\$35,000–\$49,999	16.2
\$50,000–\$74,999	17.7
≥\$75,000	22.7
Missing (<i>N</i>)	333
Race/ethnicity	
Non-Hispanic White	79.9
Non-Hispanic Black	8.5
Non-Hispanic other	4.6
Hispanic	7.0
Missing (<i>N</i>)	111
Interview language	
English	96.7
Spanish	3.3
Missing (<i>N</i>)	0
Married/partnered	
Yes	70.6
No	29.4
Missing (<i>N</i>)	73
Overall health status	
Poor/fair	24.0
Good	31.5
Very good/excellent	44.5
Missing (<i>N</i>)	67
Personal history of cancer ^a	
Yes	16.5
No	83.5
Missing (<i>N</i>)	0

(Continued)

Table 1. Continued

	Sample %
Family history of cancer	
Yes	68.4
No	31.6
Missing (<i>N</i>)	16
Cigarette smoking	
Current	16.9
Former	37.4
Never	45.8
Missing (<i>N</i>)	56
Physical activity	
<once/week	49.6
≥once/week	50.4
Missing (<i>N</i>)	71
Fruit and vegetables	
<5 times/day	84.0
≥5 times/day	16.0
Missing (<i>N</i>)	93
Body mass index	
Normal	34.1
Overweight	39.1
Obese	26.7
Missing (<i>N</i>)	121
General anxiety	
None of the time	35.0
A little of the time	40.5
Sometimes	18.7
Most of the time	3.9
All the time	1.9
Missing (<i>N</i>)	68
Colon cancer worry	
Rarely/never	69.8
Sometimes	26.4
Often	3.0
All the time	0.8
Missing (<i>N</i>)	3
Afraid of finding colon cancer if checked	
Strongly agree	11.7
Somewhat agree	20.4
Somewhat disagree	19.7
Strongly disagree	33.9
No opinion	14.2
Missing (<i>N</i>)	35
Almost everything causes cancer	
Strongly agree	9.3
Somewhat agree	34.8

(Continued)

Table 1. Continued

	Sample %
Somewhat disagree	28.0
Strongly disagree	16.0
No opinion	11.9
Missing (<i>N</i>)	12
Not much can do to lower cancer risk	
Strongly agree	6.3
Somewhat agree	22.5
Somewhat disagree	29.4
Strongly disagree	33.9
No opinion	7.9
Missing (<i>N</i>)	9
Information overload	
Strongly agree	36.4
Somewhat agree	37.9
Somewhat disagree	11.9
Strongly disagree	7.5
No opinion	6.4
Missing (<i>N</i>)	5
Ever looked for cancer information	
Yes	47.5
No	52.5
Missing (<i>N</i>)	6
Someone else ever looked for cancer information for you	
Yes	18.7
No	81.3
Missing (<i>N</i>)	8
Perceived comparative colon cancer risk	
Less likely than others	48.2
As likely as others	37.5
More likely than others	14.2
Missing (<i>N</i>)	250 ^b
Perceived absolute colon cancer risk	
Very low	28.6
Somewhat low	33.5
Moderate	29.6
Somewhat high	6.6
Very high	1.7
Missing (<i>N</i>)	208 ^b

Note. *N* = 2,949. All percentages are weighted.

^aNot including colon cancer.

^bOf the 2,949 individuals in the full sample who were aged 45 and over and who did not report a history of colon cancer, 250 were missing data on comparative perceived colon cancer risk and 208 were missing data on absolute perceived colon cancer risk.

scale from *all of the time* (1) to *none of the time* (5)). We utilized two items to assess distress related to colon cancer: the frequency with which participants worry about getting colon cancer (using a Likert-type response scale from *rarely or never* (1) to *all the time* (4)), and the extent to which they agreed or disagreed (*strongly agree* (1) to *strongly disagree* (4), with a *no opinion* option) with the statement, “You are afraid of finding colon cancer if you were checked.”

General Cancer Beliefs

Beliefs about cancer causes, lack of preventability, and information overload were examined as potential predictors. Participants reported the extent to which they agreed or disagreed (*strongly agree* (1) to *strongly disagree* (4), with a *no opinion*-option) with the following statements: “It seems like almost everything causes cancer”; “There’s not much people can do to lower their chances of getting cancer”; and “There are so many different recommendations about preventing cancer, it’s hard to know which one to follow.” We refer to this final belief as information overload.

Cancer Information Seeking

Finally, one item asked participants whether they had ever looked for cancer information from any source (yes/no). A second item asked whether someone else had ever looked for cancer information for them (yes/no).

Perceived Risk of Colon Cancer Risk

Two available items assess perceived risk for colon cancer in the HINTS. One assessed relative risk of developing colon cancer compared with the average man or woman the subject’s age (*less likely, about as likely, more likely*), and one assessed level of absolute risk of developing colon cancer utilizing five verbal anchors (*very low to very high*). These two items were used as dependent variables in this study.

Results

Descriptive Statistics

Weighted frequencies for all of the study variables are shown in Table 1. There was an approximately equal gender split and substantial variation in age, education, income, and overall health status. The sample was largely Caucasian, and more than two thirds were married or partnered. Of note, more than two thirds reported a family history of cancer, with many fewer (1 in 6) reporting a personal history of cancer. Emotion variables, both general anxiety and colon cancer worry, were positively skewed, with three quarters of participants reporting that they were nervous a little or none of the time in the past 30 days, and more than two thirds reporting that they rarely or never worried about colon cancer. In contrast, there was much more variation across all response categories on the question assessing whether they were afraid of finding colon cancer if they were checked for it. Finally, there was a high level of agreement (74.3% strongly or somewhat agree) with the statement that there are so many cancer prevention recommendations it is hard to know what to follow, whereas fewer expressed agreement that everything causes cancer (44.1%), and that there was not much to be done to lower cancer risk (28.8%). A small percentage of

individuals reported that someone else had ever looked for cancer information for them (18.7%), compared with the percentage reporting having looked for cancer information themselves (47.5%).

Perceived risk for colon cancer was positively skewed. Nearly half the sample (48.2%) reported that their risk for colon cancer was less than for others their age and sex, and 62.1% reported that their absolute risk for developing colon cancer was either very or somewhat low. These two perceived risk items were moderately correlated (Spearman's $r = .49$, $p < .0001$), and very few individuals reported high risk on one measure in tandem with low risk on the other.

Univariate Predictors of Perceived Colon Cancer Risk

Comparative Risk Perceptions

We conducted a series of univariate ordinal regression analyses to examine the association between each predictor variable and the three-level (less likely, as likely, more likely) perceived comparative colon cancer risk criterion variable. The nonsignificant predictors in those analyses (as indicated by Wald's χ^2) were gender, education, income, marital status, cigarette smoking, fruit and vegetable intake, BMI, and whether another person had ever looked for cancer information for the participant (χ^2 s ≤ 5.86 , $ps \geq .05$). The remaining predictor variables were significantly associated with comparative perceived risk. With regard to age, individuals aged 65–74 years perceived less personal risk (compared with individuals of the same gender and age) than those aged 45–54 years ($\chi^2 = 13.38$, $p = .004$). Higher levels of perceived comparative risk also were found among Hispanic individuals, those who completed the survey in Spanish; those reporting poor/fair overall health; individuals with a personal or family history of cancer; sedentary individuals; those with more frequent feelings of general anxiety or colon cancer worry; individuals who were afraid of finding colon cancer if they were checked; individuals who strongly agreed with each of the belief statements about cancer causes, lack of preventability, and information overload; and those who had ever looked for cancer information (χ^2 s from 4.59 to 197.26, $ps \leq .02$).

Absolute Risk Perceptions

Parallel analyses to those reported in the preceding paragraph were conducted with absolute perceived colon cancer risk as the criterion variable in a series of univariate linear regression analyses. The following variables were not significantly associated with absolute perceived risk (as indicated by Wald's F): gender, age, education, income, race/ethnicity, interview language, marital status, cigarette smoking, and fruit and vegetable intake (F s ≤ 4.07 , $ps \geq .05$). The remaining predictor variables were associated with absolute perceived risk, such that greater risk was found among individuals who reported being in poor/fair health; those who had a personal or family history of colon cancer; individuals who were sedentary, obese, or had higher levels of general anxiety or colon cancer worry; those who were afraid of finding colon cancer if they were checked; individuals who strongly agreed with each of the belief statements about cancer causes, lack of preventability, and information overload; as well as those who had ever looked for cancer information or had someone else do so (F s from 3.84 to 78.88, all $ps \leq .009$).

Multivariate Predictors of Perceived Colon Cancer Risk

Comparative Perceived Risk

To examine the unique association of each predictor with perceived comparative colon cancer risk, predictors that were significantly associated with perceived comparative risk in the univariate analyses were entered simultaneously as predictors in a single multiple ordinal regression analysis (again with perceived comparative risk as the three-level criterion variable). As shown in Table 2, higher levels of comparative perceived risk were found for individuals who were aged 45–54 years of age (compared with those aged 65–74 years), those who chose to have their survey conducted in Spanish rather than in English, individuals who reported poor/fair overall health, individuals who had a family cancer history, those who reported general anxiety or worry about colon cancer, and those who perceived information overload. The odds ratios for colon cancer worry indicated a particularly strong association between worry and perceived comparative colon cancer risk. Examination of the tolerance values for each variable in a parallel multiple linear regression analysis (tolerance values are not available in ordinal regression analyses) revealed no evidence of collinearity among the predictor variables.

Absolute Perceived Risk

As a parallel analysis to that described in the preceding paragraph, predictors that were significantly associated with absolute perceived risk in the univariate analyses were entered simultaneously as predictors in a single multiple linear regression analysis (with absolute risk as the outcome variable). As shown in Table 3, higher levels of absolute risk were found for individuals who reported poor/fair overall health, and for individuals who had a personal or family cancer history, worried more about colon cancer, or were afraid of finding colon cancer if they were checked. The overall regression model accounted for 22.3% of the variance in absolute perceived risk. Inspection of tolerance values revealed no evidence of collinearity among the predictor variables.

A summary of the results of the univariate and multivariate regression analyses is shown in Table 4.

Discussion

We used data from a recently conducted national probability sample in the United States (HINTS 2003) to examine patterns and predictors of perceived risk for colon cancer in individuals aged 45 and older with no prior colon cancer history. The findings reported here will be useful in two ways. First, the findings provide practical and valuable guidance concerning the development of future colorectal cancer risk communication messages. Second, results reported here should be useful in dictating further hypothesis-driven research addressing the development and maintenance of risk perceptions for colorectal cancer. We first review implications for each of our major findings, and then provide suggestions for needed target audiences and colorectal cancer communication intervention content. Finally, we review implications for future research.

We found evidence that HINTS 2003 respondents did not perceive themselves at high risk for developing colon cancer. As such, 62.1% of individuals surveyed felt their colon cancer risk was somewhat or very low, which is comparable to the

Table 2. Ordinal regression examining multivariate predictors of higher perceived comparative colon cancer risk

	Wald's χ^2	Odds ratio (95% CI)
Age	14.34**	
45–54		1.00
55–64		1.09 (0.87–1.38)
65–74		0.69 (0.54–0.89)
≥ 75		0.77 (0.53–1.11)
Race/ethnicity	4.36	
Non-Hispanic White		1.00
Non-Hispanic Black		0.80 (0.55–1.16)
Non-Hispanic other		0.86 (0.54–1.37)
Hispanic		0.63 (0.38–1.05)
Interview language	6.80**	
English		1.00
Spanish		2.60 (1.25–5.43)
Overall health status	19.52***	
Poor/fair		1.00
Good		0.62 (0.45–0.86)
Very good/excellent		0.49 (0.36–0.68)
Personal history of cancer ^a	2.02	
Yes		1.00
No		0.81 (0.60–1.09)
Family history of cancer	14.01***	
Yes		1.00
No		0.71 (0.59–0.85)
Physical activity	0.38	
<once/week		1.00
\geq once/week		0.94 (0.75–1.16)
General anxiety	19.58***	
None of the time		1.00
A little of the time		1.22 (0.99–1.50)
Sometimes		1.43 (1.11–1.85)
Most of the time		2.36 (1.49–3.75)
All the time		1.32 (0.55–3.19)
Colon cancer worry	113.22***	
Rarely/never		1.00
Sometimes		2.63 (2.09–3.30)
Often		3.86 (2.00–7.46)
All the time		18.82 (5.05–70.11)
Afraid of finding colon cancer if checked	7.43	
Strongly agree		1.00
Somewhat agree		0.94 (0.60–1.46)
Somewhat disagree		0.76 (0.49–1.19)
Strongly disagree		0.65 (0.41–1.04)
No opinion		0.76 (0.48–1.20)

(Continued)

Table 2. Continued

	Wald's χ^2	Odds ratio (95% CI)
Almost everything causes cancer	1.37	
Strongly agree		1.00
Somewhat agree		1.14 (0.80–1.63)
Somewhat disagree		1.06 (0.76–1.47)
Strongly disagree		1.21 (0.79–1.87)
No opinion		1.07 (0.72–1.59)
Not much can do to lower cancer risk	6.78	
Strongly agree		1.00
Somewhat agree		0.93 (0.61–1.42)
Somewhat disagree		1.16 (0.79–1.70)
Strongly disagree		0.92 (0.62–1.37)
No opinion		0.83 (0.46–1.49)
Information overload	13.45*	
Strongly agree		1.00
Somewhat agree		0.77 (0.61–0.97)
Somewhat disagree		0.77 (0.54–1.08)
Strongly disagree		0.51 (0.34–0.76)
No opinion		1.07 (0.68–1.68)
Ever looked for cancer information	0.19	
Yes		1.00
No		0.95 (0.76–1.19)

Note. Sample size for analysis is 2,778.

*Not including colon cancer.

Asterisks denote a significant multivariate association in an ordinal regression (as indicated by Wald's χ^2): * $p < .05$; ** $p < .01$; *** $p < .001$.

reduced risk perceptions that recently have been reported in large U.S. samples (Clipp et al., 2004; Vernon et al., 2001). In terms of comparative risk perception, nearly half of the HINTS 2003 participants (48.2%) believed that their risk for colon cancer was less than that for others their age and sex, which greatly exceeds levels of unrealistic optimism (Weinstein, 1980) reported in a recent large U.K. study, where only 17% of 18,447 general population individuals aged 55 to 64 felt that their risk was less than comparable others (Robb et al., 2004). It is important to mention that this level of unrealistic optimism refers to the sample as a whole, and not to particular individuals drawn from the sample who may have been more or less accurate concerning their own objective risk for developing colon cancer. These findings dictate the continued development of colorectal cancer risk communication messages that emphasize the frequency of these malignancies in the general population, risk factors for the disease, as well as the fact that risk does not always co-occur with medical symptoms.

We found that, consistent with prior work (Clipp et al., 2004; Robb et al., 2004), there is a strong association between age and comparative risk perceptions for colon cancer, such that those over age 65 felt that they were at less risk than did those in the younger age groups. Given that the primary risk factor for colorectal cancer is

Table 3. Linear regression examining multivariate predictors of higher perceived absolute colon cancer risk

	Wald's <i>F</i>	Beta coefficient
Overall health status	14.55***	
Poor/fair		Reference
Good		-0.16*
Very good/excellent		-0.31***
Personal history of cancer ^a	4.48*	
Yes		Reference
No		-0.13*
Family history of cancer	24.75***	
Yes		Reference
No		-0.22***
Physical activity	0.28	
<once/week		Reference
≥once/week		-0.02
Body mass index	2.79	
Normal		Reference
Overweight		0.07
Obese		0.12*
General anxiety	2.24	
None of the time		Reference
A little of the time		0.04
Sometimes		0.12*
Most of the time		0.24
All the time		-0.04
Colon cancer worry	35.72***	
Rarely/never		Reference
Sometimes		0.53***
Often		0.80***
All the time		1.21***
Afraid of finding colon cancer if checked	14.89***	
Strongly agree		Reference
Somewhat agree		0.02
Somewhat disagree		-0.11
Strongly disagree		-0.33***
No opinion		-0.18*
Almost everything causes cancer	2.41	
Strongly agree		Reference
Somewhat agree		0.17
Somewhat disagree		0.08
Strongly disagree		0.04
No opinion		0.06
Not much can do to lower cancer risk	2.22	
Strongly agree		Reference
Somewhat agree		-0.07

(Continued)

Table 3. Continued

	Wald's <i>F</i>	Beta coefficient
Somewhat disagree		-0.11
Strongly disagree		-0.16
No opinion		-0.24*
Information overload	0.33	
Strongly agree		Reference
Somewhat agree		-0.03
Somewhat disagree		-0.02
Strongly disagree		-0.09
No opinion		-0.06
Ever looked for cancer information	0.80	
Yes		Reference
No		-0.04
Someone else ever looked for cancer information for you	2.28	
Yes		Reference
No		-0.10

Note. Sample size for analysis is 2,763. $R^2 = .223$.

^aNot including colon cancer.

Asterisks next to a beta coefficient denote a coefficient significantly different than 0 (as indicated by a *t* test). * $p < .05$; ** $p < .01$; *** $p < .001$.

age, and almost all cases of colorectal cancer occur in those over age 50, this is a top priority for content development in risk communication messages, and also points to the importance of targeted messages for those individuals reaching retirement age. Interestingly, there was no effect for age on absolute likelihood, indicating that optimistic biases may play a substantial role in shaping elderly individuals' risk perceptions. Related work examining perceived risk for breast cancer indicates a similar phenomenon, in that older women underestimate their breast cancer risk as compared with younger women (Costanza, Stoddard, Gaw, & Zapka, 1992; Gerend, Aiken, West, & Erchull, 2004; Harris et al., 1991; Mah & Bryant, 1992; Wilcox & Stefanick, 1999). Why might older individuals feel more optimistic about avoiding colon cancer as well? In their work examining risk perceptions for breast cancer, Gerend and colleagues (2004) found that reduced risk perceptions in older individuals may be due to cognitive beliefs that are prominent when people make judgments under conditions of uncertainty (Kahneman & Tversky, 1973). These cognitive beliefs included, first, that if a person has not developed the disease by their current age, then they are less likely to get it, second, that they are less similar to those who develop disease; and third, that the disease is not common. Additionally, those in older age groups may have reduced knowledge about colon cancer (Ford, Coups, & Hay, 2005), which translates into uncertainty concerning whether they are at risk for developing it (Honda & Neugut, 2004). In fact, in the HINTS sample, 11% of individuals aged 65 and older answered "I don't know" concerning their comparative risk for colon cancer, compared with only 5% of those under age 65 ($\chi^2(1) = 13.52$, $p < .001$). Lipkus and colleagues (1996) also found that African

Table 4. Summary of results of univariate and multivariate regression analyses examining predictors of comparative and absolute perceived colon cancer risk

Predictor variables	Univariate regression analyses		Multivariate regression analysis	
	Comparative perceived risk	Absolute perceived risk	Comparative perceived risk	Absolute perceived risk
Demographics				
Gender	Ns	Ns		
Age	Sig	Ns	Sig	
Education	Ns	Ns		
Income	Ns	Ns		
Race/ethnicity	Sig	Ns	Ns	
Interview language	Sig	Ns	Sig	
Marital status	Ns	Ns		
Medical factors				
Overall health status	Sig	Sig	Sig	Sig
Personal history of cancer ^a	Sig	Sig	Ns	Sig
Family history of cancer	Sig	Sig	Sig	Sig
Lifestyle risk factors				
Cigarette smoking	Ns	Ns		
Physical activity	Sig	Sig	Ns	Ns
Fruit and vegetable intake	Ns	Ns		
Body mass index	Ns	Sig		Ns
Emotion variables				
General anxiety	Sig	Sig	Sig	Ns
Colon cancer worry	Sig	Sig	Sig	Sig
Afraid of finding colon cancer if checked	Sig	Sig	Ns	Sig
General cancer beliefs				
Almost everything causes cancer	Sig	Sig	Ns	Ns
There is not much one can do to lower cancer risk	Sig	Sig	Ns	Ns
Information overload	Sig	Sig	Sig	Ns
Cancer information seeking				
Ever looked for cancer information	Sig	Sig	Ns	Ns
Someone else ever looked for cancer information for you	Ns	Sig		Ns

Note. sig denotes a significant association ($p < .05$); ns denotes a nonsignificant association ($p \geq .05$); an empty cell indicates that the variable was not examined in the multivariate analysis due to a nonsignificant association in a univariate analysis. See the text and Tables 2 and 3 for a more detailed presentation of the results of each regression analysis.

^aNot including colon cancer.

American individuals over age 70 were more likely to report a lack of knowledge about risk, as compared with younger individuals. We also wondered if our findings concerning reduced risk perceptions in older individuals might be due, in part, to relatively greater experience with colon cancer screening, and thus negative test findings, in the older age group. To examine whether colon cancer screening history moderated the relationship between age and perceived risk, we examined whether there was an interaction between ever screened for colon cancer (yes versus no) and age (45–64 versus ≥ 65) on comparative risk perceptions. We conducted three separate analyses, examining, in turn, whether FOBT, flexible sigmoidoscopy, and colonoscopy screening history moderated the relationship between age and perceived risk, and, in each case, screening history had no effect (all $ps > .05$). Of note, it is also possible that older individuals may report reduced perceptions of risk as an adept strategy to manage negative affect in the context of increased threat of many diseases that are common in old age (Consedine, Magai, & King, 2004). Further inquiry into the ways in which older individuals develop lower risk perceptions for colorectal cancer, and the potential multiple mechanisms through which this may discourage maintenance of health behavior and screening activities, is clearly warranted.

Surprisingly, we found that lifestyle risk factors including level of fruit and vegetable consumption, BMI, and tobacco use status were not related to risk perceptions for colon cancer in the multivariate models. We found that, consistent with prior work (Robb et al., 2004), those who engaged in physical activity at least once a week had lower risk perceptions than those who did not engage in physical activity at least once weekly, although these effects became nonsignificant in the multivariate models. The current study does not replicate prior findings of a positive relationship between smoking status and colorectal cancer risk perceptions (Vernon et al., 2001). Prior research also has found that objective risks for colorectal cancer, including behavioral risk factors or family history information, do not necessarily translate into increased risk perceptions, even after exposure to risk communication interventions that address these risk factors (Blalock et al., 1990; Lipkus et al., 2005; Lipkus et al., 2004). In an intervention trial providing personalized computer feedback for colorectal cancer risk, Weinstein and colleagues (2004) found that half the sample did not use the risk feedback to adjust their colorectal cancer risk perceptions. Comparative but not absolute risk perceptions increased however, with feedback concerning red meat consumption and having a first-degree relative who had colon cancer, and comparative risk perceptions decreased with feedback concerning physical activity and vegetable consumption. Given individuals' relative resistance to health communication efforts to connect their lifestyle risks for colon cancer and increased cancer likelihood, alternative methods of health communication are needed.

We had the novel opportunity here to examine the relationship between colon cancer risk perceptions and some general beliefs about cancer causes, lack of preventability, information overload, and cancer information seeking. We thought it would be helpful to examine whether non-colon-cancer-specific beliefs and information seeking are linked with perceived risk for colon cancer, as findings may suggest whether these factors drive risk judgments for multiple types of cancer. Indeed, targeting general cancer beliefs in mass media messages and interventions may have beneficial effects with regard to multiple cancers. We found that in univariate analyses stronger beliefs that everything causes cancer, a sense of futility in reducing cancer risk, information overload about cancer prevention recommendations, and information seeking were related to increased colon cancer risk

perceptions. Only information overload remained significant in the multivariate analyses, however, such that those who perceived more overload felt more at risk for developing colon cancer compared with others of their age and sex. Of concern, those who feel at risk for colon cancer may feel the most besieged by cancer risk communications, and may be unable to prioritize the most pressing behavior change recommendations.

This study is also significant in the context of other positive, and negative, findings. First, perceived risk for colon cancer did not differ by gender, education, or income level of the HINTS participants. Indeed, it may be that mass media messages concerning the fact that colon cancer influences both men and women have achieved some momentum (Cram et al., 2003). Given the lack of a relationship between perceived risk and both income and education, it is impossible to explain these low-risk perceptions as exclusively a challenge for those with low educational attainment, or other socioeconomic disadvantages. We found the expected relationship between overall health status and perceived risk (Robb et al., 2004) such that those who perceived poorer health felt more comparative and absolute risk. Although the numbers are small, those individuals who chose to have their survey conducted in Spanish reported greater comparative risk for colon cancer compared with those completing the survey in English, indicating that the subgroups in need of further study, and targeted intervention, might be quite focal. We found that, consistent with prior work (Robb et al., 2004; Vernon et al., 2001; Weinstein et al., 2004), there are strong relationships between colon cancer worry and both measures of colon cancer risk perceptions, general anxiety and comparative risk perceptions, and fear of finding cancer on screening and absolute risk perceptions that dictate a potentially receptive audience for colorectal risk communication messages among those reporting higher distress.

As such, the results reported here provide information concerning distinct audiences to be targeted for colorectal cancer risk messages and the content of such interventions. First, older individuals, those with lifestyle risk behaviors, and those who perceive themselves to be quite healthy should be targeted for educational and heightened risk communications. The content of colorectal cancer interventions for these groups should, most importantly, point out that colorectal cancer is a common cancer diagnosis, with known risk factors in the general population, and that it is frequently asymptomatic. There is an additional target audience, including those with increased distress about colon cancer, and those with information overload concerning cancer prevention recommendations. These individuals may require interventions to manage anxiety, simplify the range of messages they are receiving, and provide clear guidelines for how their perceived risk and worry can be best managed through screening adherence.

Additionally, intriguing research questions remain. In particular, given our findings that lifestyle risk factors are not consistently related to risk perceptions for colon cancer, and prior work showing that risk factor feedback does not consistently influence risk perceptions for colorectal cancer (Lipkus et al., 2004; Weinstein et al., 2004), it is unclear whether the provision of a tailored risk profile is a useful motivator of colorectal cancer screening and risk reduction. Before abandoning this strategy, further work examining the mechanisms involved in individuals' discounting of the impact of lifestyle risks on their health is warranted and may be helpful in shaping a new generation of interventions to reduce future incidence of colorectal cancer (Lipkus et al., 2004). Further work also is needed to examine whether, and how,

measurement strategies for risk perceptions for colorectal cancer may be usefully improved to better explain risk attributions, how and when individuals' discount their risks, and the relationship between perceived risk and behavior change. Finally, there is an important basic science and applied rationale for further work examining risk perceptions for colorectal cancer in the elderly. It is important to explore the role of cognitive and affective processing of cancer risk beliefs in older individuals, whether colon cancer risk communication interventions differentially impact those over and under age 65, and how various aspects of good health, and negative screening results, may impact colorectal cancer risk perceptions over time. Fortunately, results gleaned from mechanistic studies will be quickly applicable to intervention development and testing.

We note some limitations of the current study. First, the cross-sectional nature of the HINTS limits our ability to examine the mechanisms behind our findings, including how perceived risk for colon cancer develops and whether these beliefs are stable over time. Second, measurement of physical activity (at least one time/week versus none) and general anxiety were not comparable with standard assessment strategies for these constructs (American College of Sports Medicine, 1998; Spielberger, Gorsuch, & Lushene, 1970; USDHHS, 1996) and thus our findings may not generalize to other studies.

The strengths of the study include the large, national probability U.S. sample we utilized, our ability to examine cancer risk perceptions among men and women, the opportunity to explore two different risk perception measures, and our ability to examine predictors that were either novel or implicated as important in prior work examining predictors of colon cancer risk perceptions. Cross-sectional studies make valuable research contributions insofar as they set the stage for subsequent hypothesis-driven research (Weinstein, 2005). Therefore, an important strength of this study involves our ability to help develop priorities for future work in this area. Given that mass media colorectal cancer information and messages tailored to segments of the population already have become widely available, this study indicates that there is more work to be done, both in intervention development and in elucidation of basic risk perception processes, in the general population.

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