Ethnic Differences in Colorectal Cancer Screening

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ABSTRACT. The present study was designed to assess ethnic disparities in CRC screening rates in a low-income population and to examine factors that could account for those differences. Participants were randomly selected and asked to complete a questionnaire about CRC screening. After controlling for gender, age, education, income, health insurance, and family history of CRC, differences in screening rates as a function of ethnicity remained. Physicians' recommendations and perceived efficacy of screening were also strong predictors of CRC screening. Psychological factors accounted in part for differences in screening rates between European Americans and Mexican Americans. doi:10.1300/J077v26n02_05

KEYWORDS. Colorectal cancer screening, ethnicity, demographic factors, psychosocial factors

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INTRODUCTION

Approximately 90% of colorectal cancer (CRC) cases and deaths are preventable, but CRC remains the third most commonly diagnosed cancer and second-ranked cause of cancer deaths in the United States (Cancer Research and Prevention Foundation, 2004). The incidence and mortality rates of CRC rise sharply with age; 90% of the cases occur in people over age 50. The American Cancer Society (2007) estimated that approximately 153,760 new cases of CRC and 52,180 CRC-related deaths would occur in the year 2007. Modifiable factors that influence CRC risk include physical inactivity, diet, obesity, smoking, and alcohol consumption. A non-modifiable risk factor is a family history of CRC; CRC onset occurs about 10 years earlier in people who have a first-degree relative with CRC than in people who do not have this family history (Fuchs et al., 1994; St John et al., 1993). The incidence of CRC in the United States has declined by nearly 20% since 1985. This decrease may be attributable to the early detection and removal of precancerous polyps, which can either prevent cancer development or lead to detection of CRC at an earlier, more treatable stage (American Cancer Society, 2003).

Current CRC screening guidelines recommend regular screening for adults at average risk of CRC who are 50 years of age or older, using one of four types of tests: (1) fecal occult blood test (FOBT; a chemical test used to detect blood in the stool); (2) flexible sigmoidoscopy (FS; using a hollow, lighted tube to visually inspect the walls of the rectum and sigmoid colon); (3) colonoscopy (using a hollow lighted tube to visually inspect the walls of the rectum and the entire colon); and (4) double contrast barium enema (DCBE; an X-ray technique for examining the colon) (Centers for Disease Control and Prevention, 2004-2005; Winawer et al., 2003). These guidelines advise that an FOBT be conducted annually, FS or DCBE be conducted every 5 years, or colonoscopy every 10 years. Multiple reports have suggested that CRC screening can reduce CRC mortality dramatically (Centers for Disease Control and Prevention, 2004-2005; Eddy et al., 1987; Newcomb, Norfleet, Storer, Surawicz, & Marcus, 1992; Selby, Friedman, Quesenberry, & Weiss, 1992; Winawer et al., 1993). However, despite evidence that screening can greatly reduce the incidence and associated mortality of CRC, screening for CRC occurs far less frequently than screening for other forms of cancer (American Cancer Society, 2003; Centers for Disease Control and Prevention, 2004-2005; Centers for Disease Control and Prevention, 2001). In 2000, only 42.5% of adults aged 50 or older had at least

one of the screening tests within the recommended time interval (Centers for Disease Control and Prevention, 2004-2005).

The incidence and mortality rates of CRC vary as a function of ethnicity. The highest rates of both incidence and mortality (per 100,000) for women and men combined from 1992 to 1998 were among African Americans (50.1 and 22.8, respectively), followed by European Americans (42.9 and 16.8). The incidence and mortality rates are lower for Hispanics (28.4 and 10.2) than for African Americans and European Americans; however, the cancer screening rates for Hispanics are also lower than in these other groups. Hispanics are less likely than African Americans or European Americans to use preventive services such as CRC screening (American Cancer Society, 2001, 2002; Winawer et al., 2003). For instance, in 2000 and 2001, only 15.4% of Hispanics reported having an FOBT in the past year, while European Americans (24.1%) and African Americans (21.6%) had higher rates (American Cancer Society, 2004). Although Hispanics have lower incidence and mortality rates, higher screening rates would reduce mortality even further within this population.

In the United States, ethnicity is associated with several variables that affect the probability of cancer screening. These variables include income, education, being a single parent, possession of health insurance, ability to take time off from work, ease of transportation to health care facilities, self-efficacy for health-related behaviors, and cultural traditions (Baquet & Commiskey, 1999; Hoffman-Goetz & Mills, 1997). Ethnic differences in knowledge, attitudes, and beliefs about CRC have also been identified, although there is a paucity of research in this area (Mitchell-Beren, Dodds, Choi, & Waskerwitz, 1989; Powe, 1995; Scroggins & Bartley, 1999).

The present study was designed to assess ethnic disparities in CRC screening among a low-income population in southern California. It was hypothesized that Mexican Americans would have significantly lower CRC screening rates within the recommended time than African Americans and European Americans, and that African Americans would have significantly lower screening rates than European Americans. After assessing ethnic disparities, we examined the nature of the observed differences. Several theoretical perspectives have been used in attempts to predict health-related behaviors in general (Ajzen, 1991; Ajzen & Fishbein, 1974; Bandura, 1977; Becker, Maiman, Kirscht, Haefner, & Drachman, 1977; Miller & Dollard, 1941) and colorectal cancer screening in particular (Myers et al., 1994). These theories highlight key psychosocial factors that lead to prevention or detection behaviors.

Borrowing from these theories, we hypothesized that social influence factors (such as receiving a physician's recommendation, being encouraged by friends or family, or hearing media coverage of CRC) would predict CRC screening. We expected psychological factors (attitudes and beliefs) to play an important role as well. More specifically, we hypothesized that seeing oneself at risk for CRC (perceived vulnerability), viewing CRC screening as an efficacious method to prevent, detect, and cure CRC (perceived efficacy of screening), and believing in one's ability to engage in CRC screening (self-efficacy) would all predict screening within the recommended time. Finally, we expected that the more people perceive barriers to CRC screening, the less likely they would be to be tested for CRC. We hypothesized that these social and psychological factors would account to some extent for ethnic disparities in CRC screening.

METHODS

Procedure

Three zip codes were randomly selected based on income levels (less than $50,000) within the areas and the representation of African Americans, Mexican Americans, or European Americans within the zip code. Research assistants went to the selected zip code areas and approached people in predetermined locations (e.g., public parks, libraries, community centers, grocery stores, post offices, and shopping centers). Potential participants were randomly selected (using a random number table) at each location. Before an individual was asked to participate, the research assistant confirmed that he or she met the criteria (age, ethnicity, living within the zip code, and speaking English or Spanish) for participation. The people approached were told that the purpose of the study was to examine ethnic differences in beliefs, knowledge, and screening practices regarding CRC. People were told that their participation was voluntary, that their answers were confidential, and that they would be paid $5.00 for completing a three-page questionnaire. When individuals agreed to participate, the research assistants explained each CRC screening test and then asked each participant to complete the questionnaire and to place it in an envelope to ensure confidentiality. In a few cases, people asked the research assistants to read the questionnaire to them, and

the research assistants complied with the request. Research assistants were available to answer questions.

Measures

The questionnaire consisted of items designed to assess demographic characteristics, family history of CRC, CRC screening rates, and social influence factors and psychological factors about CRC and CRC screening. Most items were based on the health belief model and the preventive health model for CRC screening (Becker et al., 1977; Eddy et al., 1987; Myers et al., 1990; Slattery, Edwards, Ma, & Friedman, 2000). The questionnaire was translated from English to Spanish for participants who preferred answering in Spanish. The translations were performed by fluent Spanish-speaking research assistants who worked on the project. Back-translations were not blind, and were made only as a check. The questionnaire was pilot-tested on a similar sample and revised before the data collection for this study. More specifically, the following factors were assessed.

CRC Screening Behavior

Participants were asked to indicate which type of CRC screening they had undergone, if any (i.e., FOBT, FS, colonoscopy, or DCBE), how many times they had been screened with each type of test, and the year of their most recent test.

Social Influence Factors

Respondents were asked whether their physician or health care provider had recommended CRC screening (yes/no), whether they had heard media coverage about CRC and CRC screening (yes/no), and whether friends or family members encouraged them to be screened for cancer (yes/no).

Psychological Factors

Perceived vulnerability was assessed with two five-point Likert scales ranging from 1 (strongly disagree) to 5 (strongly agree) measuring respondents' perceived likelihood of developing CRC and the frequency with which they think about CRC.

Perceived efficacy of screening was assessed with three ten-point Likert scales ranging from 1 (not at all) to 10 (extremely) measuring respondents' confidence in its ability to detect CRC, their confidence in its ability to prevent CRC, and their confidence that, if CRC were found early, it could be cured.

Self-efficacy for CRC screening was assessed with two five-point Likert scales ranging from 1 (strongly disagree) to 5 (strongly agree) measuring respondents' confidence in their ability to prevent themselves from getting CRC, and their confidence in their ability to obtain a CRC screening test if they wanted one. Barriers to CRC screening were assessed by asking respondents to indicate (yes/no) among 14 reasons, the ones they believed could prevent a person from being screened for CRC (fear of finding cancer, embarrassment/shame, discomfort with physicians, not knowing the importance, getting time off work, transportation difficulties, not knowing where to go, believing that CRC is not preventable, being too busy, not wanting to know, not liking medical tests, invasiveness of procedure, seems painful, and other).

Statistical Analysis

Statistical analysis of the data was performed in several stages. First, we tested for demographic differences between the three ethnic groups. Second, we examined the descriptive statistics for the screening behaviors and social and psychological factors, and the inter-correlations among all the variables. Then, we performed a hierarchical logistic regression to examine the impact of ethnicity, social influence factors, and psychological factors on the dependent variables, while controlling for demographics. We entered in the first step demographic variables we wanted to control for: those on which the three ethnic groups differed significantly, as well as gender and family history of CRC, since the literature has shown that these two factors predict CRC screening (Eloubeidi, Wallace, Desmond, & Farraye, 2003; Fuchs et al., 1994; St John et al., 1993; Wardle, Miles, & Atkin, 2005). In the second step, we entered ethnicity, which was dummy-coded so that the three groups could be compared. This required the logistic regression to be performed twice; once to compare European Americans to African Americans and European Americans to Mexican Americans, and once to compare African Americans and Mexican Americans. We used the Centers for Disease Control (CDC) guidelines to define screening within the recommended time.

RESULTS

Participants

One hundred fifty-eight randomly selected participants completed the questionnaire (51.3% female). Their mean age was 60.99 (SD = 9.44), and the age range was from 50 to 88. The goal was to recruit 50 people (25 men and 25 women) from each ethnic group. Of the participants, 31.6% reported their ethnicity as European American (N = 50), 31.6% identified themselves as Mexican American/Latino (N = 50), and 36.7% as African American (N = 58). Also, 24.7% of the participants spoke Spanish as their first language, and of those who were immigrants (N = 40) the mean number of years in the United States was 26.45 (SD = 17.27). Fifty-three percent of the participants were married, and 43.7% were employed (32.3% were retired). Their mean level of education was 12.12 years (SD = 3.72), which corresponds to high school graduate, and 63.3% of the sample had a family income under $30,000.

Demographic Differences

We checked for demographic differences between the three ethnic groups (see Table 1). The groups did not differ in gender [χ^2 (2, N = 158) = .82, ns], marital status [χ^2 (6, N = 158) = 5.31, ns], or employment [χ^2 (2, N = 158) = 2.24, ns]. The income level varied across the groups [χ^2 (2, N = 158) = 21.13, P < .001, Kruskal-Wallis test]: European Americans reported significantly higher incomes than African Americans (Z = 2.02, P < .05, Mann-Whitney test) and Mexican Americans (Z = 4.64, P < .001). African Americans reported significantly higher incomes than Mexican Americans (Z = 2.68, P < .008). The ethnic groups differed in their levels of education as well [F (2, 155) = 29.44, P < .0001]: Mexican Americans had significantly lower levels of education than both European Americans (P < .05) and African Americans (P < .05). Moreover, health insurance status varied across ethnic groups [χ^2 (2, N = 158) = 27.65, P < .00001]: European Americans (P < .00001) and African Americans (P < .0007) were more likely to have health insurance than Mexican Americans. European Americans also were more likely to have health insurance than African Americans (P < .05). Finally, age varied as a function of ethnicity [F (2, 155) = 3.41, P < .04]: European Americans were significantly older than Mexican Americans (P < .05). Five percent of the sample (5 European Americans and

TABLE 1. Demographic Means (SD) or Percentages for Each Ethnic Group

N = 158	European Americans (N = 50)	African Americans (N = 58)	Mexican Americans (N = 50)
Gender			
Male	54.0%	46.6%	46.0%
Female	46.0%	53.4%	54.0%
Age*	62.66	61.97	58.18
	(9.20)	(10.18)	(8.27)
Education***	14.06	12.83	9.36
	(2.37)	(2.26)	(4.54)
Income**			
< $10,000	18.0%	29.3%	36.0%
$10,000-$29,999	22.0%	29.3%	56.0%
$30,000-$59,999	44.0%	32.8%	8.0%
$60,000-$89,999	8.0%	6.9%	0.0%
≥ $90,000	8.0%	1.7%	0.0%
Health insurance***	94.0%	81.0%	50.0%
CRC family history	10.0%	5.2%	0.0%
Marital status			
Single	32.0%	27.6%	16.0%
Married	48.0%	48.3%	64.0%
Widowed	10.0%	10.3%	12.0%
Divorced	10.0%	13.8%	8.0%
Employment			
Employed	42.0%	37.9%	52.0%
Not employed	58.0%	62.1%	48.0%

*$P < .05$, **$P < .01$, ***$P < .001$.

3 African Americans) reported a family history of CRC. Fisher's exact tests indicated that the differences among the ethnic groups were not significant (P > .05).

CRC Screening Behavior

Of the entire sample, 8.9% reported an FOBT within the past year, 11.4% reported a FS within the past 5 years, 15.2% reported a colonoscopy within 10 years, and 5.1% reported a DCBE within the past 5 years. Overall, 27.2% reported at least one screening test within the recommended time. Of those who were screened within the recommended time (N = 43), 32.6% had an FOBT, 41.9% had an FS, 55.8% had a colonoscopy, and 18.6% had a DCBE. Sixty-seven percent of

those tested within the recommended time underwent one test, 20.9% received two tests, and 11.7% received three or four tests within the recommended time.

We assessed ethnic differences for the overall screening rates, and for each specific screening method, within the recommended times (see Table 2). There were significant differences among ethnic groups on overall screening within the recommended time [χ^2 (2, N = 158) = 22.70, P < .00002]. African Americans [24.1%, χ^2 (1, N = 108) = 7.78, P < .006] and Mexican Americans [8.0%, χ^2 (1, N = 100) = 21.42, P < .00001] were significantly less likely to be screened than European Americans (50.0%). Mexican Americans were significantly less likely to be screened than African Americans [χ^2 (1, N = 108) = 5.04, P < .03].

There were also significant differences among the ethnic groups on FOBT screening [χ^2 (2, N = 158) = 8.36, P < .02], FS screening [χ^2 (2, N = 158) = 6.44, P < .04], and colonoscopy [χ^2 (2, N = 158) = 8.06, P < .02] (see Table 2). Mexican Americans were significantly less likely to have been screened with FOBT [χ^2 (1, N = 100) = 7.11, P < .008], and FS [χ^2 (1, N = 100) = 6.06, P < .02] than European Americans and less likely to have a colonoscopy than both European Americans [χ^2 (1, N = 100) = 8.31, P < .004] and African Americans [χ^2 (1, N = 108) = 4.77, P < .03]. African Americans tended to be less likely than European Americans to have had an FOBT [χ^2 (1, N= 108) = 3.13, P < .08]. There were no significant differences between ethnic groups in screening with the DCBE [χ^2 (2, N = 158) = .21, ns].

Social Influence Factors

Seventy-seven percent of the sample saw a health practitioner within one year prior to the survey. Ninety-three percent visited a health care giver within five years prior to the survey. Although, according to the

TABLE 2. Overall Screening Rates with Each Method Within the Recommended Time for Each Ethnic Group

N = 158	European Americans	African Americans	Mexican Americans
FOBT (N = 14)	18.0%$_a$	6.9%	2.0%$_a$
FS (N = 18)	20.0%$_b$	10.3%	4.0%$_b$
Colonoscopy (N = 24)	24.0%$_c$	17.2 %$_d$	4.0%$_{c\ d}$
DCBE (N = 8)	6.0%	5.2%	4.0%

Note: Percentages sharing a same subscript differ statistically at $P < .01$ ($_a$ & $_c$) or at $P < .05$ ($_b$ & $_d$).

CDC guidelines, CRC screening would be recommended for the entire sample, only 43.0% of respondents stated that their physician had recommended that they be screened. Yet, 67.7% reported that they had heard media coverage related to CRC screening. Finally, 54.4% of the participants reported being encouraged by friends or family to be screened for cancer.

Psychological Factors

Perceived Vulnerability

The mean response of the perceived likelihood of developing CRC was 1.92 (SD = 1.13); the mean response to how often they think about CRC was 1.87 (SD = 1.33). These two items were positively correlated ($r = .48$, $P < .001$) and were averaged into an index of "perceived vulnerability" for further analyses. This index ranged from 1 (low vulnerability), to 5 (high vulnerability), with a mean of 1.90 (SD = 1.06).

Perceived Efficacy of Screening

Participants were more confident about the ability of CRC screening to detect CRC (M = 6.82; SD = 3.18), than to prevent CRC (M = 5.91; SD = 3.55; $T = 4.23$, $P < .001$) or to cure CRC if it is found early (M = 6.28; SD = 3.57; $T = 2.76$, $P < .008$). The difference between the ratings for the ability of screening to prevent or cure CRC was not significant ($T = 1.78$, $P < .08$). These three items were averaged into an index of "perceived efficacy of screening" for further analyses. The internal consistency of this index was satisfactory (Cronbach's $\alpha = .88$) and the index ranged from 1 (low efficacy), to 10 (high efficacy), with a mean of 6.34 (SD = 3.09).

Self-Efficacy for Screening

The mean response of the respondents' confidence in their ability to prevent themselves from getting CRC was 3.28 (SD = 1.46); the mean response for their confidence in their ability to obtain a CRC screening test if they wanted one was 4.22 (SD = 1.23). These two items were positively correlated ($r = .41$, $P < .001$) and were averaged into an index of "self-efficacy for screening" for further analyses. The index ranged from 1 (low self-efficacy) to 5 (high self-efficacy). The mean of the responses was 3.77 (SD = 1.13).

Perceived Barriers

When participants were asked which factors they believed could prevent a person from being screened, "fear of finding cancer" (81.0%), "not knowing it was important" (75.3%), and "seems painful" (72.8%) were listed by about two-thirds of the sample. The least frequently reported factors were "transportation difficulties" (40.5%), "discomfort with physicians" (50.6%), and "getting time off from work" (51.9%); nonetheless, all factors (except other barriers, reported by 10.1% of the sample) were listed by at least 40% of the sample ("not knowing where to go," 58.2%; "belief that it is not preventable," 55.1%; "being too busy," 58.2%; "didn't want to know," 64.6%; "don't like medical tests," 68.4%; "invasiveness of procedure," 69.0%; "embarrassment/shame," 63.3%). We calculated an index of "total barriers perceived," which was the sum of all the barriers reported for each participant. This index ranged from 0 to 14. Participants reported an average of 8.19 barriers (SD = 3.67).

Intercorrelations

Table 3 shows the inter-correlations among demographic variables, family history of CRC, social influence factors, psychological factors, and CRC overall screening within the recommended time. Several demographic variables were correlated with each other. Health insurance was associated with age ($r = .33$, $P < .001$), income ($r = .23$, $P < .004$), and education ($r = .21$, $P < .01$): older people, people with higher incomes, and people with higher education, were more likely to have health insurance. Also, younger people ($r = -.16$, $P < .05$) and participants with more education ($r = .34$, $P < .001$) reported higher incomes. Ethnicity was associated with age, education, income, and health insurance, as described above. Women ($r = .23$, $P < .005$) and people with higher incomes ($r = .21$, $P < .008$) were more likely to report a family history of CRC than their counterparts. Being Mexican American was associated with a lower probability of having a family history of CRC ($r = -.16$, $P < .05$).

People with higher incomes ($r = .26$, $P < .002$) and people with a family history of CRC ($r = .16$, $P < .05$) were more likely to have heard media coverage of CRC. People with higher education ($r = .17$, $P < .04$) or higher incomes ($r = .27$, $P < .002$), and people with health insurance ($r = .23$, $P < .005$) were more likely to get a doctor's recommendation for CRC than their counterparts. Ethnicity was also associated with

TABLE 3. Intercorrelations Among Demographic Variables, Family History of CRC, Social Influence Factors, Psychological Factors, and Overall Screening Within Recommended Time

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. Gender	–															
2. Age	−.07	–														
3. Education	.05	−.05	–													
4. Income	−.06	−.16*	.34***	–												
5. Insurance	.06	.33***	.21**	.23**	–											
6. History	.23**	−.02	.09	.21**	−.00	–										
7. African	.03	.08	.15	.02	.10	.00	–									
8. Mexican	.04	−.20*	−.51***	−.33***	−.40***	−.16*	–	–								
9. European	−.07	.12	.36***	.31***	.29***	.15	–	–	–							
10. Media	.11	.02	−.02	.26**	.08	.16*	−.09	−.03	.12	–						
11. Physician	−.02	.03	.17*	.27**	.23**	.15	−.03	−.21**	.23**	.35***	–					
12. Family	.05	−.07	.03	.20*	.18*	.10	−.04	−.12	.16	.13	.41***	–				
13. Vulnerability	−.02	.01	−.22**	−.12	.01	−.02	.03	.02	−.04	.03	.06	.20*	–			
14. Efficacy	.07	−.00	−.01	−.01	−.10	.05	−.03	−.00	.03	.15	.15	.08	.33***	–		
15. Self-efficacy	.04	.07	−.24	.02	−.05	.12	.02	.00	−.03	.22**	.18	.15	.15	.25**	–	
16. Barriers	.17	−.03	−.09	−.07	−.03	−.02	.03	.08	−.11	.06	−.01	−.08	.03	−.09	.16*	–
17. Screening	.03	.17*	.25**	.07	.25**	.18*	−.05	−.29***	.35	.12	.45***	.25**	.19*	.30***	.11	−.09

*$P < .05$, **$P < .01$, ***$P < .001$.

physicians' recommendations. European Americans were more likely to have had CRC screening recommended by their physicians than both minority groups ($r = .23$, $P < .004$), and Mexican Americans were less likely to have been recommended for CRC screening than the other two groups ($r = -.21$, $P < .01$). People with higher incomes ($r = .20$, $P < .02$), and people with health insurance ($r = .18$, $P < .03$) were also more likely to be encouraged by their family/friends to get cancer screening than their counterparts. Receiving a doctor's recommendation for CRC was also positively associated with receiving encouragement from their family/friends ($r = .41$, $P < .001$).

More educated participants reported lower perceived vulnerability to CRC ($r = -.22$, $P < .006$) and lower self-efficacy for CRC ($r = -.24$, $P < .003$). Having heard media coverage ($r = .22$, $P < .007$) and having received a physician's recommendation for CRC ($r = .18$, $P < .03$) were both associated with greater self-efficacy. People who were encouraged by their family/friends to get cancer screening also reported greater perceived vulnerability to CRC ($r = .20$, $P < .02$). The more participants perceived CRC screening as efficacious, the more they felt vulnerable to CRC ($r = .33$, $P < .001$) and the more they reported self-efficacy ($r = .25$, $P < .003$). Women reported a greater number of barriers to CRC screening than men ($r = .17$, $P < .04$) and there was a positive correlation between self-efficacy and the number of barriers reported ($r = .16$, $P < .05$).

In addition, people who were older ($r = .17$, $P < .04$), who had higher education ($r = .25$, $P < .003$), who had health insurance ($r = .25$, $P < .002$), or who had a family history of CRC ($r = .19$, $P < .03$) were more likely to be screened for CRC within the recommended time than their counterparts. Ethnicity was also associated with screening, as described above. People who received a physician's recommendation ($r = .45$, $P < .001$) or who were encouraged by their family/friends ($r = .25$, $P < .003$) were more likely to report screening. Finally, participants who perceived greater vulnerability to CRC ($r = .19$, $P < .02$) or who perceived CRC screening as more efficacious ($r = .30$, $P < .001$), were more likely to have been screened for CRC.

Social and Psychological Factors That Predict CRC Screening

We performed a logistic regression to determine the influence of ethnicity, as well as of the social and psychological factors examined

previously, on CRC overall screening within the recommended time, while controlling for the demographic variables. In the first step, we entered gender, age, education, income, health insurance, and family history of CRC. In the second step, ethnicity was entered. In the third step, we entered the social influence factors, and in the fourth step, the indices of perceived vulnerability, perceived efficacy of screening, self-efficacy for screening, and the total number of barriers reported (see Table 4).

TABLE 4. Logistic Coefficients, Partial Correlations, Odds Ratios, and P Levels for CRC Screening

Variable	Coefficient	R	Odds Ratio	*P*	Change in χ^2
First step					
Gender	−.189	.000	.828	.646	$\chi^2 = 27.42$, $P < .0002$
Age	.024	.000	1.024	.267	
Education	.194	.006	1.214	.006	
Income	−.188	.000	.828	.388	
Health insurance	1.654	.140	5.227	.018	
Family history of CRC	1.952	.123	7.042	.028	
Second step					
Gender	−.040	.000	.961	.926	$\chi^2 = 7.17$, $P < .03$
Age	.015	.000	1.015	.520	
Education	.128	.066	1.136	.102	
Income	−.295	.000	.744	.188	
Health insurance	1.337	.090	3.806	.071	
Family history of CRC	1.628	.083	5.094	.079	
African versus European American	−.955	−.125	.385	.035	
Mexican versus European American	−1.60	−.143	.201	.022	
African versus Mexican American*	−.648	.000	.523	.328	
Third step					
Gender	.169	.000	1.184	.725	$\chi^2 = 24.04$, $P < .0001$
Age	.033	.000	1.034	.225	
Education	.129	.052	1.138	.121	
Income	−.483	−.089	.617	.074	
Health insurance	.626	.000	1.870	.454	
Family history of CRC	1.268	−.000	3.552	.215	
African versus European American	−1.017	−.114	.362	.047	
Mexican versus European American	−1.593	−.124	.203	.038	

Variable	Coefficient	R	Odds Ratio	*P*	Change in χ^2
African versus Mexican American	−.576	.000	.562	.426	
Media coverage	−.274	.000	.761	.637	
Physician's recommendation	2.189	.283	8.920	.000	
Family encourage screening	.343	.000	1.410	.517	
Fourth step					
Gender	.259	.000	1.296	.647	$\chi^2 = 20.83$, $P < .0004$
Age	.029	.000	1.030	.326	
Education	.182	.119	1.199	.051	
Income	−.374	.000	.688	.210	
Health insurance	1.242	.000	3.462	.184	
Family history of CRC	1.253	−.000	3.499	.333	
African versus European American	−1.442	−.170	.237	.017	
Mexican versus European American	−1.552	−.106	.212	.065	
African versus Mexican American	−.110	.000	.896	.893	
Media coverage	−.582	.000	.559	.379	
Physician's recommendation	2.439	.299	11.466	.000	
Family encourage screening	.057	.000	1.059	.926	
Perceived vulnerability	.484	.093	1.622	.079	
Perceived efficacy of screening	.304	.218	1.355	.005	
Self-efficacy for screening	.400	.000	1.492	.184	
Perceived barriers	−.094	.000	.911	.219	

*Although the comparisons between the three ethnic groups were tested in two separate logistic regressions, we report them in the same table.

The overall model was significant [χ^2 (15, N = 158) = 79.46, P < .0001]. The demographic variables entered in the first step contributed significantly to the model [χ^2 (6, N = 158) = 27.42, P < .0002]. Education, health insurance, and family history significantly predicted overall screening within the recommended time in that step: people with a family history of CRC were seven times more likely to get screened than people without such a history. The odds ratio (OR) = 7.04, 95% CI = 5.30 to 8.79, P < .03; people with health insurance were five times more likely to get screened than people without insurance (OR = 5.23, 95% CI = 3.85 to 6.60, P < .02); and for each additional year of education, the likelihood of being screened increased by 1.21 times (95% CI = 1.08 to 1.35, P < .007).

Adding ethnicity in the second step led to a significant change in χ^2 [χ^2 (2, N = 158) = 7.17, P < .03]. European Americans were nearly five

times as likely to get screened as Mexican Americans (OR = 4.97, 95% CI = 3.59 to 6.35, P < .03) and 2.60 times more likely to be screened than African Americans (CI = 1.71 to 3.49, P < .04). There was no significant difference between Mexican Americans and African Americans. When ethnicity was entered in the equation, health insurance, education, and family history were no longer significant predictors.

Adding the social variables in the third step led to a significant change in χ^2 [χ^2 (3, N = 158) = 24.04, P < .0001]. A physician's recommendation for CRC screening was a significant predictor for screening: participants who received a doctor's recommendation were almost nine times as likely to be screened as participants who did not receive a recommendation (OR = 8.92, 95% CI = 7.78 to 10.06, P < .0003). When the social variables were entered in the equation, the differences between European Americans and African Americans (OR = 2.76, 95% CI = 1.76 to 3.77, P < .05) or Mexican Americans remained significant (OR = 4.92, 95% CI = 3.41 to 6.42, P < .04). In that step, no other variables were significant predictors.

In the final step of the regression, we entered the psychological variables, which led to a significant change in χ^2 [χ^2 (4, N = 158) = 20.83, P < .0004]. The perceived efficacy of screening was a significant predictor of screening: participants who perceived greater efficacy of screening were more likely to have been screened than those who perceived lower efficacy of screening (OR = 1.35, 95% CI = 1.14 to 1.57, P < .005). Perceived vulnerability was not a significant factor; however, there was a slightly greater likelihood that those who reported greater vulnerability to CRC had been screened (OR = 1.62, 95% CI = 1.08 to 2.16, P < .08). When the psychological variables were entered in the equation, the difference between African Americans and European Americans remained significant (OR = 4.23, 95% CI = 3.04 to 5.42, P < .02), but the difference between Mexican Americans and European Americans was reduced (OR = 4.72, 95% CI = 3.07 to 6.37, P < .07). Finally, a physician's recommendation remained a significant predictor of screening (OR = 11.47, 95% CI = 10.15 to 12.78, P < .0004).

DISCUSSION

In our study, screening rates were lower than they were in the national data. The overall percentage of our sample that had been screened within the recommended time was 27.2% as opposed to 42.5% at the national level for year 2000 (Centers for Disease Control and Prevention,

2004-2005). The results indicated that there were ethnic differences in CRC screening rates among low-income individuals. The overall rate for screening for CRC within the recommended time for European Americans was 50%. The screening rates for African Americans and Mexican Americans were 24.1 and 8.0%, respectively. These results are in agreement with national data indicating ethnic disparities in CRC screening (American Cancer Society, 2002, 2001; Winawer et al., 2003). Our sample had lower FOBT rates than the national sample for European Americans (18% vs. 24.1%), African Americans (6.9% vs. 21.6%), and Mexican Americans (2% vs. 15.4%) (American Cancer Society, 2004). One reason that we observed lower screening rates than those in the national data may be that we recruited a low-income group. One study that included large numbers of participants indicated that socioeconomic factors, such as low educational attainment, limited or no health insurance, negligible use of preventive services, or lack of access to a usual source of care, were associated with lower utilization of CRC screening (Cokkinides, Chao, Smith, Vernon, & Thun, 2003). All of these data indicate that more action is needed to increase CRC screening rates, particularly those of low-income African Americans and Mexican Americans.

It is interesting to note that only 9% of the participants had received the least expensive CRC screening test (FOBT) within the recommended time. Participants were more likely to report being screened with the more expensive and more invasive procedures. Of those who were screened within the recommended time, only one-third had an FOBT, and more than half received a colonoscopy. It is possible that people did not understand the differences among the screening tests and just reported the test they were more familiar with. However, before giving participants the questionnaire to complete, the research assistant explained each screening test, using a standardized format. Another reason might be that physicians recommend more comprehensive screening methods. One-third of those who had been screened received two or more tests, and all but one participant who reported an FOBT also reported another test.

An important goal of our study was to understand the nature of ethnic differences in CRC screening. Ethnic categories in the American society coincide with other demographic divisions: as illustrated in our study, ethnic groups differ in their access to education, in income, and in ability to afford health insurance. Lower education, lower income, and lack of health insurance could easily account for health disparities among ethnic groups, in particular in access to CRC screening. It is very interesting to note that in our study, ethnic disparities in CRC screening rates

remained, even after controlling for the demographic variables that are known to be important predictors of CRC screening. In other words, ethnic differences cannot be accounted for by differences in incomes, education, or health insurance, as one might have thought.

Because of all the intercorrelations among demographics, social influence factors, and psychological factors, it was essential to tease apart the specific contributions of each variable in predicting CRC screening. Our study allows us to exclude social influence factors as potential mediators: access to the media, physicians' recommendations, or encouragement from family and friends, do not seem to explain why ethnic groups have different screening rates. Although the number of physicians' recommendations varied between ethnic groups, the effect of ethnicity remained significant when this social influence factor was entered in the regression. It is interesting to note that when psychological factors were entered in the logistic regression, the difference in screening rates between European Americans and Mexican Americans was reduced. This suggests that beliefs about one's vulnerability and, most of all, the perceived efficacy of screening, may account for the differences in screening rates for these two ethnic groups. In other words, the particularly low screening rates that characterize Mexican Americans could be in part attributed to a greater tendency to believe that CRC screening lacks efficacy and that one is not at risk for CRC.

Clearly multiple factors affect the decision to undergo CRC screening. Recommendation from a physician has been one of the strongest correlates of CRC screening (Brenes & Paskett, 2000; Codori, Peterson, Miglioretti, & Boyd, 2001; Friedman, Webb, Richards, & Plon, 1999; Holt, 1991; Myers et al., 1990; Thomas & Clarke, 1998). However, although most physicians would endorse the use of CRC screening, the number of physicians who actually recommend and/or perform the screening procedures is quite low (Cooper, Fortinsky, Hapke, & Landefeld, 1997; Friedman et al., 1999; Myers et al., 1990; Sandler, Holland, Brooks, Konrad, & Guild, 1989; Schoen, Weissfeld, & Kuller, 1995; Weitzman, Zapka, Estabrook, & Goins, 2001). In our study all of the participants were within the age group for which CRC screening is recommended, but only 43% reported that their physician recommended screening. This low percentage cannot be attributed to an absence of visits to a health care practitioner; 93% of the sample had seen a health care provider within 5 years before the survey. Even when controlling for all other variables, a physician's recommendation was the strongest predictor of screening within the recommended time. Participants who received such a recommendation were more than 11 times more

likely to get screened than people who did not get a recommendation. Intervening with physicians to increase the number of recommendations appears to be an important and plausible strategy to increase screening rates. Such efforts have already been successful (Myers et al., 2004; Wei, Ryan, Dietrich, & Colditz, 2005).

It is important to point out that the percentage of participants who reported visiting health practitioners was 77%; this is higher than might be expected from a low-income population. However, the mean age of the participants' was below the typical retirement age. Forty-four percent of the sample was still employed and they may have had health care coverage through their employment. In addition, it is quite possible that our older participants had access to Medicare. It could be also that participants did not accurately recall their last visit to the doctor and that their last visit had occurred more than 1 year ago. Another possibility is that some participants reported seeing a doctor at least once in the past year so that they appeared to care about their health.

Media reports also would be expected to influence the probability of being screened. Almost 68% reported hearing media coverage related to CRC screening, and hearing media coverage was associated with greater self-efficacy in screening. However, hearing this coverage was not a significant predictor of screening. It is possible that messages in the media need to be made more effective, for example by improving the way they are framed, in order to change behavior.

The advice of family and friends was predicted to influence screening. Over half of the participants reported being encouraged by friends and family to be screened for cancer. This factor was associated with greater perceived vulnerability to CRC, and increased self-efficacy about CRC screening. Encouragement from friends and family to get screened was also significantly correlated to screening, but it was not a significant predictor when entered in the logistic regression.

Participants across ethnic groups thought that they were at low risk of developing CRC. Their perception of CRC screening efficacy was above the mean, as was their level of self-efficacy. The more they felt at risk, and the more they saw CRC screening as efficacious, the more likely they were to be screened. When all the variables were entered in the logistic regression, perceived efficacy of screening was a strong predictor of CRC screening. Perceived vulnerability had only a marginal impact on screening. This suggests that, along with making people more aware of their risks of developing CRC, altering their belief about the effectiveness of the CRC tests, not just in detecting, but also in preventing and curing CRC, is crucial to motivate individuals to engage in screening.

The mean number of barriers endorsed was 8 out of 14. Thus, most low-income people perceive several barriers to screening. The more barriers people reported in our study, the less confidence they reported in their ability to obtain screening for CRC. However, the perception of barriers did not affect actual screening rates. The lack of effect might be because we did not assess the barriers that the participants personally experienced, but rather what they thought people in general might be exposed to. It is possible that learning more about the barriers that people directly experience, and addressing them in interventions, might further increase CRC screening rates. Our data suggest that the majority of participants could benefit both from addressing psychological barriers (especially fear of finding cancer and the potential pain associated with screening procedures) and from increasing knowledge about the importance of screening and the ability of screening to prevent cancer.

Our results indicated that ethnicity, physician's recommendation, and perceived efficacy of screening were all predictors of screening in the final model. Education and participants' perception of their vulnerability to developing CRC were marginally significant in the last step of the regression. We believe that interventions should be developed and tested in future research to determine whether people from different ethnic groups respond differently to interventions. The interventions should provide information about the benefits of screening to increase people's knowledge about how the screening procedures are linked to prevention of CRC. In addition, the materials developed for interventions need to be written and/or presented at a level that can be understood by people from all educational backgrounds. We also need to be sure that people understand the risk factors and methods for preventing CRC so that modifiable behaviors can be changed. Finally, our data confirm that the most important predictor of CRC is a physicians' recommendation for screening. If we are to increase national screening rates for CRC, we need to intervene with both patients and physicians. Physicians need to be taught the importance of their recommendations for patients' behavior. Interventions for getting physicians to increase the frequency with which they recommend CRC screening should be developed and tested.

Several limitations to our study should be noted. The first limitation is the relatively small sample size. Although we had enough participants to detect ethnic disparities in screening rates, many of the correlations were small, despite being statistically significant. Thus the relationships between the variables tended to be stable but weak.

Another limitation is that we did not assess the reason for obtaining CRC screening (e.g., as a routine exam or as a follow-up for symptoms); therefore we were not able to distinguish between diagnostic tests and screening tests. Because of that, our estimates may overestimate the use of CRC tests as detection practices. Finally, our study was limited in its ability to test for causal relations in predicting CRC screening: we sought to predict past screening behavior with social influence and psychological factors that might have been influenced by the screening behavior. Despite these limitations, our study highlights the complex nature of ethnic disparities in CRC screening and indicates a need for more research in that area.

In sum, this study revealed strong ethnic disparities in CRC screening rates among low-income participants. Rates were especially low for African Americans and Mexican Americans. Ethnic disparities remained after controlling for demographic variables. Physicians' recommendations and the perceived efficacy of screening were strong predictors of CRC screening. Psychological factors, particularly perceived efficacy of screening accounted in part for differences in screening rates between European Americans and Mexican Americans.

More research is needed to further investigate the nature of ethnic disparities in screening rates. If the occurrence of CRC is to be reduced, effective behavioral interventions should be developed for both people in the community and for physicians. We need to consider the role of ethnicity and test interventions that are culturally sensitive in an attempt to reduce the disparities in CRC screening. The kinds of barriers to screening may be different for people from different ethnic groups. The interventions need to focus on the efficacy of CRC screening tests and on increasing patients' perceived vulnerability to CRC. Finally, future research is necessary to determine whether different interventions for each ethnic group are superior to a single intervention for all groups.

IMPLICATIONS FOR CLINICAL PRACTICE

The findings from this study indicate that it is imperative for physicians to recommend screening for CRC to all of their patients 50 years of age or older. It is particularly important for low-income patients and those from underrepresented ethnic groups. Health care providers could provide their patients with information about the importance of screening and the value of early detection.

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