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Beliefs Associated With Fecal Occult Blood Test and Colonoscopy Use at a Worksite Colon Cancer Screening Program

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Abstract

Colorectal cancer (CRC) is the second leading cause of cancer death in the United States. Although regular screening can decrease morbidity and mortality from CRC, screening rates nationwide are very low. This descriptive study assessed beliefs associated with fecal occult blood test and colonoscopy use among participants of a worksite colon cancer screening program. Randomly selected employees, aged 40 and older, were mailed a survey on CRC screening-related beliefs. Instruments were tested for reliability and validity. Results indicated that fecal occult blood test use was significantly associated with being female, Caucasian, having low perceived barriers, and provider recommendation. Colonoscopy use was significantly associated with higher knowledge, lower barriers, higher benefits, higher self-efficacy, and provider recommendation. Findings may be used to develop interventions designed to improve CRC screening rates.

In recent years, colorectal cancer (CRC) has been recognized as a significant health problem. It is the second leading cause of cancer death in the United States and until recently, largely ignored. Although there has been a decreasing trend in mortality from CRC, over 56,000 deaths are estimated in 2003.¹ In addition, the American Cancer Society (ACS) estimates that over 147,500 new cases of CRC will be diagnosed in 2003.¹

Early detection and removal of polyps can lead to decreased mortality as well as decreased morbidity from the disease.² Survival from CRC is inversely related to stage of diagnosis. Those diagnosed with localized disease have higher 5-year survival rates: 90% for colon cancer and 80% for rectal cancer.³ Polyps are precursors to CRC, taking about 7 to 12 years to progress to cancer.^{4,5} Despite the promising prognosis for early-stage diagnosis, only about 37% of CRC is diagnosed at an early stage.⁶

Inadequate use of screening tests is a major contributing factor to CRC mortality. Because there is enough evidence to support the use of regular screening to aid in early detection, the National Cancer Institute and ACS are among the major organizations calling for more research into ways to increase early detection.^{7,8} Despite the benefits of early detection, CRC screening rates are very low and have not increased substantially in recent years. Data

from the Behavioral Risk Factor Surveillance System show that only 39.7% of those surveyed had had a Fecal Occult Blood Test (FOBT) in the preceding year, and only 41.7% reported having had a sigmoidoscopy in the preceding 5 years.⁹ Although there was a minimal increase in test use since 1993, rates were generally low. The Centers for Disease Control and Prevention¹⁰ reports 35% of those aged 50 or older as having had an FOBT in the preceding 2 years and 37% of those aged 50 or older as having had a sigmoidoscopy. Women were slightly less likely to have had an FOBT than men (34% versus 36%); women were, however, much less likely to have had a sigmoidoscopy (33% versus 43%).¹⁰ These rates are well below the *Healthy People 2010* goals to achieve screening rates of at least 50% for both screening behaviors.¹¹ It is also important to remember that these screening rates were collected through self-report. There is some evidence in the literature that self-report for CRC screening overestimates actual use when compared with medical record data.^{12,13} Therefore, CRC screening rates may be even *lower* than reported.

A more recent study assessing the correlates of CRC screening reported that under use of CRC screening tests was highest among those aged 50 to 64 years, those with lower education, and lack of health insurance and preventive services.¹⁴ Such findings underscore the need to determine factors associated with screening to develop interventions to promote screening.

There is, however, some controversy surrounding the recommended guidelines for early detection of colorectal cancer. Screening with FOBT has been shown to reduce mortality from CRC by 15% to 33%.² Sigmoidoscopy has been shown to reduce CRC mortality by up to 70%.^{15,16} Currently, third-party reimbursement is generally available for annual FOBT and a flexible sigmoidoscopy every 4 to 5 years.

There is indirect evidence suggesting that colonoscopy is an effective screening method. The reduction in mortality demonstrated in FOBT screening trials can be attributed to the use of follow-up colonoscopy.^{17–19} The National Polyp Study and the Italian Multicenter Study both demonstrated a reduction in the incidence of CRC by using colonoscopy to remove adenomatous polyps.^{5,20} Additionally, recent observational evidence suggests that approximately half of the adenomas and cancers occurring in the proximal colon would be missed by a sigmoidoscopy.^{21,22} The ACS screening recommendations support screening by any of these three tests. For the above reasons and because FOBT and colonoscopy were the screening tools offered to participants in the screening program studied here, these two tests were the outcomes of choice.

The purpose of this study was to identify beliefs and demographic factors associated with FOBT and colonoscopy use, respectively. The sample was derived from among employees of a large Midwestern pharmaceutical company (Eli Lilly and Company) who are offered a somewhat-unique Colon Cancer Program. Eli Lilly and Company employs 41,134 individuals worldwide, with approximately 12,949 located at their corporate office in Indianapolis, IN. Employees (aged 40 and older) and retirees and their dependents are offered a free screening colonoscopy every 5 years. An annual FOBT is offered to those aged 40 and older through a yearly health physical program in the company. The Colon Cancer Program began in 1995, and 4114 people have been screened so far of an eligible 26,366. Because participation rates in the program were low (16%), we conducted a descriptive survey to assess factors associated with past use of FOBT and colonoscopy. Because our survey was conducted in 2000 (5 years after the program's inception) employees would have had only one colonoscopy through the program. Accordingly, we only assessed lifetime use of colonoscopy. In this study, cost of CRC screening was eliminated as a barrier.

The identification of such predictors could be the basis for developing interventions to promote use of FOBT and colonoscopy through worksite cancer screening programs. According to Vernon,²³ adherence to screening was highest in employer-sponsored programs.

Study Questions

The three research questions were as follow:

1. What beliefs and demographic factors predict ever having had an FOBT?
2. What beliefs and demographic factors predict having had an FOBT in the last year?
3. What beliefs and demographic factors predict past use of colonoscopy?

Theoretical Framework and Factors Associated with Screening Use

The conceptual framework for the current study is derived from the PRECEDE-PROCEED Model (PPM)²⁴ and the Health Belief Model (HBM).²⁵ The PPM posits that behavior change is influenced by predisposing and enabling factors. Predisposing factors are defined as the antecedents that provide a rationale for behavior change (eg, demographic variables, beliefs, and knowledge); enabling factors are the external resources that facilitate behavior change (eg, access to health care, recommendation from one's provider). Belief variables for this study were derived from the HBM. The HBM explicates that, for behavior change to occur, an individual must perceive a disease as serious, must perceive themselves at increased risk for developing the disease (susceptibility), the perceived benefits of the action must outweigh the perceived barriers to taking the action, and that their confidence in their ability to perform the action must be high (self-efficacy).²⁵

Given that the theoretical models presented here were significant in promoting use of other cancer screening tests,^{26,27} we used a similar conceptual framework for this study. Survey questions assessed perceived benefits, perceived barriers, perceived self-efficacy, fear of colorectal cancer, knowledge, and health care provider recommendation. Past research with other cancer screening behaviors (such as mammography) identified knowledge and fear as significant predictors of behavior.^{28,29} Perceived benefits, barriers, susceptibility, knowledge, fear, age, and gender were all shown to be associated with FOBT use.^{30–39} Intention to screen for CRC was significantly related to perceived susceptibility, benefits, and self-efficacy among Caucasian male employees.⁴⁰

Five worksite-based studies reported prospective adherence to sigmoidoscopy of at least 30%,^{41–45} indicating that such a setting may be used successfully for screening programs. Studies examining participation in and adherence to, and factors associated with adherence to colonoscopy screening are very few. Rex and colleagues⁴⁶ invited health care providers and their spouses to undergo free colonoscopies. Barriers reported were being distressed and feeling uncomfortable. Less than 15% of physicians, nurses, and their spouses underwent a colonoscopy. The National Polyp Study reported 80% adherence for a second colonoscopy after a polypectomy.⁵ Studying first-degree relatives of colon cancer patients, Rawl and colleagues^{47,48} found that higher benefits and lower barriers were significantly associated with colonoscopy use.

Methods

Study Instruments

Subscales used in this study were previously tested for reliability and validity.⁴⁷ In addition, a pilot study was conducted with the target sample and items were refined further. All scales

demonstrated good reliability with Cronbach's alphas above 0.70. Responses to all beliefs and knowledge subscales were summed and dichotomized in to two categories (high/low) for the purposes of statistical analyses, based on the midpoint for each scale.

Sample Selection

Institutional review board permission was obtained before implementing this study. A list of full-time employees (approximately 6000) at the Indianapolis branch of Eli Lilly and Company was generated in Excel. From this list, a random sample of employees ($n = 508$) was selected and sent an introductory letter, along with the survey, a return envelope, and a \$3.00 coupon for the on-site company cafeteria. Of the surveys mailed, 98 were returned as undeliverable because wrong addresses or employees having left the company. The response rate was approximately 54%, with 220 employees returning completed surveys.

Data Analysis

Data analysis was conducted using SPSS 10.1. Descriptive frequencies were run for all variables. Next bivariate analysis (chi-square and correlations) were conducted with each independent variable (predisposing and enabling factors) and the outcomes of FOBT in the last year, FOBT ever, and colonoscopy ever. Three multivariate models using binomial logistic regression were conducted for each outcome variable and the associated independent variables. In bivariate analysis no variables were significantly associated with having had an FOBT in the last year at $P < 0.05$; however, in keeping with exploratory nature of this research, variables associated at $P \leq 0.25$ were included in the multivariate analysis.⁴⁹

Results

The demographic characteristics of the sample are presented in Table 1. Individual and familial risk for CRC was assessed in the demographic section (eg, personal or family history of CRC, polyps, familial adenomatous polyposis, or hereditary nonpolyposis colorectal cancer). Participants with a positive individual or family history were not included in this analysis ($n = 3$). The sample was predominantly male, Caucasian, and married. The majority of study participants reported having a graduate/professional degree. Approximately half the sample reported having had a colonoscopy (52%); however, only about 31% reported that their provider had recommended the test. Bivariate chi-square analysis was first conducted separately for each outcome variable (ie, FOBT and colonoscopy use; Table 2).

Variables associated ($P < 0.05$) with ever having had an FOBT were provider recommendation and perceived barriers (see Table 2). Of the 63.7% who reported that their providers had not recommended an FOBT to them, 48.9% had not had the test. Of the 36.3% who stated their provider had recommended the test, 28.4% had had an FOBT. Of the 50.5% who reported high barriers, 36.2% had not had an FOBT.

Variables significantly associated with colonoscopy use ($P < 0.05$) were education, knowledge, perceived barriers, perceived benefits, perceived self-efficacy, communication, and provider recommendation. Those with a bachelor's degree were least likely to have had a colonoscopy (14.3%) compared with people with high school or less education (47.9%), those with some college (46.9%), or those with a graduate or professional degree (50.6%). Additionally, age was significantly associated with colonoscopy use only ($r = .19$, $P < 0.05$), ie, those who were older were more likely to have had a colonoscopy.

Those with high knowledge scores were more likely to have had a colonoscopy than those with low knowledge scores (61.3% versus 38.6%); those reporting high perceived benefits were more likely to have had a colonoscopy than those with low benefits (69.3% versus

30.7%); those with low barriers were more likely to have had a colonoscopy than those with high barriers (75.3% versus 24.7%); and those with high self-efficacy were more likely to have had a colonoscopy than those with low self-efficacy (72.9% versus 27.1%). Those who obtained high scores on the communication subscale were also more likely to have had a colonoscopy than those who scored low (67.4% versus 32.6%). Respondents who reported that the procedure was recommended by their provider were significantly more likely to have had the test than those who reported that their providers did not recommend the test (55.4% versus 44.6%).

Binomial logistic regression analysis was then conducted modeling the odds of having had an FOBT in the past year (Table 3), ever having had an FOBT (Table 4) and having had a colonoscopy (Table 5). Independent variables significant in bivariate analysis (at $P \leq 0.25$)⁴⁹ with each outcome variable were entered into the logistic regression models.

Marital status and perceived benefits were significantly associated with having had an FOBT in the last year (Table 3). Employees with high perceived benefits were more likely to have had an FOBT in the past year than those with low benefits (OR = 3.01, CI 1.08–8.40). Those without a partner were less likely than those with partners to have had an FOBT in the past year (OR = 0.27, CI 0.07–0.99).

Table 4 presents the odds of ever having had an FOBT. Employees who reported that their provider had recommended the test were more likely to have had an FOBT (OR = 17.24, CI = 6.72–44.22). Older employees were more likely to have had an FOBT (OR = 1.09, CI = 1.10–1.18). Women were less likely than men to have had an FOBT (OR = 0.37, CI 0.15–0.92), and non-Caucasians were less likely than Caucasians to have had an FOBT (OR = 0.26, CI = 0.08–0.73). Employees with low perceived barriers were more likely to have had an FOBT (OR = 3.20, CI = 1.33, 7.72).

Multivariate results for having a colonoscopy are presented in Table 5. Independent variables entered in the model were education, knowledge, perceived barriers, perceived benefits, perceived self-efficacy, communication, and provider recommendation.

Employees who reported that their provider had recommended the test to them were more likely to have had the test than those who reported that their providers had not recommended the test (OR = 5.26, CI = 2.23–12.45). These results have implications for worksite intervention research and are discussed further in the next section. People who had high knowledge scores were more likely to have had a colonoscopy than those who scored low on knowledge (OR = 3.56, CI = 1.24–10.23). Those with high self-efficacy scores were more likely to have had a colonoscopy than those with low self-efficacy scores (OR = 3.68, 1.47–9.20). Employees who perceived high benefits were more likely to have had a colonoscopy than those who perceived low benefits to having a colonoscopy (OR = 2.53, CI = 1.06–6.03).

Discussion

If, as recent research suggests,^{21,22,50} a colonoscopy becomes the preferred CRC screening mechanism, then the theoretical framework that guided this study could be used to develop effective interventions to increase colonoscopy use. Most of the belief variables were significant as theoretically predicted. For example, those who had had a colonoscopy perceived higher benefits to the test, higher self-efficacy or confidence in their ability to have the test, and higher knowledge. Additionally, high perceived barriers significantly predicted lower odds of ever having had an FOBT, while high benefits predicted higher odds of having had an FOBT in the last year. However, perceived barriers were not significantly

associated with colonoscopy use. This could be due to the higher educational level of the respondents. Typically, high barriers are significantly related to lower education.²⁷

Communication with providers was not significant in the regression analysis for any of the three outcomes. Respondents in this sample were highly educated which may explain why communication was not a significant predictor of colonoscopy use. We do know that perceptions of communication with a provider may influence the behavior of less educated people or even certain minority groups.^{51–54} Education, gender, or ethnicity were not significantly associated with communication in this study. We recommend continuing to assess this construct with less educated samples. Similarly, education was not a significant predictor of FOBT or colonoscopy use and may be explained by the high education levels in this sample.

Provider recommendation was a significant predictor of colonoscopy and FOBT use, suggesting a simple and cost-effective intervention to increase screening behavior. For this worksite program, a letter was sent to all providers in the health plans serving the company detailing the results of the study and emphasizing the importance of FOBT and colonoscopy recommendation. Use of FOBT and colonoscopy as part of the program will continue to be monitored. Because there was no further intervention planned for providers or employees at this site, it was not feasible to implement anything further than the letter to providers as a follow-up to this study.

Despite its significant association with other cancer-screening behaviors and CRC screening in some studies,^{39,55,56} perceived susceptibility has not been consistently associated with CRC screening.²³ Perceived susceptibility for developing CRC was not a significant predictor of behavior in this study, leading us to believe that the instrument may need to be refined further. Perceived susceptibility was not significantly associated with any demographic variables either in this study.

Although past research identified fear as associated with FOBT use,³⁶ fear was not a significant predictor of FOBT or colonoscopy use in this study. Operational definitions of fear differed between past studies and the current one, which may explain the lack of significance.

Results presented here are similar to the results of a study with a high risk sample using all the same constructs (except self-efficacy) conducted by Rawl and colleagues,⁴⁷ supporting the generalizability of our results. For example, tailored messages to promote screening could address the individual's beliefs such as benefits, barriers, and self-efficacy.

Limitations of this study include the fact that we used a single work-site sample for whom the cost of colonoscopy was paid for by the employer. Colonoscopy is an expensive procedure and is not widely reimbursed as a screening test by most third-party payors. However, there is increasing discussion in the literature about offering colonoscopy as the screening method of choice for those at average risk for CRC.⁵⁰ The lack of ethnic diversity in the sample is another limitation. We recognize that people of various ethnic groups may well have different beliefs than Caucasians. Our retrospective research design poses another limitation to the interpretation of results. Employees were asked about their beliefs in relation to past CRC screening behaviors. Psychosocial correlates of past behavior may differ from correlates of prospective behavior. However, a strength of this study is that the beliefs assessed were specific to each screening test rather than CRC screening in general. An individual may have different beliefs and confidence related to FOBT compared to colonoscopy. Additionally, we must insert a note of caution regarding the interpretation of the results for gender, ethnicity, and marital status since there were greater numbers of men, Caucasians, and those with partners in this study. Despite these limitations, the associations

we found may provide a basis for developing interventions to increase CRC screening, at least in settings where colonoscopy is offered as a free benefit.

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TABLE 1

Demographic Characteristics of the Sample

Variable	<i>n</i>	%
Age ($\bar{x}$ = 1.57; SD = 5.15)		
Education		
High school or less	28	13
Some college	67	32
Bachelor's degree	30	14
Graduate/professional	87	41
Degree [*]		
Race		
Caucasian	177	83
Noncaucasian	36	17
Marital Status		
With a partner [†]	168	79
Without a partner [‡]	45	21
Gender		
Male	123	58
Female	90	42

^{*} Includes master's degree, PhD, MD, DO.

[†] Married or living with a partner.

[‡] Single, divorced, separated, or widowed

TABLE 2

Bivariate Analysis for Beliefs, Demographics, and Screening Test Use

Variable	FOBT in Last Year		Ever Had FOBT		Ever Had Colonoscopy	
	χ^2	P*	χ^2	P*	χ^2	P*
MD recommendation (yes/no)	NS		54.42	<0.001	32.49	<0.001
Communication (high/low)	NS		NS		4.04	0.056
Barriers (high/low)	1.59	0.243	18.03	<0.001	33.54	<0.001
Benefits (high/low)	2.36	0.177	NS		20.60	<0.001
Self-efficacy (high/low)	NS		4.14	.055	32.71	<0.001
Knowledge (high/low)	NS		3.80	0.058	10.48	<0.001
Education (high school/some college/bachelors/graduate or professional degree)	NS		5.18	0.159	11.86	<0.01
Ethnicity (Caucasian/non-Caucasian)	3.33	0.079	2.56	0.138	NS	
Marital status (with/without partner)	3.68	0.094	NS		NS	
Fear (high/low)	0.90	0.232	NS		NS	
Gender	NS		2.46	0.151	NS	

* Variables with P value ≤ 0.25 were included in multivariate analyses.

NS, not significant.

TABLE 3

Logistic Regression: Fecal Occult Blood Test Within the Past Year

Independent Variables	Odds Ratio	Confidence Interval
Ethnic [*]	0.35	0.12, 1.11
Marital status [†]	0.27	0.07, 0.99
Barriers [‡]	1.33	0.47, 3.79
Benefits [‡]	3.01	1.08, 8.40
Fear [‡]	0.622	0.24, 1.63

* Caucasian/non-Caucasian.

[†] With partner/without partner.

[‡] High/low.

TABLE 4

Logistic Regression: Ever Had Fecal Occult Blood Test

Independent Variables	Odds Ratio	Confidence Interval
Age	1.09	1.10, 1.18
Barriers [*]	3.20	1.33, 7.72
Communication [*]	0.67	0.286, 1.56
Doctor recommendation [†]	17.24	6.72, 44.22
Education ^a	1.45	0.33, 6.32
Education ^b	2.82	0.56, 14.31
Education ^c	2.53	0.59, 10.85
Ethnic [‡]	0.26	0.08, 0.73
Gender	0.37	0.15, 0.92
Knowledge [*]	2.18	0.72, 6.58
Self-efficacy [*]	1.23	0.52, 2.93

^a Less than or high school vs. some college;^b less than or high school vs. bachelor's degree;^c less than or high school vs. graduate/professional degree.^{*} High/low.[†] Yes/No.[‡] Caucasian/non-Caucasian.

TABLE 5**Logistic Regression: Ever Had Colonoscopy**

Independent Variables	Odds Ratio	Confidence Interval
Barriers [*]	1.89	0.78, 4.56
Benefits [*]	2.53	1.06, 6.03
Communication [*]	1.25	0.56, 2.82
Doctor recommendation [†]	5.26	2.23, 12.45
Education ^a	1.44	0.33, 6.33
Education ^b	0.18	0.03, 1.12
Education ^c	1.38	0.32, 5.94
Knowledge [*]	3.56	1.24, 10.23
Self-efficacy [*]	3.68	1.47, 9.20

^a Less than or high school vs. some college;

^b less than or high school vs. bachelor's degree

^c less than or high school vs. graduate/professional degree.

^{*} High/low.

[†] Yes/No.