

Knowledge of Colon Cancer Screening in a National Probability Sample in the United States

JENNIFER S. FORD, ELLIOT J. COUPS, AND
JENNIFER L. HAY

Memorial Sloan-Kettering Cancer Center, New York, New York, USA

This study examined colon cancer screening knowledge and potential covariates (demographic, health, health care, and cancer information seeking) among adults of at least 45 years of age. Data were analyzed from the 2003 National Cancer Institute's (NCI's) Health Information National Trends Survey (HINTS 2003), a U.S. random-digit dial study. Our sample consisted of 3,131 adults (53.6% female, 77.9% White). The colon cancer screening knowledge questions assessed whether participants had heard of the fecal occult blood test (FOBT; 73.7%), knew the recommended start age (26.1%), knew the frequency of FOBT (39.5%), had heard of flexible sigmoidoscopy or colonoscopy (84.3%), knew the start age (39.6%), and knew the frequency with which to test (12.8%). Factors associated with lower knowledge (all equal to $p < .05$ in a multivariate analysis) included being younger (45 to 49 years old) or older (70 years old or more), African American or non-Hispanic other, unmarried; had lower educational attainment; had not visited a health care provider in the past year; had not previously undergone FOBT; and had never looked for cancer information. This study documents low rates of colon cancer screening knowledge in the general population, and identifies subgroups where health communication interventions are most warranted.

Adequate knowledge of cancer screening is likely an important prerequisite for initiating and sustaining screening (Breslow, Sorkin, Frey, & Kessler, 1997; Green & Kreuter, 1990), and successful health communication is a primary route to increasing and reinforcing knowledge about cancer, as well as available methods of cancer control and prevention (NCI, 2002; Nelson et al., 2004). Health communication can influence perceptions, beliefs, and attitudes that may change social norms about screening, and also increase demand for cancer screening services (NCI, 2002). Given that it is often people with the greatest health burdens that have the least knowledge, health communication strategies may help address disparities that exist in health care in the United States (see Healthy People 2010). In this study, we identify predictors

We thank Jamie Ostroff, PhD, for aiding in the development of the Health Information National Trends Survey (HINTS) Workgroup at Memorial Sloan-Kettering Cancer Center. We also thank Christopher S. Webster for his administrative support. Elliot Coups is now at Fox Chase Cancer Center, Division of Population Science.

Address correspondence to Jennifer S. Ford, Memorial Sloan-Kettering Cancer Center, Department of Psychiatry and Behavioral Sciences, 641 Lexington Avenue, Seventh Floor, New York, NY, USA. E-mail: fordj@mskcc.org

of inadequate colon cancer screening knowledge in order to highlight groups for whom communication strategies may greatly impact screening.

Colorectal cancer is the third most prevalent cancer among men and women in the United States (American Cancer Society [ACS], 2005), and has well-known risk factors including age (ACS, 2005), diet (consumption of red meat, low consumption of fruits and vegetables), smoking, alcohol consumption, excessive body weight, and physical inactivity (Bingham, 1999; Boutron, Faivre, Dop, Quipourt, & Senesse, 1995; Harvard Colon Cancer Risk Assessment and Communication Tool for Research [HCCRACR-R]; Martinez, McPherson, Annegers, & Levin, 1995; Negri et al., 1999; Sesink, Termont, Kleibeuker, & Van Der Meer, 2000; Weinstein et al., 2004). If it is detected early, survival rates for colorectal cancer are high (82%–87%; Dunlop et al., 1997).

Adoption of screening modalities¹ remains low, however, at approximately 38% across a number of studies (e.g., Subramanian, Klosterman, Amonkar, & Hunt, 2004). National guidelines now recommend regular colorectal cancer screening for average-risk individuals starting at the age of 50 with one or more of the following: yearly FOBT, flexible sigmoidoscopy every 5 years, yearly FOBT plus flexible sigmoidoscopy every 5 years, double-contrast barium enema every 5 years, or colonoscopy every 10 years (ACS, 2005; U.S. Preventive Services Task Force [USPSTF], 2002). In fact, recent surveys have shown that 30%–44% of U.S. adults over the age of 50 report having flexible sigmoidoscopy or colonoscopy in the past 10 years, and 20% report FOBT testing in the past year (Centers for Disease Control and Prevention, 1999; Cokkinides, Chao, Smith, Vernon, & Thun, 2003).

Lack of awareness of screening guidelines for colorectal cancer may be a primary determinant of low screening rates (Brown, Potosky, Thompson, & Kessler, 1990; Seeff et al., 2004; Shokar, Vernon, & Weller, 2005; Wardle, Waller, Brunswick, & Jarvis, 2001). For instance, in large U.S. samples, the most common reason cited for not having undergone FOBT or endoscopy was lack of awareness of the need for colorectal cancer screening (Janz, Wren, Schottenfeld, & Guire, 2003; Seeff et al., 2004). Among 115 urban, mostly minority men and women, 87% of participants had heard of colorectal cancer, and only 46% knew of a screening test for it (Wolf et al., 2001). In a study of older African Americans, the average screening knowledge score was 78 out of 100, and 90% knew that screening began after age 50 (Green & Kelly, 2004). A study of colorectal cancer screening among older women caregivers (Sarna & Chang, 2000) found that lack of knowledge about colorectal cancer testing was a primary screening barrier, and a recent qualitative study in Canada found low levels of knowledge about colorectal cancer and its prevention in the general population (Goel et al., 2004). A telephone survey of 893 individuals aged 40 to 70 years old found that 65%–73% reported ever having heard of FOBT (Polednak, 1990).

Understanding the covariates of knowledge of colorectal cancer screening is a sound first step to addressing these knowledge deficits. Prior work in this area has identified demographic factors related to greater colorectal cancer screening knowledge, including gender (Green & Kelly, 2004; Kim, Yu, Chen, Kim, & Brintnall, 1998; Polednak, 1990), higher socioeconomic status (Dale et al., 1999; Price, Davis, Sparrow, & Wilding, 1993), greater education (e.g., Guerra et al., 2005; Kim et al., 1998; Polednak, 1990), and higher literacy (Davis et al., 2001; Dolan et al., 2004), but see Guerra and Colleagues (2005) for negative findings.

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

Findings regarding gender have been mixed, with some studies reporting men have greater cancer screening knowledge, others finding women have greater knowledge, and some reporting no significant gender differences. A more comprehensive picture of disparities in knowledge of colorectal cancer screening would provide a worthwhile base for the development of appropriate communication messages regarding screening.

Our study expands on the prior limited literature of covariates of colorectal cancer screening knowledge in the following ways. First, we examine the distribution of knowledge about colon cancer¹ screening modalities in a U.S. national probability sample that is the largest assessed to date. Second, prior literature has found gender, socioeconomic, and literacy differences in colorectal cancer screening knowledge (Dale et al., 1999; Davis et al., 2001; Green & Kelly, 2004; Kim et al., 1998; Polednak, 1990; Price et al., 1993), and we expand on this literature by examining age, racial/ethnic, income, and marital-status-related differences in knowledge of colon cancer screening tests. Third, this study examines novel factors that could usefully inform the development of colorectal cancer screening messages for certain subgroups, including extent of health care coverage (health care coverage, presence of regular provider, health care visit frequency), medical factors (overall health status, personal and family cancer history), screening history (ever advised about, and ever completed, FOBT, flexible sigmoidoscopy, or colonoscopy), lifestyle colon cancer risk factors (cigarette smoking, physical activity, fruit and vegetable consumption, and body mass index [BMI]), and presence and extent of cancer information seeking (ever searched for, first source found, level of satisfaction with information found).

Methods

Procedure

The data for this study are from the Health Information National Trends Survey (HINTS 2003; Nelson et al., 2004), a national probability survey of the U.S. adult population conducted by the NCI in 2002 and 2003. Participants in the HINTS were selected using random-digit dialing and completed a one-time telephone interview. The response rate for the household screener was 55%, and the response rate for the extended interview was 62.8%. The HINTS used a cross-sectional complex sample survey design, with oversampling of African American and Hispanic populations, data weighting, and jackknife variance estimation. Additional details regarding the HINTS are available elsewhere (NCI, 2005; Nelson et al., 2004). All statistical analyses were conducted using SUDAAN. (Research Triangle Institute, 2004.)

Participants and Sample Selection

The HINTS sample consisted of 6,369 individuals. For this study, we excluded participants who were under the age of 45 ($n = 2,988$), had a history of colon cancer ($n = 49$), were missing data on either of these variables ($n = 41$), or were missing data on the screening knowledge criterion variable used in this study (see the Measures section; $n = 160$), leaving a sample size of 3,131. We chose to exclude participants younger than 45, as colon cancer screening is recommended for those over the age of 50. We anticipated that knowledge of screening methods would be most

appropriate and applicable within a group of adults who were either close to or at the age of recommended screening.²

Measures

Demographics

Participants reported their gender, age, education, income, race/ethnicity, and marital status. We examined screening knowledge among individuals ages 45 to 49, as well as to those ages 50 and greater, as examination of this younger age group would allow for extrapolation of the study results to individuals approaching the age at which screening should commence. The survey was completed in English or Spanish.

Health and Health Care

Participants indicated whether they currently had any kind of health care coverage, if they had a regular health care provider, and the number of times they visited a health care provider in the last year. They also completed a single item regarding their overall health status (using a 5-point Likert-type scale from *poor* to *excellent*). Two items asked participants whether they, or anyone in their family, ever had been diagnosed with cancer.

Participants indicated whether they had ever undergone FOBT, sigmoidoscopy, or colonoscopy, and whether they had been advised by a health care provider in the past year to have an FOBT. Individuals who reported never having had a sigmoidoscopy or colonoscopy were asked whether they had ever been advised to receive these tests.

Participants completed a series of questions regarding behavioral risk factors, including tobacco use, physical activity, diet, and body mass index. We followed established guidelines for categorizing individuals as current, former, or never smokers (Lethbridge-Cejku & Vickerie, 2005). Participants indicated whether they engage in at least one physical activity session per week that is long enough to work up a sweat. Based on responses to four questions about consumption of fruit, fruit juice, nonfried potatoes, and other vegetables in the past month, we categorized individuals as consuming fruits and vegetables less than five or five or more times per day. We chose to dichotomize this variable to be consistent with the 5-a-Day recommendation from the NCI, ACS, and Centers of Disease Control at the time of assessment. Participants also reported their height and weight, from which we calculated body mass index (BMI) and identified individuals who were overweight (BMI between 25.0 and 29.9) or obese (BMI of 30 or more; NIH, 1998).

Cancer Information Seeking

We used data from three cancer information seeking variables: whether participants had ever looked for information about cancer; the source they would go to first if they needed information about cancer; and, for individuals who reported having ever looked for cancer information, their level of satisfaction with their overall search.

Colon Cancer Knowledge

Participants were asked if they knew any tests that detect colon cancer. We coded participants as knowing a test if they mentioned one or more valid tests (e.g., FOBT,

²The study results regarding covariates of colon cancer screening knowledge were not substantively different when the sample was restricted to individuals aged 50 and above.

stool blood test, sigmoidoscopy, colonoscopy, barium enema). Participants then were asked whether they had ever heard of FOBT (or stool blood test), and if they had, the age at which people should commence home FOBT and the frequency with which it should be conducted. We denoted individuals as knowing the start age for FOBT if they answered “50 years of age,” and as knowing the frequency for FOBT if they answered “every year (to less than 2 years).” Individuals who responded to either question by saying that you should follow a health care provider’s recommendation also were denoted as providing a correct response. We denoted participants as having FOBT screening knowledge if they gave correct responses to all three FOBT knowledge questions.

A parallel set of three questions to the FOBT questions were asked about sigmoidoscopy or colonoscopy. (Note that these questions referred to “sigmoidoscopy or colonoscopy” and did not distinguish between the two tests.) Answers of “50 years of age” and “when a health care provider says you should” were denoted as correct for the recommended start age. For the recommended frequency question, responses of “every 5 to less than 10 years” or “every 10 years or more” were denoted as correct. Additionally, individuals who responded that the frequency depends on the results of previous tests or that a health care provider’s recommendation should be followed also were denoted as knowing the recommended frequency. We denoted participants as having sigmoidoscopy/colonoscopy screening knowledge if they gave correct responses to the three questions about these tests. Finally, we created a *summary colon cancer screening knowledge variable* by denoting people as having correct screening knowledge if they had either FOBT or sigmoidoscopy/colonoscopy screening knowledge. We did not require individuals to have knowledge about more than one screening modality, as national screening guidelines are met if testing is carried out with any one of FOBT, sigmoidoscopy, or colonoscopy. This summary knowledge variable was used as the criterion variable in a series of univariate and multivariate analyses.

Results

Descriptive Statistics for Colon Cancer Screening Knowledge Variables

Frequencies for the colon cancer screening knowledge variables are shown in Table 1. More than half of the sample was able to name a colon cancer test, and around three quarters had heard of each of FOBT and sigmoidoscopy or colonoscopy. The rates of knowing the start age and frequency of FOBT and sigmoidoscopy/colonoscopy however, were considerably lower. Only 12.8% of the sample correctly identified the recommended frequency for sigmoidoscopy/colonoscopy. Of those participants who had heard of sigmoidoscopy or colonoscopy, 27.3% indicated that the recommended frequency of testing is every year to less than 2 years. Fewer than 1 in 6 participants (15.5%) were denoted as having FOBT screening knowledge, and even fewer (7.4%) had sigmoidoscopy/colonoscopy screening knowledge. One in 5 participants (21.0%) had screening knowledge about either FOBT or sigmoidoscopy/colonoscopy.

Descriptive Statistics for Covariates of Colon Cancer Screening Knowledge

Frequencies for the covariates of screening knowledge are shown in the “Sample %” column of Table 2. Selected frequencies are noted here. Around 1 in 6 participants

Table 1. Frequencies for colon cancer screening knowledge items

	Sample %
Know any colon cancer test	57.3
<i>Fecal Occult Blood Test (FOBT)</i>	
Heard of FOBT	73.7
Know start age for FOBT (50 years) ^a	26.1
Know frequency of FOBT (every year) ^a	39.5
Have FOBT screening knowledge ^b	15.5
<i>Sigmoidoscopy/Colonoscopy</i>	
Heard of sigmoidoscopy/colonoscopy	84.3
Know start age for sigmoidoscopy/colonoscopy (50 years) ^c	39.0
Know frequency of sigmoidoscopy/colonoscopy (every 5–10 years) ^c	12.8
Have sigmoidoscopy/colonoscopy screening knowledge ^b	7.4
<i>Summary Colon Cancer Screening Knowledge Variable</i>	
Have FOBT or sigmoidoscopy/colonoscopy screening knowledge ^d	21.0

^aIndividuals who had not heard of FOBT are denoted as not knowing the start age and frequency of FOBT. Individuals who answered this question by saying that you should follow a health care provider's recommendation are denoted as providing a correct response.

^bIndividuals who had heard of FOBT and knew its start age and frequency are denoted as having FOBT screening knowledge. Individuals who had heard of sigmoidoscopy/colonoscopy and knew its start age and frequency are denoted as having sigmoidoscopy/colonoscopy screening knowledge.

^cIndividuals who had not heard of sigmoidoscopy or colonoscopy are denoted as not knowing the start age and frequency for sigmoidoscopy/colonoscopy. Individuals who answered this question by saying that you should follow a health care provider's recommendation are denoted as providing a correct response. Additionally, individuals who responded that the frequency depends on the results of previous tests are denoted as providing a correct response to that question.

^dThis variable is used as the colon cancer knowledge summary variable in subsequent analyses (see results shown in Tables 2 and 3).

Total $N = 3,131$. Due to missing values, sample sizes vary from 3,123 to 3,131. All percentages are weighted.

reported having had cancer, and two thirds of participants reported a family history of cancer. Less than a quarter (21.7%) of the sample reported being advised to undergo FOBT in the past year, and even fewer participants reported ever having been advised to undergo sigmoidoscopy or colonoscopy. Rates of ever having undergone FOBT screening, sigmoidoscopy, and colonoscopy were 40.9%, 24.5%, and 31.9%, respectively. Just under half (45.3%) of the participants reported that they had ever looked for cancer information. Most individuals (59.1%) stated that they would first consult a health care provider if they needed information about cancer, and individuals who had looked for cancer information reported a high degree of satisfaction with the information they found.

Univariate Covariates of Colon Cancer Screening Knowledge

For each level of every variable, Table 2 also shows the rate at which individuals had FOBT or sigmoidoscopy/colonoscopy screening knowledge. A chi-square test was used to examine the significance of the univariate association between each covariate

Table 2. Descriptive statistics and univariate covariates of colon cancer screening knowledge summary variable

	Sample % (N = 3,131)	Have FOBT or sigmoidoscopy/ colonoscopy screening knowledge %	χ^2
Gender			0.73
Male	46.4	20.2	
Female	53.6	21.8	
Missing (N)	0		
Age			69.11***
45–49	21.7	13.8	
50–59	32.6	27.7	
60–69	22.9	24.4	
≥70	22.8	15.1	
Missing (N)	0		
Education			89.25***
≤High school 12th grade	19.3	7.9	
High school graduate	33.0	20.6	
Some college	23.5	23.2	
College graduate	24.1	30.7	
Missing (N)	69		
Income			64.56***
<\$25,000	31.2	12.4	
\$25,000–\$34,999	13.8	16.1	
\$35,000–\$49,999	16.0	22.5	
\$50,000–\$74,999	16.8	28.0	
≥\$75,000	22.2	31.5	
Missing (N)	369		
Race/ethnicity			82.50***
Non-Hispanic White	77.9	24.1	
Non-Hispanic Black	9.8	9.9	
Non-Hispanic Other	4.7	12.7	
Hispanic	7.6	10.5	
Missing (N)	117		
Interview language			43.22***
English	96.2	21.7	
Spanish	3.8	3.6	
Missing (N)	0		
HCP ever advised colonoscopy ^b			18.90***
Yes	11.0	33.0	
No	89.0	13.9	
Missing (N)	100		
Ever done FOBT			30.93***
Yes	40.9	28.2	
No	59.1	16.1	
Missing (N)	5		

(Continued)

Table 2. Continued

	Sample % (<i>N</i> = 3,131)	Have FOBT or sigmoidoscopy/ colonoscopy screening knowledge %	χ^2
Ever had sigmoidoscopy			21.5***
Yes	24.5	30.0	
No	75.5	18.1	
Missing (<i>N</i>)	41		
Ever had colonoscopy			10.79**
Yes	31.9	25.7	
No	68.1	18.8	
Missing (<i>N</i>)	39		
Cigarette smoking			14.42**
Current	16.7	14.4	
Former	37.7	23.7	
Never	45.6	21.6	
Missing (<i>N</i>)	49		
Physical activity			12.88***
<once/week	51.2	17.7	
≥once/week	48.8	24.7	
Missing (<i>N</i>)	70		
Fruit and vegetables			0.12
<5 times/day	83.6	21.5	
≥5 times/day	16.4	20.8	
Missing (<i>N</i>)	103		
Body mass index			0.56
Normal	34.1	22.3	
Overweight	39.3	21.2	
Obese	26.5	20.8	
Missing (<i>N</i>)	140		
Ever looked for cancer information			34.79***
Yes	45.3	26.5	
No	54.7	16.4	
Missing (<i>N</i>)	7		
Married/partnered			41.61***
Yes	69.4	24.2	
No	30.6	14.1	
Missing (<i>N</i>)	72		
Health care coverage			17.22***
Yes	92.1	22.1	
No	7.9	9.7	
Missing (<i>N</i>)	68		
Have a regular HCP			17.51***
Yes	77.7	22.8	
No	22.3	14.3	
Missing (<i>N</i>)	9		

(Continued)

Table 2. Continued

	Sample % (N = 3,131)	Have FOBT or sigmoidoscopy/ colonoscopy screening knowledge %	χ^2
No. of HCP visits in last year			45.43***
0	11.7	10.1	
1	15.7	23.6	
2-4	42.9	24.2	
≥5	29.8	19.5	
Missing (N)	17		
Overall health status			28.44***
Poor/fair	24.7	15.4	
Good	31.8	19.9	
Very good/excellent	43.4	25.5	
Missing (N)	66		
Personal history of cancer ^a			0.19
Yes	16.7	21.8	
No	83.3	20.9	
Missing (N)	0		
Family history of cancer			0.64
Yes	67.3	21.7	
No	32.7	20.2	
Missing (N)	22		
HCP advised FOBT in past 12 months			33.36***
Yes	21.7	33.1	
No	78.3	17.7	
Missing (N)	5		
HCP ever advised sigmoidoscopy ^b			10.85***
Yes	6.4	35.8	
No	93.6	14.7	
Missing (N)	101		
First source for cancer information			17.96**
Health care provider	59.2	19.7	
Internet	21.9	25.4	
Other source	16.6	22.0	
Don't know	2.4	7.7	
Missing (N)	1		
Satisfied with cancer information found ^c			2.89
Strongly disagree	3.4	25.3	
Somewhat disagree	9.8	25.1	

(Continued)

Table 2. Continued

	Sample % (<i>N</i> = 3,131)	Have FOBT or sigmoidoscopy/ colonoscopy screening knowledge %	χ^2
Somewhat agree	47	28.2	
Strongly agree	39.8	24.2	
Missing (<i>N</i>)	24		

Note. All percentages are weighted. HCP = health care provider; FOBT = fecal occult blood test.

* $p < .05$; ** $p < .01$; *** $p < .001$.

^aNot including colon cancer.

^bThis question was answered by individuals who reported never having had a sigmoidoscopy or a colonoscopy ($n = 1,704$).

^cThis question was answered by individuals who had ever looked for cancer information from any source or had someone else look for cancer information for them ($n = 1,572$).

and this screening knowledge summary variable. There was no gender difference in screening knowledge, and individuals were less likely to have screening knowledge if they were aged 45–49 or were 70 years or older, had lower levels of education or income, were not White, were not married, or had completed the interview in Spanish. They also were less likely to have colon cancer screening knowledge if they did not have any health care coverage, did not have a regular health care provider, did not visit a health care provider in the last year, and reported poorer overall health. They were also less likely to have colon cancer screening knowledge if they were not advised to have FOBT in the past year, had never been advised to receive sigmoidoscopy or colonoscopy, or had never had an FOBT, sigmoidoscopy, or colonoscopy. Finally, they were also less likely to have colon cancer screening knowledge if they were current smokers, were physically inactive, had never looked for cancer information, or did not know where they would go first if they had a need to get information about cancer. There was no difference in FOBT or sigmoidoscopy/colonoscopy screening knowledge according to whether participants had a personal or family history of cancer, quantity of fruit and vegetable consumption, level of BMI, and regardless of the level of satisfaction with the cancer information found among those who had searched for it.

Multivariate Covariates of Colon Cancer Screening Knowledge

We used logistic regression to examine multivariate covariates of colon cancer screening knowledge. The dichotomous criterion variable in this analysis was the summary variable of colon cancer screening knowledge (having FOBT or sigmoidoscopy/colonoscopy screening knowledge). We considered those covariates from Table 2 that were associated with this summary variable at $p < .10$ as eligible for the multivariate analysis. To avoid multicollinearity, we omitted income as a covariate, as it was correlated at $r = .57$ with education. We retained education over income, due to its closer conceptual link with the knowledge dependent variable. We also omitted the three covariates that asked about being advised by a health care

Table 3. Logistic regression examining multivariate covariates of colon cancer screening knowledge summary variable

	Wald's χ^2	Odds ratio ^a (95% CI)
Age	38.61***	
50–59		2.24 (1.59–3.15)
60–69		1.70 (1.11–2.62)
≥70		1.11 (0.71–1.72)
Education	12.10**	
High school graduate		2.06 (1.18–3.59)
Some college		2.06 (1.18–3.59)
College graduate		2.65 (1.48–4.73)
Race/ethnicity	8.71*	
Non-Hispanic Black		0.46 (0.25–0.86)
Non-Hispanic other		0.51 (0.29–0.91)
Hispanic		0.86 (0.46–1.62)
Interview language	1.54	
Spanish		0.41 (0.10–1.73)
Married/partnered	6.53*	
No		0.72 (0.56–0.93)
Health care coverage	2.36	
No		0.56 (0.26–1.20)
Have a regular HCP	0.96	
No		0.83 (0.56–1.22)
No. of HCP visits in last year	12.43**	
1		2.17 (1.13–4.16)
2–4		2.01 (1.03–3.90)
≥5		1.49 (0.73–3.03)
Overall health status	1.05	
Good		1.03 (0.74–1.43)
Very good/excellent		1.16 (0.86–1.57)
Ever done FOBT	6.48*	
No		0.68 (0.50–0.92)
Ever had sigmoidoscopy	1.69	
No		0.81 (0.58–1.12)
Ever had colonoscopy	0.15	
No		0.95 (0.73–1.23)
Cigarette smoking	2.53	
Former		1.34 (0.91–1.99)
Never		1.22 (0.81–1.85)
Physical activity	0.72	
≥once/week		0.90 (0.69–1.16)
Ever looked for cancer information	5.98*	
No		0.76 (0.60–0.95)
First source for cancer information	0.91	
Internet		0.96 (0.74–1.25)
Other source		1.10 (0.79–1.54)
Don't know		0.79 (0.11–5.63)

Note. $N = 2,895$; HCP = health care provider; FOBT = fecal occult blood test.

^aThe respective reference categories for each variable are as follows: age 45–49; ≤high school 12th grade; non-Hispanic White; English interview language; married/partnered; have health care coverage; have a regular HCP; 0 last year HCP visits; poor/fair health status; had FOBT; had sigmoidoscopy; had colonoscopy; current smoker; physically active < once/week; yes, ever looked for cancer information; HCP is first source for cancer information.

* $p < .05$; ** $p < .01$; *** $p < .001$.

provider to undergo FOBT, sigmoidoscopy, and colonoscopy. Data for the latter two of these covariates were available only for individuals who had never received a sigmoidoscopy or colonoscopy. Thus, we conducted a separate logistic regression analysis to examine the association between screening knowledge and the three “advised” covariates.

The results of the multivariate logistic regression analysis are shown in Table 3. Individuals aged 45–49 were significantly less likely to have screening knowledge than those aged 50–59 and 60–69. Individuals with lower levels of education and people who were not married were less likely to have screening knowledge. Compared with non-Hispanic White individuals, non-Hispanic African Americans and those in the non-Hispanic other category were less likely to have screening knowledge. Individuals who had not visited a health care provider in the previous year were less likely to have screening knowledge than individuals who had up to four visits in the previous year. People who reported never having undergone FOBT were less likely to have screening knowledge than individuals who previously had undergone FOBT, but neither receipt of sigmoidoscopy nor colonoscopy was associated with screening knowledge.³ Individuals who had never looked for information about cancer were less likely to have screening knowledge than those who had looked for cancer information.

As noted above, we repeated the above logistic regression analysis with the additional three covariates that asked about being advised by a health care provider to undergo FOBT, sigmoidoscopy, and colonoscopy. The sample for this analysis consisted of 1,582 participants who reported never previously having a sigmoidoscopy or colonoscopy. Individuals who reported not being advised to undergo FOBT in the previous year were less likely to have screening knowledge than those receiving such advice (Wald’s $\chi^2 = 4.64$, $p = .03$, OR = 0.63, 95% CI 0.40–0.97). Similarly, individuals who reported never being advised to receive sigmoidoscopy were less likely to have screening knowledge than those reporting such advice (Wald’s $\chi^2 = 6.50$, $p = .01$, OR = 0.39, 95% CI 0.18–0.82). Advice regarding the receipt of colonoscopy was not associated with screening knowledge (Wald’s $\chi^2 = 1.95$, $p = .16$, OR = 0.67, 95% CI 0.37–1.19).

Discussion

In this large national probability survey of adults in the United States, we found low rates of colon cancer screening knowledge. Fewer than 60% (57.3%) could name any colon cancer screening test, and only 21% met our criteria for having FOBT or sigmoidoscopy/colonoscopy screening knowledge. To satisfy our criterion, participants had to demonstrate that they had heard of the test in question, knew the start age for screening, and knew the recommended frequency of testing. On average, participants erred on the conservative side, assuming that the start age for both FOBT and sigmoidoscopy/colonoscopy was between 31–49 years old (19.9% and 15.1%, respectively). Additionally, one of the more common mistakes that

³Given the overlap between the screening knowledge criterion variable and the three variables that assessed whether individuals had ever undergone FOBT, sigmoidoscopy, and colonoscopy, we repeated the multivariate logistic regression analysis shown in Table 3 without these three variables. The results of that analysis did not differ substantively from the results shown in Table 3.

participants made when asked about frequency of testing was to assume more frequent testing than is currently recommended. That is, for frequency of FOBT, 11.4% of participants incorrectly stated that testing should be done *more often* than once a year. For sigmoidoscopy/colonoscopy, 27.3% of participants incorrectly reported that testing should occur every 1 to 2 years, 13.7% stated every 2 to 3 years, and 19.5% reported every 3 to 5 years. These results are consistent with another recent study examining colorectal cancer screening knowledge in a large sample of male veterans, where only 53% had heard of colorectal screening tests, 30% knew the correct age to start screening, 24% knew what FOBT was, and 29% knew what flexible sigmoidoscopy was (Dolan et al., 2004). The current study is the first to document *combined* knowledge of colon cancer tests, age at initiation, and recommended interval for completion, all of which are critical for adherence with screening guidelines. The low rate of colon cancer screening knowledge (21%) reported here demonstrates the need to increase colon cancer screening awareness and knowledge among adults in this country.

Consistent with prior work (Green & Kelly, 2004; Guerra et al., 2005; Kim et al., 1998; Polednak, 1990) we found relationships between race/ethnicity and education with colon cancer screening knowledge in our multivariate model. We also found significant differences by age, such that those who were ages 45–49, and over 70, were less likely to have adequate screening knowledge. This significant increase in screening knowledge at age 50 may indicate that physicians initiate educational counseling about colorectal cancer screening at this point, whereas the significantly lower knowledge in those aged 70 and above may indicate reduced health literacy in older age groups (Davis, Williams, Marin, Parker, & Glass, 2002; Williams, Davis, Parker, & Weiss, 2002), which likely extends to knowledge of colon cancer screening tests. It is important to keep in mind, however, that adequate knowledge reached only 28% in those ages 50 to 59.

Additionally, we found that individuals who had no visits with a health care provider in the previous year (compared with 1 to 4 visits), or had never looked for cancer information, had lower colon cancer screening knowledge. Individuals who reported seeing their health care provider 5 or more times in the prior year, however, had less knowledge than those who saw their provider between 1 and 4 times. One potential explanation is that those individuals who saw their provider frequently may be in worse health and thereby less focused on preventive behaviors like colon cancer screening. In fact, further examination of the data demonstrated that those individuals who reported seeing their provider frequently (5 or more times in the prior year) were significantly more likely to report being in worse health (fair to poor). In our univariate analyses, both seeing one's health care provider and self-rated health status were significantly related to colon cancer screening knowledge; however, health status was not significantly associated with knowledge in our multivariate analyses. It is possible that the variable that measured health care provider visits also included the variance accounted for by health status (i.e., people in worse health saw their health care provider more often over the past year).

We also found that those individuals who had never undergone FOBT had lower screening, knowledge than those who had undergone FOBT. There was no significant relationship however, between having had sigmoidoscopy or colonoscopy and colon cancer screening knowledge. This may be due to the fact that the question asked did not limit screening for preventive purposes only. Therefore, some of the

individuals who reported having had a sigmoidoscopy or colonoscopy could have been screened for diagnostic purposes, thus not contributing to increased knowledge about colon cancer screening. Additionally, several significant findings in the univariate analyses were not significant in the multivariate analysis. We found no relationship between colon cancer screening knowledge and whether the interview was conducted in Spanish or English, having a regular health care provider, having health care coverage, overall health status, ever having had a sigmoidoscopy or colonoscopy, being a cigarette smoker, level of physical activity, and primary source of cancer information. There is no prior research to suggest that objective risks for colon cancer (i.e., cigarette smoking, sedentary lifestyle, poor diet) should translate into increased screening knowledge.

We note some limitations of the current study. While we attempted to examine what we believed to be the minimum amount of knowledge of colon cancer screening needed to potentially facilitate screening (i.e., type of test, age to get screened, and frequency of screening), we were unable to examine the relationship between knowledge and screening adherence given the nature of the HINTS 2003 data. Not only were the data limited in being cross-sectional, the measurement of knowledge was limited (sigmoidoscopy and colonoscopy were asked together in one question), and the measurement of screening behavior did not limit screening to preventive screening in the absence of symptoms. While we cannot draw conclusions about screening knowledge and adherence with this dataset, this relationship has been shown in prior literature (Brown et al., 1990; Calle, Flanders, Thun, & Martin, 1993; Phillips, Cohen, & Moses, 1999). Additionally, the relatively low response rate of the HINTS 2003 survey may limit generalizability of our findings regarding colon cancer screening knowledge and its related covariates. The survey was introduced to potential participants as a survey run by the NCI, potentially either attracting more individuals who had an interest in cancer and cancer research, or those who had greater knowledge. As such, those who participated may have greater knowledge than those who refused, indicating that our findings could be a conservative estimate of accurate knowledge of colon cancer screening in the United States.

The findings reported here reflect an important manifestation of the health care “knowledge gap” (McQuail & Windahl, 1993), in this case, regarding basic knowledge of colon cancer screening among non-Caucasians, the elderly, those with lower educational attainment, and those who show evidence of a more distant relationship to their health care providers and cancer screening information. Of note, it is a positive sign that those who had seen their health care provider in the prior year or who had received screening recommendations had greater knowledge, which indicates the probable influence of providers on colorectal cancer screening knowledge. While we recognize that knowledge is not necessarily the ultimate predictor of screening behavior, it is likely a prerequisite before other barriers or facilitators—such as attitudes about screening—can be adequately addressed. Importantly, this “knowledge gap” must be addressed at multiple levels of public policy and public health; such multiple-level health communication routes include the mass media, managed care, as well as face-to-face exchanges between patients and physicians (Street, 2003). For example, mass media messages can be usefully constructed to contain basic information about types of colorectal cancer screening tests, as well as the appropriate interval and age to begin them. Mass media approaches likely result in knowledge change more easily than attitudinal change (Salmon & Atkin, 2003). Direct physician communication is implicated as well, as it would be quite constructive for physicians

to know whether a given patient's lack of adherence with screening is based on lack of knowledge or another reported barrier, given that this knowledge deficit is potentially easily rectified (Davis et al., 2001). Knowledge deficits concerning screening knowledge for colorectal cancer have been reported among primary care providers themselves, which warrants additional investigation regarding appropriate health communication messages geared for them (O'Malley, Beaton, Yabroff, Abramson, & Mandelblatt, 2004). Addressing a wide range of barriers to physician–patient communication of preventive colon cancer screening may, in fact, increase awareness, knowledge, and potentially adherence to FOBT, flexible sigmoidoscopy, colonoscopy, or all of these tests (O'Malley et al., 2004). Health communication messages directed at patients increases the frequency of colon cancer screening requests to their providers (Pignone, Harris, & Kinsinger, 2000).

In summary, the findings reported here will be useful in developing health communication priorities for cancer prevention and control. Most centrally, they demonstrate a deficit in adequate knowledge about colon cancer screening in the U.S. general population, which may need to be addressed first before attitudinal factors about colorectal cancer screening can be adequately ascertained. This study also provides an indication of the specific subgroups where levels of screening knowledge are even lower, including the elderly, racial/ethnic minority groups, and those individuals who do not regularly see their physician and do not seek out cancer information. Among these groups, tailored communications of basic screening knowledge is a pressing need and should be provided at multiple contextual points of communication, including at the mass media and physician–patient encounters. We hope the findings here contribute to the setting of these national priorities for health communication in cancer, and ultimately will lead to an appropriate increase in utilization of colorectal cancer screening tests in the United States.

References

- American Cancer Society (ACS). (2005). *Colorectal Cancer Facts & Figures Special Edition 2005*. Atlanta: Author.
- Bingham, S. A. (1999). High-meat diets and cancer risk. *The Proceedings of the Nutrition Society*, 58(2), 243–248.
- Boutron, M. C., Faivre, J., Dop, M. C., Quipourt, V., & Senesse, P. (1995). Tobacco, alcohol, and colorectal tumors: A multistep process. *American Journal of Epidemiology*, 141(11), 1038–1046.
- Breslow, R. A., Sorkin, J. D., Frey, C. M., & Kessler, L. G. (1997). Americans' knowledge of cancer risk and survival. *Preventive Medicine*, 26(2), 170–177.
- Brown, M. L., Potosky, A. L., Thompson, G. B., & Kessler, L. G. (1990). The knowledge and use of screening tests for colorectal and prostate cancer: Data from the 1987 National Health Interview Survey. *Preventive Medicine*, 19(5), 562–574.
- Calle, E. E., Flanders, W. D., Thun, M. J., & Martin, L. M. (1993). Demographic predictors of mammography and Pap smear screening in US women. *American Journal of Public Health*, 83(1), 53–60.
- Centers for Disease Control and Prevention. (1999). Screening for colorectal cancer—United States, 1997. *Morbidity and Mortality Weekly Report*, 48, 116–121.
- Cokkinides, V. E., Chao, A., Smith, R. A., Vernon, S. W., & Thun, M. J. (2003). Correlates of underutilization of colorectal cancer screening among U.S. adults, age 50 years and older. *Preventive Medicine*, 36(1), 85–91.
- Dale, W., Campbell, T., Ignacio, L., Song, P., Kopnick, M., Mamo, C., et al. (1999). Self-assessed health-related quality of life in men being treated for prostate cancer with

- radiotherapy: Instrument validation and its relation to patient-assessed bother of symptoms. *Urology*, 53(2), 359–366.
- Davis, T. C., Dolan, N. C., Ferreira, M. R., Tomori, C., Green, K. W., Sipler, A. M., et al. (2001). The role of inadequate health literacy skills in colorectal cancer screening. *Cancer Investigation*, 19(2), 193–200.
- Davis, T. C., Williams, M. V., Marin, E., Parker, R. M., & Glass, J. (2002). Health literacy and cancer communication. *CA: A Cancer Journal for Clinicians*, 52(3), 134–149.
- Dolan, N. C., Ferreira, M. R., Davis, T. C., Fitzgibbon, M. L., Rademaker, A., Liu, D., et al. (2004). Colorectal cancer screening knowledge, attitudes, and beliefs among veterans: Does literacy make a difference? *Journal of Clinical Oncology*, 22(13), 2617–2622.
- Dunlop, M. G., Farrington, S. M., Carothers, A. D., Wyllie, A. H., Sharp, L., Burn, J., et al. (1997). Cancer risk associated with germline DNA mismatch repair gene mutations. *Human Molecular Genetics*, 6(1), 105–110.
- Goel, V., Gray, R., Chart, P., Fitch, M., Saibil, F., & Zdanowicz, Y. (2004). Perspectives on colorectal cancer screening: A focus group study. *Health Expectations: An international journal of public participation in health care and health policy*, 7(1), 51–60.
- Green, P. M. & Kelly, B. A. (2004). Colorectal cancer knowledge, perceptions, and behaviors in African Americans. *Cancer Nursing*, 27(3), 206–215.
- Green, L. W. & Kreuter, M. W. (1990). Health promotion as a public health strategy for the 1990s. *Annual Review of Public Health*, 11, 319–334.
- Guerra, C. E., Dominguez, F., Shea, J. A. (2005). Literacy and knowledge, attitudes, and behavior about colorectal cancer screening. *Journal of Health Communication*, 10(7), 651–663.
- Janz, N. K., Wren, P. A., Schottenfeld, D., & Guire, K. E. (2003). Colorectal cancer screening attitudes and behavior: A population-based study. *Preventive Medicine*, 37(6 Pt. 1), 627–634.
- Kim, K., Yu, E. S., Chen, E. H., Kim, J., & Brintnall, R. A. (1998). Colorectal cancer screening. Knowledge and practices among Korean Americans. *Cancer Practice*, 6(3), 167–175.
- Lethbridge-Cejku, M., & Vickerie, J. (2005). Summary health statistics for U.S. adults: National Health Interview Survey, 2003. National Center for Health Statistics. *Vital and Health Statistics*, 10(225), 116–117.
- Martinez, M. E., McPherson, R. S., Annegers, J. F., & Levin, B. (1995). Cigarette smoking and alcohol consumption as risk factors for colorectal adenomatous polyps. *Journal of the National Cancer Institute*, 87(4), 274–279.
- McQuail, D. & Windahl, S. (1993). *Communication models for the study of mass communications* (2nd ed.). New York: Longman.
- National Cancer Institute (NCI). (2002). Making health communication programs work. U.S. Department of Health and Human Services. Bethesda, MD. Retrieved August 10, 2003, from http://www.nhlbi.nih.gov/guidelines/obesity/ob_gdlns.pdf.
- National Cancer Institute (NCI). (2005). *Health Information National Trends Survey*. Retrieved March 11, 2005, from <http://www.cancercontrol.cancer.gov/hints/>
- National Institutes of Health, National Heart Blood and Lung Institute. (1998). Clinical guidelines on the identification, evaluation and treatment of overweight and obesity in adults. *NIH Publication No. 98-4083*. Washington, DC: U.S. Government Printing Office.
- Negri, E., Bosetti, C., La Vecchia, C., Fioretti, F., Conti, E., & Franceschi, S. (1999). Risk factors for adenocarcinoma of the small intestine. *International Journal of Cancer*, 82(2), 171–174.
- Nelson, D. E., Kreps, G. L., Hesse, B. W., Croyle, R. T., Willis, G., Arora, N. K., et al. (2004). The Health Information National Trends Survey (HINTS): Development, design, and dissemination. *Journal of Health Communication*, 9(5), 443–460; discussion 481–444.
- O'Malley, A. S., Beaton, E., Yabroff, K. R., Abramson, R., & Mandelblatt, J. (2004). Patient and provider barriers to colorectal cancer screening in the primary care safety-net. *Preventive Medicine*, 39(1), 56–63.
- Phillips, J. M., Cohen, M. Z., & Moses, G. (1999). Breast cancer screening and African American women: Fear, fatalism, and silence. *Oncology Nursing Forum*, 26(3), 561–571.
- Pignone, M., Harris, R., & Kinsinger, L. (2000). Videotape based decision aid for colon cancer screening. A randomized, controlled trial. *Annals of Internal Medicine*, 133, 761–769.
- Polednak, A. P. (1990). Knowledge of colorectal cancer and use of screening tests in persons 40–74 years of age. *Preventive Medicine*, 19(2), 213–226.

- Price, J. M., Davis, S. S., Sparrow, R. A., & Wilding, I. R. (1993). The effect of meal composition on the gastrocolonic response: Implications for drug delivery to the colon. *Pharmaceutical Research*, *10*(5), 722–726.
- Research Triangle Institute. (2004). *SUDAAN (Version 9.0.0)* [Computer software]. Research Triangle Park, NC: Author.
- Salmon, C. T. & Atkin, C. (2003). Using media campaigns for Health Communication. In T. L. Thompson, A. M. Dorsey, K. I. Miller, & R. Parrott (Eds.), *Handbook of health communication* (pp. 449–472). Mahwah, NJ: Lawrence Erlbaum Associates, Inc.
- Sarna, L. & Chang, B. L. (2000). Colon cancer screening among older women caregivers. *Cancer Nursing*, *23*(2), 109–116.
- Seeff, L. C., Nadel, M. R., Klabunde, C. N., Thompson, T., Shapiro, J. A., Vernon, S. W., et al. (2004). Patterns and predictors of colorectal cancer test use in the adult U.S. population. *Cancer*, *100*(10), 2093–2103.
- Sesink, A. L., Termont, D. S., Kleibeuker, J. H., & Van Der Meer, R. (2000). Red meat and colon cancer: Dietary haem, but not fat, has cytotoxic and hyperproliferative effects on rat colonic epithelium. *Carcinogenesis*, *21*(10), 1909–1915.
- Shokar, N. K., Vernon, S. W., & Weller, S. C. (2005). Cancer and colorectal cancer: Knowledge, beliefs, and screening preferences of a diverse patient population. *Family Medicine*, *37*(5), 341–347.
- Shokar, N. K., Vernon, S. W., & Weller, S. C. (2005). Cancer and colorectal cancer: Knowledge, beliefs, and screening preferences of a diverse patient population. *Journal of Health Communication*, *10*(7), 651–663.
- Street, R. L. (2003). Communication in medical encounters: An ecological perspective. In T. L. Thompson, A. M. Dorsey, K. I. Miller, & R. Parrott (Eds.), *Handbook of health communication* (pp. 63–89). Mahwah, NJ: Lawrence Erlbaum Associates, Inc.
- Subramanian, S., Klosterman, M., Amonkar, M. M., & Hunt, T. L. (2004). Adherence with colorectal cancer screening guidelines: A review. *Preventive Medicine*, *38*(5), 536–550.
- U.S. Preventive Services Task Force (USPSTF). (2002). Screening for colorectal cancer: Recommendation and rationale. *Annals of Internal Medicine*, *137*(2), 129–131.
- Wardle, J., Waller, J., Brunswick, N., & Jarvis, M. J. (2001). Awareness of risk factors for cancer among British adults. *Public Health*, *115*(3), 173–174.
- Weinstein, N. D., Atwood, K., Puleo, E., Fletcher, R., Olditz, G., & Emmons, K. M. (2004). Colon cancer: Risk perceptions and risk communication. *Journal of Health Communication*, *9*(1), 53–65.
- Williams, M. V., Davis, T., Parker, R. M., & Weiss, B. D. (2002). The role of health literacy in patient-physician communication. *Family Medicine*, *34*(5), 383–389.
- Wolf, R. L., Zybert, P., Brouse, C. H., Neugut, A. I., Shea, S., Gibson, G., et al. (2001). Knowledge, beliefs, and barriers relevant to colorectal cancer screening in an urban population: A pilot study. *Family and Community Health*, *24*(3), 34–47.

Copyright of Journal of Health Communication is the property of Routledge and its content may not be copied or emailed to multiple sites or posted to a listserv without the copyright holder's express written permission. However, users may print, download, or email articles for individual use.