Factors Associated with Racial/Ethnic Differences in Colorectal Cancer Screening

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Introduction: **Racial/ethnic differences in colorectal cancer (CRC) screening rates are thought to account, in part, for the racial/ethnic differences in CRC disease burden. The purpose of this study was to examine which factors mediate racial/ethnic differences in CRC screening.**

Methods: **Five hundred sixty participants attending a primary care clinic, aged 50 to 80 years, and of African-American, Hispanic, or non-Hispanic white race/ethnicity were interviewed. The goal was to assess the contribution of sociodemographic characteristics, knowledge, beliefs about CRC, and the health care experience with their primary care doctor to racial/ethnic differences in CRC screening. The outcome variable was self-reported screening. All analyses were weighted; bivariate testing and multivariate logistic regression was conducted.**

Results: **The response rate was 55.7%, with no sociodemographic differences noted between respondents and nonrespondents. Respondents were African-American (n = 194), Hispanic (n = 162), and non-Hispanic white (n = 204); 64.5% were aged 50 to 64 years; 63.1% were women; 96.9% were insured; and over half reported a total annual income of less than $25,000. Overall 62.5% were current with CRC screening: 67.5% of non-Hispanic whites, 54.3% of African-Americans, and 48.6% of Hispanics ($P < .001$). A doctor's recommendation (odds ratio, 3.86); awareness of screening (odds ratio, 3.32); older age (odds ratio, 2.88); greater education (odds ratio, 2.02); and perceived susceptibility (odds ratio, 1.74) contributed to racial/ethnic differences in CRC screening.**

Conclusions: **Interventions to address CRC screening disparities among racial/ethnic groups should focus on the health care setting and patient education about CRC screening; differences in attitudes and beliefs seem to be less important. (J Am Board Fam Med 2008;21:414–426.)**

Colorectal cancer (CRC) is the second leading cause of cancer deaths in the United States.[1] The American Cancer Society anticipates 148,810 new cases and 49,960 deaths from this disease in 2008.[2] Although CRC affects all segments of the population, minority groups experience a greater burden of disease, with the highest incidence and mortality occurring among African-Americans.[1] CRC screening facilitates early detection and treatment and has resulted in a reduction in CRC incidence and mortality; it is therefore widely recommended for people aged 50 and older.[3–8]

However, despite the evidence and recommendations, screening rates remain low[9–23] and are consistently lower in minority groups.[9,11,12,20–24] To understand low screening rates, investigators have examined the association between CRC screening and a multitude of factors including demographics, health care access, knowledge, attitudes and beliefs, medical history, and other preventive behaviors.[11–13,15,18–20,22–38] Studies and interventions focusing on disparities in CRC screening have tended to focus on a single racial/ethnic group[39–43] and have shown mixed results. There remains a need for studies that examine a wide array of factors simultaneously in diverse multiethnic populations and that compare associations across racial/ethnic groups to determine which underlying factors explain the differences in CRC screening across groups.

The information gained will guide interventions designed to reduce racial/ethnic disparities in CRC screening. The purpose of the present study, therefore, was to (1) simultaneously examine the association between a wide range of vari-

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ables and CRC screening in a multiethnic population of African-American, Hispanic, and non-Hispanic white participants attending a primary care clinic, and (2) to determine the contribution of these factors to racial/ethnic differences in CRC screening.

Methods

Patients and Setting

Patients were recruited from a University-based family medicine clinic in Southeast Texas during a 16-month period in 2004 and 2005. Although surveys conducted over large scale regions offer information about a larger population, a primary care setting was chosen as the site for this study because multiple topics could be handled in-depth and most CRC screening delivery is initiated in outpatient primary care settings.

The clinic serves a diverse mix of racial/ethnic groups from both urban and semirural areas; there is an excess of 40, 000 visits per year. The racial/ethnic distribution of patients over the age of 50 years is 66% non-Hispanic white, 24% African-American, and 10% Hispanic. More than 90% are insured. To be eligible, patients had to be 50 to 80 years of age and of non-Hispanic white, African-American, or Hispanic race/ethnicity. Individuals with a history of CRC or high risk of CRC (familial adenomatous polyposis syndrome, hereditary nonpolyposis CRC, or ulcerative colitis) were excluded.

A stratified sampling scheme, balanced by race/ethnicity; age (<65, ≥ 65); and sex was instituted to increase the statistical power for comparisons across racial/ethnic groups and the older age group. Interviewers recruited patients for each stratum until the target number was reached. Interviewers were bilingual (Spanish and English). Interviewers approached patients attending the clinic for any reason and invited them to participate in the study. The study was approved by the University of Texas Medical Branch Institutional Review Board and informed written consent was obtained from each patient. Interviews were conducted in a private room around the time of the doctor visit and lasted approximately 45 minutes.

Survey Development

Variables were chosen for inclusion in the study if they had been correlated with CRC screening in previous studies or were found to be important in our previous qualitative work in the same population[44] and if they were relevant for the practice setting. Items were developed to be culturally and linguistically appropriate, and a Spanish language version of the items was developed using standard methods.[45] The final instrument consisted of items organized into the following categories: (1) sociodemographic characteristics, (2) knowledge and beliefs about CRC and CRC screening, (3) medical history, and (4) health care experience variables. The outcome variable was self-reported history of CRC screening.

Measures

The outcome variable, self-reported CRC screening, was assessed with validated items adapted from Vernon et al.[46] A detailed description of each test preceded each question; descriptions were pilot tested for comprehension and feedback was incorporated into the final version. Current screening was determined by whether the patient reported that they had undergone any of the recommended tests, for any reason according to guidelines current at the time, as follows: annual home fecal occult blood testing or flexible sigmoidoscopy every 5 years; or annual fecal occult blood testing plus flexible sigmoidoscopy every 5 years; or double contrast barium enema every 5 years; or colonoscopy every 10 years.[6,7] The sociodemographic items were adapted from a national survey[47] and elicited information about the patient's age, educational level, sex, income, and insurance type. Race and ethnicity was self-reported and elicited with a 2-part question consistent with Federal criteria.[48]

A 21-item knowledge test was developed covering CRC prevalence (1 item), symptoms (5 items), risk factors (13 items), screening test availability (1 item), and treatment (1 item). These items were developed de novo based on the findings from prior studies and qualitative interviews in this population.[44,49,50] An additional question assessed awareness of screening. We utilized the Health Belief model to examine attitudes and beliefs about CRC screening because it provides a useful organizing framework for explaining screening behavior.[15,18,27,29–35,50–54] Scales were developed specifically for this multiethnic population and were tested to assess the constructs of perceived susceptibility (4 items), perceived benefits (10 items), and perceived barriers (11 items). All response categories were 3- to 5-point rating scales, ranging from strongly agree to strongly disagree. We included a 15-item fatalism scale because it is recognized as being an additional barrier in minority groups.[55] Medical history items included overall perceived health status, whether there was a family history of CRC in a first-degree relative, and health behaviors such as whether they had ever had an annual health examination or had previous testing for CRC. Health care experience variables included whether patients named a regular primary care doctor, whether they had ever received a doctor recommendation for a CRC screening test, and their satisfaction with their regular doctor or the previous provider, which was assessed with 3 items.[27,29] A summary of the scale measures is included in the Appendix.

Analysis

Descriptive statistics were used to describe patient demographic characteristics, and reliability on the knowledge and belief scales (Cronbach's alpha) was checked. A higher scale score indicated greater perception of that variable, except for perceived barriers, which were reverse coded. Analyses were conducted with weighting to make the sample representative of the clinic population from which it was drawn. We examined the bivariate relationship between potential explanatory variables (socioeconomic factors, knowledge and belief scales, medical history, and health care experience) with both race/ethnicity and CRC screening using χ^2 or analysis of variance as appropriate, and using 2-sided tests and $\alpha = .05$. We then conducted series of nested logistic regression models and the scales were dichotomized at the mean score for ease of interpretation of the odds ratios. The first model included race/ethnicity with age, sex, and education as covariates. A second model evaluated knowledge and beliefs; a third model evaluated health care experience and medical history variables (without the knowledge and belief scales), and a final model included all variables together. For each model the effect of the variables on the odds ratios between race/ethnicity and current CRC screening was ascertained. Statistical analyses were conducted using SAS version 9.1.3 (SAS Institute, Inc., Cary, NC) and SUDAAN version 9.0.1 (Research Triangle Institue, Research Triangle Park, NC).

Results

Demographic characteristics

Of the 1079 eligible patients approached for the study, 133 refused and 344 agreed but could not be scheduled at a mutually convenient time, giving an overall response rate of 55.7%. The first 30 interviews were used for piloting purposes and 12 subsequent surveys were incomplete; this left a total of 560 surveys complete for analysis. Thirty surveys were completed in Spanish. The rate of missing responses was less than 1% for each variable with the exception of income (3%); all missing responses were excluded from analysis. The final sample was 204 non-Hispanic white, 194 African-American, and 162 Hispanic patients, and almost all had health insurance (96.9%). We recruited slightly fewer Hispanics than planned and so we tested for statistical bias and observed no statistical differences between the respondents and nonrespondents by race/ethnicity, age, or sex. Further, the weighted sample was identical in profile to the clinic population aged 50 or older. The sample fell at the low end of the socioeconomic scale, with more than half of respondents reporting a total annual income of less than $25,000 (see Table 1).

Race/Ethnicity and Socioeconomic Factors, Knowledge and Beliefs, Medical History, and Health Care Experience Variables

Race/ethnicity was strongly associated with educational level ($P < .001$) and income ($P < .001$), and educational level and income were associated with each other (rho = .50; $P < .05$). A large percentage (96.9%) of patients had health insurance, no age or sex differences were noted among racial/ethnic subgroups (Table 1).

The knowledge and belief scales showed good reliability (Appendix). Minority groups perceived fewer benefits to screening (mean scores: non-Hispanic whites, 32.82; African-Americans, 31.43; and Hispanics, 30.52; $P < .0001$); were more fatalistic (mean scores: non-Hispanic whites, 18.27; African-Americans, 19.97; and Hispanics, 20.99; $P < .0001$); and had lower knowledge scores compared with non-Hispanic whites (mean scores: non-Hispanic whites, 9.87; African-Americans, 8.24; and Hispanics, 8.39; $P < .0001$). Hispanics, in particular, were least likely to be aware of screening for CRC. There were no racial/ethnic differences in perceived

Table 1. Socioeconomic factors, Knowledge and Beliefs, Medical History, and Health Care Experience Variables and Their Association with Race/Ethnicity

	Total (%)	White (%)	African-American (%)	Hispanic (%)
Sociodemographic variables				
Age				
50–64	64.5	66.7	60.9	58.2
65–80	35.5	33.3	39.1	41.8
Sex				
Female	63.1	61.7	68.4	59.6
Education (yrs)†				
0–11	19.8	12.2	28.4	50.3
12	32.1	32.5	34.1	25.2
≤13	48.1	55.3	37.6	24.5
Income†				
<$15,000	38.5	31.5	53.8	47.9
$15,000–25,000	17.4	17.3	16.8	19.4
$25,000–50,000	19.4	19.7	18.8	18.8
>$50,000	24.7	31.4	10.6	13.9
Insurance type				
Public	27.0	23.9	31.8	35.6
Private	34.5	37.9	26.1	32.0
Mixed	33.5	33.4	37.3	25.6
Other	2.0	2.3	0.8	2.2
None	3.1	2.6	4.0	4.6
Medical history and health care experience				
Health status†				
Good/excellent	66.4	74.3	50.1	53.2
Family history of CRC				
Yes	14.8	16.7	10.5	11.8
Previous testing†				
Yes	55.5	62.4	43.4	38.7
Annual health exam†				
Yes	94.3	96.4	93.3	82.8
Regular PCP				
Yes	91.6	92.8	88.7	90.1
Dr. recommendation*				
Yes	64.0	66.0	64.3	49.9
Doctor satisfaction				
Mean score	11.31	11.37	11.37	11.15
Knowledge				
Awareness of screening†				
Yes	93.4	96.0	90.4	83.1

Statistical testing is for differences in variables across the 3 racial/ethnic groups. CRC, colorectal cancer; PCP, primary care physician.
*Variables that are significantly different amongst racial/ethnic subgroups at $P < .05$.
†$P < .001$.

susceptibility or barriers to CRC screening. Of the medical history and health care experience variables, minority groups reported poorer overall health status, lower rates of previous testing and annual health exams, and receipt of a doctor recommendation for CRC screening (Table 1).

Current CRC Screening and Sociodemographic Variables, Beliefs, Medical History, and Health Care Experience Variables

Overall, 62.5% were current with CRC screening according to recommended guidelines. CRC screening rates were lowest in the minority groups:

Table 2. Prevalence of Current Screening by Test Type and Racial/Ethnic Group

Test Type	Total (%)	White (%)	African American (%)	Hispanic (%)
Any test‡	62.5	67.5	54.3	48.6
FOBT	19.0	18.6	21.8	15.5
FS	12.7	12.9	14.5	6.8
DCBE*	26.5	28.8	24.9	14.6
COL†	42.6	47.5	33.0	32.5

Statistical testing is for differences in variables across the 3 racial/ethnic groups. More than one test type can be reported by each subject. FOBT, fecal occult blood testing; FS, flexible sigmoidosopy; DCBE, double contrast barium enema; COL, colonoscopy.
*Variables that are significantly different amongst racial/ethnic subgroups at $P < .05$.
†$P < .01$.
‡$P < .001$.

67.5% in non-Hispanic whites, 54.3% in African-Americans, and 48.6% in Hispanics ($P < .001$). Colonoscopy was the most prevalent test but was reported least often by African-Americans and Hispanics; double contrast barium enema was reported least often by Hispanics (Table 2).

Older age and non-Hispanic white race/ethnicity were associated with higher rates of current CRC screening in bivariate analyses (Table 3). Of the knowledge and beliefs, fewer perceived barriers ($P < .0001$), less fatalistic attitudes ($P < .05$), and awareness of screening ($P < .001$) were associated with screening. Of the medical history and health care experience variables, having a regular doctor, having annual exams, having a doctor recommendation, and previous testing were all significantly associated with current CRC screening (Table 3).

The first multivariate model tested the effect of race/ethnicity while controlling for other sociodemographic factors (education, age, and sex). Income was excluded from further analyses because of its redundancy with education (rho = .50), and because of missing values (3%). Insurance was excluded because the majority (96.9%) was insured. Minority groups were significantly less likely to be current with screening even after controlling for sociodemographic factors. Furthermore, younger age and lower educational level were also associated with lower screening levels. This suggests that socioeconomic factors do not entirely explain racial/ethnic differences in screening (Table 4).

In a second model, where knowledge and belief variables were added to the above sociodemographic factors, the association of race/ethnicity with screening did not change meaningfully, although higher perceived susceptibility, fewer barriers, and an awareness of screening were significant. Addition of the health care experience and medical history variables in the third model tended to reduce the association between race/ethnicity and screening in both minority groups; this change was entirely attributable to doctor recommendation, which was the only significant variable in this set. Educational level and age retained their independent effect on screening.

When all potential explanatory variables were included in the final model, racial/ethnic differences became nonsignificant in both groups, but a greater reduction in the odds ratio was observed for Hispanics. Older age, higher educational level, a doctor's recommendation for CRC screening, awareness of screening, and perceived susceptibility remained significantly associated with screening. We also checked for and found no interactions between race/ethnicity and all significant variables in the last 2 models.

Discussion

The purpose of this study was to understand which factors underlie differences in CRC screening among different racial/ethnic groups. We examined a wide range of factors simultaneously in a multiethnic population of African-American, Hispanic, and non-Hispanic white patients and found that racial/ethnic differences in screening were attenuated primarily by the health care experience and less so by psychosocial differences or socioeconomic differences among groups. The strongest association was with receiving a doctor recommendation, awareness of screening, older age, higher educational level, and perceived susceptibility.

Table 3. Association Between Current CRC Screening and Sociodemographic Variables, Beliefs, Medical History, and Health Care Experience Variables

	Current Screening (%)
Sociodemographic variables	
Race/ethnicity†	
White	67.5
African-American	54.3
Hispanic	48.6
Sex	
Male	65.0
Female	61.0
Education (yrs)	
0–11	51.0
12	63.5
≤13	66.5
Age*	
<65	57.7
≥65	71.2
Income	
<$15,000	54.3
$15,000–25,000	66.1
$25,000–50,000	68.3
>$50,000	67.0
Insurance type	65.5
Public	
Private	56.1
Mixed	68.3
Other	48.0
None	54.1
Medical history and health care experience	
Health status	
Good/excellent	65.9
Poor/fair	55.8
Family history	64.1
Yes	
No	62.2
Previous testing*	69.3
Yes	
No	54.1
Annual health exam†	64.2
Yes	
No	34.6
Regular PCP	
Yes	64.0
No	46.2
Dr. Recommendation‡	
Yes	74.2
No	42.1

Current screening refers to the percentage within each category that were current with screening guidelines. Statistical tests are for comparison of screening rates across categories of the same variable. CRC, colorectal cancer; PCP, primary care physician.

*Indicates current CRC screening was significantly different at $P < .01$ level across categories of the variable.

†$P < .001$.

‡$P < .0001$.

A significant contributor to racial/ ethnic differences in CRC screening was a doctor's recommendation for CRC screening; minority groups were significantly less likely to report receiving a doctor's recommendation. Previous work has documented the importance of a doctor recommendation for CRC screening.[15,24,51,56–60] We found only one previous study that compared doctor recommendation rates across racial/ethnic groups, and that study also reported that physicians are less likely to recommend screening to minority patients or to those of lower educational level.[24] Work in Hispanic populations is limited and has revealed conflicting findings about this topic. One study[42] found that, in a breast and cervical screening program of Hispanic women, there was no association between doctor recommendation and CRC screening, whereas another study[18] found that doctor recommendation was associated with CRC screening when controlling for other factors in a community population of Mexican-Americans. Our findings are consistent with the latter study and suggest that a doctor recommendation is likely to be important in primary care Hispanic populations. The reasons physicians give for failing to recommend CRC screening include concerns that the patient does not understand the pros and cons of testing and will not be compliant,[51,61,62] the financial costs to the patient,[57] or because of competing demands and lack of awareness that the patient is due for screening.[62] Our findings suggest that targeting physician recommendation for CRC screening is a very important priority for addressing disparities in CRC screening rates and is in keeping with the recommendations of a meta-analysis of preventive services intervention trials that concluded that the most successful interventions were those involving the provider and practice-based improvements in care.[63]

We ran sequential models to assess the relative effect of each set of variables on the odds ratios for screening. In our initial model, race/ethnicity effects remained significant after controlling for educational level, suggesting that socioeconomic status is only partially responsible for the effect of race/ethnicity on screening. Although previous studies have found that socioeconomic status is associated with CRC screening,[9,10,12,13,16,21,23] only 2 previous studies have examined the effect of socioeconomic factors on racial/ethnic differ-

Table 4. Logistic Regression Models: Adjusted Odds Ratios of Current CRC Screening

	Model 1 (n = 542) OR (95% CI)	Model 2 (n = 542) OR (95% CI)	Model 3 (n = 542) OR (95% CI)	Model 4 (n = 542) OR (95% CI)
Race/ethnicity				
White	1.00	1.00	1.00	1.00
African-American	**0.59 (0.37–0.95)**	**0.58 (0.35–0.96)**	0.64 (0.38–1.07)	0.59 (0.34–1.03)
Hispanic	**0.54 (0.33–0.89)**	**0.54 (0.32–0.92)**	0.73 (0.43–1.25)	0.68 (0.38–1.21)
Age				
50–64	1.00	1.00	1.00	1.00
65–80	**2.37 (1.48–3.79)**	**2.81 (1.71–4.60)**	**2.46 (1.45–4.17)**	**2.88 (1.68–4.95)**
Gender				
Male	1.00	1.00	1.00	1.00
Female	0.79 (0.50–1.25)	0.79 (0.49–1.28)	0.86 (0.53–1.40)	0.89 (0.53–1.49)
Socioeconomic				
Education (yrs)				
0–11	1.00	1.00	1.00	1.00
12	**2.07 (1.13–3.81)**	**1.94 (1.05–3.59)**	**1.93 (0.99–3.72)**	1.82 (0.94–3.51)
≤13	**2.21 (1.23–3.99)**	**2.03 (1.08–2.96)**	**2.11 (1.15–3.86)**	**2.07 (1.09–3.92)**
Knowledge and beliefs				
Susceptibility		**1.80 (1.10–2.96)**		**1.74 (1.04–2.91)**
Benefits		1.06 (0.63–1.78)		1.04 (0.60–1.81)
Barriers		**1.68 (1.03–2.75)**		1.70 (1.00–2.89)
Fatalism		1.17 (0.70–1.95)		1.32 (0.78–2.24)
Knowledge		1.05 (0.64–1.73)		1.03 (0.60–1.76)
Awareness of screening (reference not)		**3.71 (1.76–7.80)**		**3.32 (1.47–7.53)**
Medical history/health care interaction				
Health status (referent is fair/poor)			1.05 (0.63–1.74)	0.99 (0.60–1.65)
Family history of CRC (reference none)			1.08 (0.53–2.18)	1.01 (0.48–2.13)
Previous testing (reference is none)			1.43 (0.87–2.37)	1.43 (0.85–2.39)
Annual health exam (referent is never)			2.00 (0.92–4.35)	1.86 (0.78–4.41)
Regular doctor (reference none)			1.35 (0.53–3.44)	1.38 (0.49–3.90)
Dr. Recommendation (reference none)			**3.94 (2.37–6.57)**	**3.86 (2.30-6.50)**
Doctor satisfaction			0.63 (0.38–1.06)	0.62 (0.37–1.04)
Hosmer and Lemeshow goodness of fit	0.22	0.11	0.69	0.73

Odds ratios are for CRC screening with any test according to recommended guidelines; **bold** type indicates statistical significance. OR, odds ratios; CRC, colorectal cancer; PCP, primary care physician.

ences in CRC screening. In one study, disparities in screening between black and white Medicare beneficiaries with a usual physician were mitigated entirely when individual educational level was controlled for.[23] In the other study, CRC screening disparities between whites and nonwhites in the Medicare population were only partly accounted for when controlling for level of education.[21] Our study supports a partial role for socioeconomic factors and also identifies potentially modifiable factors that may contribute to racial/ethnic differences in CRC screening.

Our other finding, that younger patients are consistently screened at lower rates in all 3 groups, needs to be addressed because it may have a disproportionate impact in African-Americans, who are diagnosed at a younger age.[64] Age remained significant despite controlling for a variety of factors including doctor recommendation, suggesting that other factors may be important, such as compliance with screening after receiving a doctor recommendation.

Our study is one of the first to directly compare CRC knowledge and beliefs across the major racial/ethnic groups residing in the United States; in the final model, higher levels of perceived susceptibility and awareness of screening were associated with higher levels of screening, but overall this set of variables had only a minimal effect on the odds ratios for race/ethnicity and CRC screening. Although we did find that minority groups perceived fewer benefits to CRC screening and were more fatalistic, neither of these had an effect on CRC screening when we controlled for other factors. Awareness of screening was an important variable in this set, suggesting that education about CRC screening in minority patients will be important in addressing racial/ethnic differences in CRC screening. Higher levels of perceived susceptibility have been described as being associated with screening in some studies[65,66] and suggest that patient initiatives focusing on the increased risk of CRC from age 50 and on could be important in addressing disparities. Perceived barriers have been associated with screening in more homogenous populations[27,29–35] and among African-Americans.[15,43] We found it to have an odds ratio similar in magnitude to that of perceived susceptibility, but it was not statistically significant. Overall, less is known about the relationship between beliefs and CRC screening in Hispanic populations, although a recent study found no belief variables were related to screening in multivariate analyses[18] and another found that only fatalism was associated.[42] Our findings are significant in that they suggest that cultural or psychosocial differences between groups may be less important contributors to differences in screening rates and that provider or system initiatives will have greater impact on improving screening rates in minority groups.

This study has specific implications for improving CRC screening in diverse, multiethnic clinic populations. It suggests that directly targeting patient attitudes may be less important overall in addressing disparities in CRC screening. The focus should be on enhancing doctor recommendation for screening in minority groups and on improving patient awareness of screening. A review reveals that 2 recent clinic-based interventions successfully used each of these strategies separately to modestly improve CRC screening,[41,67] although a third study did not.[68] One of these studies[67] reported results by race/ethnicity and noted less improvement in non-whites compared with whites. These findings suggest that the combining doctor recommendation and patient education about screening could be a more powerful approach to eliminating racial/ethnic disparities in CRC screening.

Strengths and Limitations

The study has a number of limitations. First, it was a clinic-based population that was of lower socioeconomic status but predominantly insured, which affects its generalizability to other groups. Although insurance coverage is often confounded with socioeconomic status (poor or less educated are less likely to have insurance) and age (those 65 and older have Medicare), in this study, controlling for insurance enabled us to examine the effects of race, education, and age independent of insurance coverage. Our findings can be generalized to insured patients that make visits to outpatient primary care practices in the United States, which account for over 384 million outpatient visits to primary care practices with non-Federally employed physicians.[69] Secondly, CRC screening was self-reported and was not verified by medical record abstraction, and although studies do suggest that there is a good correlation between self-report and actual screening[70] there is conflicting evidence about whether the accuracy of self-report varies by sociodemographic group.[58,71] Third, this was a cross-sectional study so we cannot draw conclusions about causal relationships. Fourth, we did not distinguish between tests done for screening versus diagnosis of symptoms because it is not known how accurately patients can distinguish between the two; this may have affected the findings. Also, although our response rate was 55.7%, a major reason for this was difficulty in scheduling patients who agreed to participate; these patients were considered to be nonrespondents. However, we did determine that respondents were no different to nonrespondents and were representative of the clinic population. Strengths of the study include the recruiting of African-Americans and Hispanic patients in sufficient numbers to make comparisons across groups and that our psychosocial instrument was specifically developed, based on a previous study in the same population,[44] to be culturally and linguistically appropriate; it displayed excellent psychometric properties.

Overall, our study makes an important contribution to the literature because it enhances our understanding of the reasons underlying racial/ethnic differences in CRC screening. It seems that what matters most when demographic, attitudinal, and health experience variables are considered together is that the health experience variables seem to be most important. This suggests that future strategies to address racial/ethnic disparities should focus predominantly on the health care environment and less on patient attitudes and beliefs.

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Appendix: Attitude and Belief Measures

Scale Type	Mean ± SD (range) Cronbach Alpha Reliability
Barriers	37.29 ± 6.69 (11–44) α = 0.84
How much do the following things affect your decision to get tested for colon cancer?	
Cost?	
Discomfort?	
Inconvenience?	
Fear of finding something wrong?	
Worrying about the results?	
Embarrassment?	
Lack of time?	
Problems with transportation?	
Fear about the treatment?	
Concerns about the messiness of the test?	
Lack of information concerning colon cancer?	
Benefits	31.5 ± 3.7 (20–40) α = 0.80
Some types of cancer can actually be cured.	
If colon cancer is detected early, chances of cures are very high.	
There are medical tests now that can detect colon cancer in its very early stages.	
There is very little I can do to reduce my chances of dying from colon cancer.	
Even if colon cancer is detected early, nothing can be done about it.	
The benefits of having a test to find colon cancer early outweigh any difficulties I may have going through it.	
Cancer is like a death sentence; if you get it, you will surely die from it.	
If I had a test to find colon cancer early, it could save my life.	
Having a test to find colon cancer early makes sense to me.	
I believe that a test to find colon cancer early can help to protect my health.	

Appendix: Continued

Scale Type	Mean ± SD (range) Cronbach Alpha Reliability
Susceptibility	8.78 ± 2.0 (4–14) $\alpha = 0.72$
What do you think your chance of getting colon cancer is?	
Compared with others your age and sex, what do you think your chance is that you will develop colon cancer?	
How worried are you that you may develop colon cancer?	
How much does it concern you that you may develop colon cancer?	
Fatalism	19.70 ± 2.0 (15–30) $\alpha = 0.87$
Please indicate if you agree with the following statements:	
I think if someone is meant to have colon cancer, it doesn't matter what kinds of food they eat, they will get colon cancer anyway.	
I think if someone has colon cancer, it is already too late to get treated for it.	
I think someone can eat fatty foods all their life, and if they are not meant to get colon cancer, they won't get it.	
I think if someone is meant to get colon cancer, they will get it no matter what they do.	
I think if someone gets colon cancer, it was meant to be.	
I think if someone gets colon cancer, their time to die is soon.	
I think if someone gets colon cancer, that's the way they were meant to die.	
I think getting checked for colon cancer makes people scared that they may really have colon cancer.	
I think if someone is meant to have colon cancer, they will have colon cancer.	
I think some people don't want to know if they have colon cancer because they don't want to know they may be dying from it.	
I think if someone gets colon cancer, it doesn't matter whether they find it early or late, they will still die from it.	
I think if someone has colon cancer and gets treatment for it, they will probably still die from the colon cancer.	
I think if someone was meant to have colon cancer, it doesn't matter what doctors and nurses tell them to do, they will get colon cancer anyway.	
I think if someone is meant to have colon cancer, it doesn't matter if they eat healthy foods, they will still get colon cancer.	
I think colon cancer will kill you no matter when it is found and how it is treated.	
Knowledge	$\alpha = 0.56$ $k = 12$
Your risk of colon cancer decreases with age.	
Drinking a glass of red wine a day protects you against colon cancer.	
Smoking does not affect your chance of getting colon cancer.	
Eating foods high in bran/fiber reduces the risk of colon cancer (cereals, oatmeal, whole wheat bread).	
Homosexual men are more likely to develop colon cancer.	
If one of your parents gets colon cancer, it increases your chance of getting colon cancer.	
Not bathing regularly increases the chance of getting colon cancer.	
White people are more likely to get colon cancer than African-Americans.	
Hemorrhoids can be a sign for colon cancer.	
A person can have colon cancer without having pain or other symptoms.	
There is no test to find colon cancer early.	
If you have surgery to remove colon cancer, it is more likely to spread.	

Appendix: Continued

Scale Type	Mean ± SD (range) Cronbach Alpha Reliability
Satisfaction	11.22 ± 1.23 (4–12) α = 0.69
How much do you believe that your regular doctor has helped you to get better? (any time in your life when you have been ill)	
How satisfied are you with your regular doctor?	
My regular doctor listens carefully to what I have to say.	