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## Trends in Self-Reported Health Care Provider Recommendations for Colorectal Cancer Screening by Race

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### Abstract

**Objective**—To examine whether a racial difference exists in self-reported recommendations for colorectal cancer screening from a health care provider, and whether this difference has changed over time.

**Method**—Secondary analysis of the 2002, 2004, 2006, and 2008 Maryland Cancer Surveys, cross-sectional population-based random-digit-dial surveys on cancer screening. Participants were 11,368 white and 2,495 black Maryland residents age 50 years.

**Results**—For each race, recommendations for colonoscopy/sigmoidoscopy increased over time (67%–83% for whites, 57%–74% for blacks;  $p < 0.001$  for both), but the race difference remained approximately 10% at each survey. Among respondents without a colonoscopy in the last 10 years ( $n = 5,081$ ), recommendations for fecal occult blood test (FOBT) in the past year decreased over time for whites (37%–24%,  $p < 0.001$ ) and for blacks (36–28%,  $p = 0.05$ ), with no difference by race in any year. In multivariable analysis, the effect of race on the odds of reporting a provider recommendation did not vary significantly across time for either test ( $p = 0.80$  for colonoscopy/sigmoidoscopy,  $p = 0.24$  for FOBT for effect modification by year).

**Conclusion**—Whites were more likely than blacks to report ever receiving a provider recommendation for colonoscopy/sigmoidoscopy. Although the proportion of patients receiving recommendations for colonoscopy/sigmoidoscopy increased over time, the gap between races remained unchanged.

### Keywords

colorectal cancer; screening; racial disparity; prevention; patient-health care provider interaction

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#### Conflict of Interest Statement:

The authors declare that there are no conflicts of interest.

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## Introduction

Colorectal cancer (CRC) remains the second leading cause of cancer deaths in the United States (Edwards, et al., 2010), despite the availability of screening tests that are effective at preventing and treating CRC (American Cancer Society (ACS), 2008). For average-risk adults age 50 years or older, national CRC prevention guidelines recommend: colonoscopy every 10 years, sigmoidoscopy every 5 years, and/or high-sensitivity fecal occult blood test (FOBT) every year (US Preventive Services Task Force, 2008; Smith et al., 2010; McFarland, et al., 2008). Increasing the proportion of adults age 50 to 75 years receiving CRC screening has been recognized as an important public health objective in Healthy People 2010 and Healthy People 2020 (Anonymous 2010a; Anonymous 2010b).

Lack of a physician recommendation is a primary barrier to CRC screening (Wee, et al., 2005; Guerra, et al., 2007; Klabunde, et al., 2006), and studies have demonstrated a strong association between health care providers' recommendations and CRC screening (Beydoun and Beydoun, 2008; Sarfaty and Wender, 2007). Increasing the proportion of adults receiving counseling from their providers about CRC screening has been recognized as a developmental objective in Healthy People 2020 (Anonymous, 2010b).

Blacks are known to have a lower prevalence of screening than whites (ACS, 2008; Seeff, et al., 2004; Schenck, et al., 2006; Cooper and Koroukian, 2004) which is an important factor contributing to higher rates of CRC incidence and mortality among blacks compared to whites (ACS, 2008). Age-adjusted incidence rates (per 100,000) of CRC during 2003–2007 were 47.4 for whites and 58.9 for blacks, while mortality rates (per 100,000) during the same period were 17.1 for whites and 24.7 for blacks (Altekruse, et al., 2010). It is therefore of particular interest to examine whether the self-reported prevalence of receiving recommendations for CRC screening varies by patient race. If blacks are less likely to self-report recommendations, this would suggest that interventions to improve CRC screening of blacks may be better aimed at physicians, rather than to the community. Prior studies of the association between race and self-reported screening recommendations have differed, with one study finding racial differences in physician recommendations for FOBT or colonoscopy/endoscopy (Klabunde, et al., 2006) and other studies finding no significant difference for recommendations for any CRC screening tests (Wee, et al., 2005; Burgess, et al., 2010; Shokar, et al., 2006). These studies have also found a strong relationship between the racial gap in recommendations and the gap in up-to-date CRC screening (Wee, et al., 2004; Schenck, et al., 2006; Burgess, et al., 2010), and in a population with no racial difference in recommendations, blacks were significantly more likely than whites to receive CRC screening (Dolan, et al., 2005).

It is also unclear whether the relationship between race and screening recommendations has changed due to interventions to increase the prevalence of CRC screening. Since 2001, local health departments in Maryland have educated providers on the importance of recommending CRC screening to their patients. Thus, this study examines whether a racial difference in self-reported CRC screening recommendations from providers exists in a sample of Maryland adults, and whether this difference changed from 2002 through 2008.

## Methods

### Study Design

This secondary analysis used data from the 2002, 2004, 2006, and 2008 Maryland Cancer Survey, a set of cross-sectional, population-based, random-digit-dial, computer-assisted land line telephone interview surveys that used list-assisted stratified sampling by geography to oversample rural residences (Steinberger, et al., 2002; Steinberger, et al., 2005; Poppell, et

al., 2007; Poppell, et al., 2009). Survey respondents were non-institutionalized Maryland residents age 40 years or older. In 2002, 2004, and 2008, eligible respondents were English-speakers, whereas respondents in 2006 were English- or Spanish-speaking. The Maryland Cancer Surveys were approved by the Institutional Review Boards of the Maryland Department of Health and Mental Hygiene and the University of Maryland, Baltimore.

## Participants

A total of 309,535 telephone numbers were screened or called (84,172 in 2002, 66,950 in 2004, 61,273 in 2006, and 97,140 in 2008), resulting in 20,306 completed interviews (5,071 in 2002, 5,007 in 2004, 5,187 in 2006, and 5,041 in 2008). The Council of American Survey Research Organizations (CASRO) response rate for the survey, defined as Completed Interviews/(Known Eligible + Presumed Eligible), was 38.4% in 2002, 38.3% in 2004, 29.7% in 2006, and 40% in 2008.

This analysis was further limited to respondents age 50 years or older, based on national CRC screening guidelines (US Preventive Services Task Force, 2008; McFarland, et al., 2008; Smith, et al., 2003). Respondents who did not report their race (n=109), those who reported a race other than white or black (n=451), and those missing data about CRC screening recommendations (n=347) were excluded, leaving a sample size of 13,863.

## Measurements

Respondent race was self-reported as white or black/African American. Hispanic respondents were included in their racial group. Using questions from the National Health Interview Study (Anonymous, 2010e), provider recommendations for CRC screening were determined by describing each test and asking: "Has a doctor or other health professional ever recommended that you have a sigmoidoscopy or colonoscopy?" and "In the past 12 months, has a doctor or other health professional recommended that you have a home blood stool test?" (i.e., FOBT). Respondents who had had a colonoscopy/sigmoidoscopy were asked which test was most recent and how long it had been since that test. These questions were used to determine whether respondents were up-to-date with colonoscopy (defined as colonoscopy within preceding 10 years based on ACS guidelines).

Based on significance in prior studies (Wee, et al., 2005; Klabunde, et al., 2006), covariates chosen from the survey for examination included: gender, age, marital status, education, body mass index (BMI), health care coverage (e.g., health insurance, HMOs, Medicare, Medical Assistance), time since last routine check-up, and family history of CRC (i.e., whether a first degree relative had ever been diagnosed with colon cancer). Employment status and geographic stratum (rural/urban residence, based on the phone number's location) were also examined.

## Statistical Analysis

Because guidelines only recommend annual FOBT for patients who are not up-to-date with colonoscopy, the analysis of recommendations for FOBT in the past year was performed in the subset of respondents who were not up-to-date on colonoscopy; similar results were found when analysis of recommendations for FOBT included all respondents. Analysis of ever receiving a recommendation for colonoscopy/sigmoidoscopy included all respondents.

Logistic regression models were run between respondent race and recommendation for colonoscopy/sigmoidoscopy to determine estimates of odds ratios (OR) and 95% confidence intervals (CI), bivariable for unadjusted estimates and multivariable for adjusted. Similar logistic regression models were run between respondent race and recommendation for FOBT in the past year, among respondents not up-to-date with colonoscopy. Covariates

were chosen a priori based on their associations with CRC screening recommendation or race variables; thus, all covariates were included in adjusted models, as was survey year (as a categorical variable).

To examine whether the racial difference in recommendations for colonoscopy/sigmoidoscopy changed over time, the significance of an interaction term between race and survey year was examined in a logistic regression model that included main effects for race and survey year, and in a logistic regression model that included all covariates. Survey year was modeled as a continuous variable. Similar logistic regression models were run to examine whether the association between race and recommendations for FOBT in the past year changed over time, among respondents who were not up-to-date on colonoscopy. Data were analyzed using SAS 9.1 (SAS Institute Inc., Cary, NC). Results were weighted to the Maryland population by race, age, and gender.

## Results

The sample included 2,495 black respondents (24%) and 11,368 white respondents (Table 1). All covariates differed significantly ( $p<0.01$ ) by race. Blacks were less likely than whites to be male (42% vs. 46%, respectively) and to be older. Blacks were also less likely than whites to have health care coverage (92% vs. 97%), and to report a family history of CRC (10% vs. 13%). Blacks were less likely than whites to have ever had a colonoscopy/sigmoidoscopy (62% vs. 69%,  $p<0.001$ ), to have ever had an FOBT (53% vs. 57%,  $p=0.001$ ), and to be up-to-date with colonoscopy (53% vs. 58%,  $p<0.001$ ).

Overall, whites were significantly more likely than blacks to report provider recommendations for colonoscopy/sigmoidoscopy (75% vs. 65%,  $p<0.001$ ). Among respondents reporting a recommendation for colonoscopy/sigmoidoscopy, the proportion of blacks and whites who were up-to-date with colonoscopy were both 73%. The proportion of whites reporting a recommendation for colonoscopy/sigmoidoscopy increased from 67% in 2002 to 83% in 2008 ( $p<0.001$ ; Figure 1). Similarly, the proportion of blacks reporting a recommendation for colonoscopy/sigmoidoscopy increased from 57% in 2002 to 74% in 2008 ( $p<0.001$ ). For each race, there was an increase of ~4% between the 2002, 2004, and 2006 surveys, and a ~7% increase by the 2008 survey. The percentage difference between races was significant for each survey (~10%,  $p<0.001$  for each), and this difference did not change over time ( $p=0.55$ ). The association between race and recommendations for colonoscopy/sigmoidoscopy remained significant after adjustment for demographic and health care characteristics (OR 1.43, 95% CI 1.26–1.63; Table 2). Although the adjusted model also showed a significant increase in the odds of reporting recommendations for colonoscopy/sigmoidoscopy between 2002 and 2008, the effect of race did not change significantly over time ( $p=0.80$  for interaction term). Other significant predictors of reporting recommendations for colonoscopy/sigmoidoscopy included urban residence, being married, increasing education, health care coverage, more recent routine check-up, and family history of CRC.

A similar analysis examining reported recommendations for FOBT in the past year was performed among respondents not up-to-date with colonoscopy ( $n=5,801$ ). The proportions of whites and blacks who reported recommendations for FOBT were similar at each survey year, and in all years combined (Figure 2). These proportions declined over time for both races. For whites, the proportion reporting recommendations for FOBT decreased significantly, from 37% in 2002 to 24% in 2008 ( $p<0.001$ ); for blacks, the proportion reporting recommendations for FOBT decreased from 36% in 2002 to 28% in 2008, a marginally significant decrease ( $p=0.05$ ). The racial difference in reporting recommendations for FOBT was not significant at any survey ( $p>0.30$  for each), or in all

years combined ( $p=0.24$ , OR 0.90, 95% CI 0.75–1.10 for adjusted model). Significant predictors of reporting recommendations for FOBT in the past year included college education, obese BMI, health care coverage, and more recent routine check-up.

## Discussion

In this large study of non-institutionalized Maryland residents age 50 years or older, blacks were significantly less likely than whites to report ever receiving provider recommendations for colonoscopy/sigmoidoscopy, but there was no significant racial difference in reporting recommendations for FOBT in the past year. Prior studies have differed in their results, with Klabunde, et al. (2006) finding whites more likely than blacks to report physician recommendations for both colonoscopy/sigmoidoscopy and FOBT, whereas other studies found no difference between black and white respondents in reporting counseling about CRC screening tests (Wee, et al., 2005; Burgess, et al., 2010; Shokar, et al., 2006).

Results from these studies and the current study may have differed due to the populations studied. Although Wee et al. (2005) used results from a nationally generalizable survey of US households, the other studies were performed in more selective populations (i.e., Medicare consumers in North and South Carolina (Klabunde, et al., 2006), patients from 24 VA medical facilities (Burgess, et al., 2010), and patients from a primary care clinic (Shokar, et al., 2006)). The racial disparity in recommendations for colonoscopy/sigmoidoscopy in the current study could also result from differences in health care access, which are recognized to contribute to health care disparities (Smedley, et al., 2003). However, health care access may not fully explain this disparity, as results adjusted for health care access variables (health care coverage and time since last check-up) were almost identical to unadjusted results. Differences in provider performance or patient behavior may also explain the observed racial disparity. For example, patients who visit providers mainly for acute illness are unlikely to have preventive care discussed. Thus, if this pattern is more common among blacks, a racial disparity in screening recommendations would result.

The racial difference in reporting recommendations for colonoscopy/sigmoidoscopy persisted at ~10% at all four surveys. This disparity did not change significantly over time even when the analysis was adjusted for several patient characteristics known to be associated with recommendations. It is interesting to note that each race had a consistent rate of improvement over the six years, indicating that the programs and policy changes implemented during this period were equally effective in increasing recommendations for colonoscopy/sigmoidoscopy in both races. Although it is encouraging that there was no racial disparity in reporting recommendations for FOBT in the past year at any survey, it is discouraging that there was no improvement in the disparity in colonoscopy/sigmoidoscopy recommendations. Racial disparities in CRC screening behaviors have been recognized for many years (Breen, et al., 2001), and increased awareness of this difference by physicians could help reduce such disparities if considered when making recommendations (Sarfaty and Wender, 2007). With only 72% of respondents reporting ever receiving a recommendation for colonoscopy/sigmoidoscopy, providers should be promoting CRC screening more widely for all age-eligible patients. Given the persistence of the racial disparity in recommendations for colonoscopy, however, it is critical for providers to be particularly sensitive to the barriers to CRC screening among their black patients. In particular, the racial disparity in up-to-date colonoscopy may be associated with the disparity in provider recommendations. Several effective interventions have been developed that aim to increase CRC screening among blacks (Friedman and Borum, 2007; Khankari, et al., 2007; Ward, et al., 2008; Powe, et al., 2010), and one intervention that included physician health literacy training and priming patients with educational materials has been shown to improve the rates of recommendations to black patients (Khankari, et al., 2007). Thus, there is hope that the



racial disparity in provider recommendations, and in turn the disparity in CRC screening, can be narrowed or eliminated by 2015.

### Study Limitations and Strengths

Interpretation of the results from this study is limited based on the use of self-report data. There was no validation of recommendations with medical chart review, so self-report of having received a recommendation may be inaccurate. Patients who were screened may be more likely to recall a recommendation. Studies have shown a higher sensitivity and lower specificity for self-report of CRC screening tests by whites compared to blacks (Rauscher, et al., 2008), suggesting that the racial disparity in the current study may be reflect reporting differences, but no studies have compared racial differences in the accuracy of self-report of recommendations for screening. Also, the study sample was limited to non-institutionalized residents using land-line phone numbers; this population may have changed over time. Finally, although the analysis accounted for several likely confounders, residual bias may exist from unmeasured factors including differences in the healthcare system (e.g., numbers and types of providers available), psychosocial factors (e.g., perceived CRC risk, health seeking behavior), and health factors (e.g., health status, chronic disease status). Future research should explore these variables, particularly as they suggest interventions to address the gap in screening.

The Maryland Cancer Surveys are population-based samples, providing generalizability to the Maryland population. Results from this study may not be generalizable beyond Maryland, because its median income is higher than other states' (Anonymous, 2010d) and it mandates insurance coverage of CRC screening including colonoscopy (Anonymous, 2010c). This study has a large sample size which provides substantial power to test the associations of interest. Finally, the methods of the Maryland Cancer Surveys remained almost identical with respect to the variables in this analysis, permitting appropriate comparisons for time trends.

### Conclusions

This study found that blacks were significantly less likely than whites to report receiving provider recommendations for colonoscopy/sigmoidoscopy on each of the Maryland Cancer Surveys, which may contribute to racial differences in CRC screening rates, and thus to the disparity in CRC incidence and mortality. The reasons for this racial difference should be explored further to design interventions eliminating this disparity. Although prevalence of recommendations increased in both blacks and whites, the disparity was unchanged between 2002 and 2008. Providers should be encouraged to recommend colonoscopy/sigmoidoscopy to all eligible patients, especially blacks, which will increase overall screening and may help eliminate the disparity in CRC screening and outcomes.

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## Abbreviations

<b>ACS</b>	American Cancer Society
<b>BMI</b>	body mass index
<b>CASRO</b>	Council of American Survey Research Organizations
<b>CI</b>	confidence interval
<b>CRC</b>	colorectal cancer
<b>FOBT</b>	fecal occult blood test
<b>GED</b>	general educational development tests
<b>OR</b>	odds ratio

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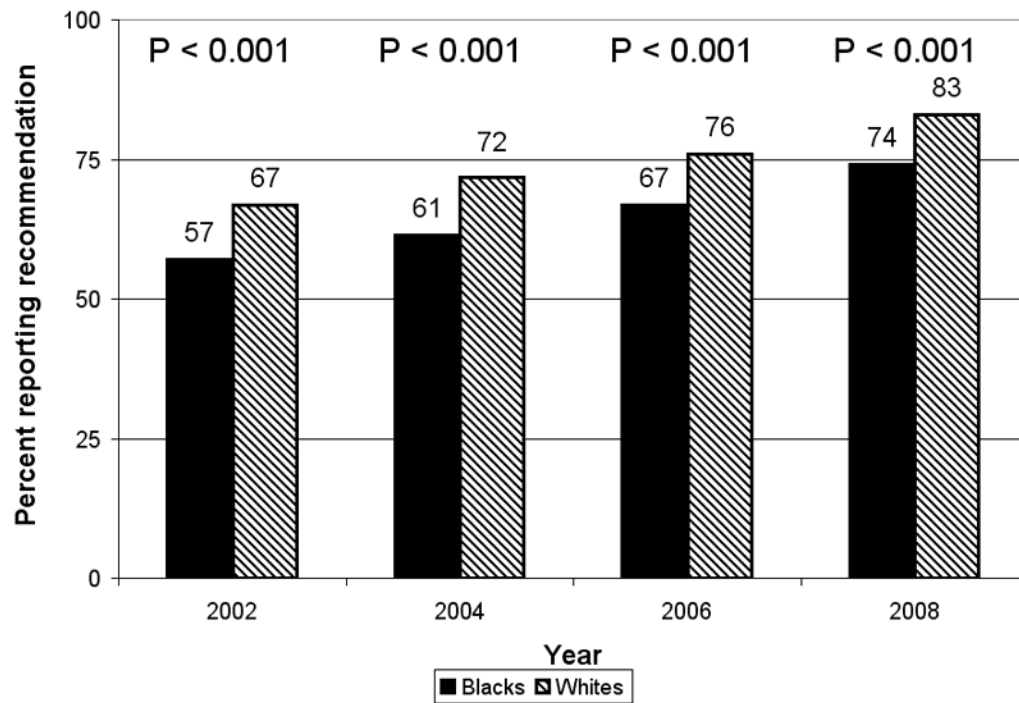
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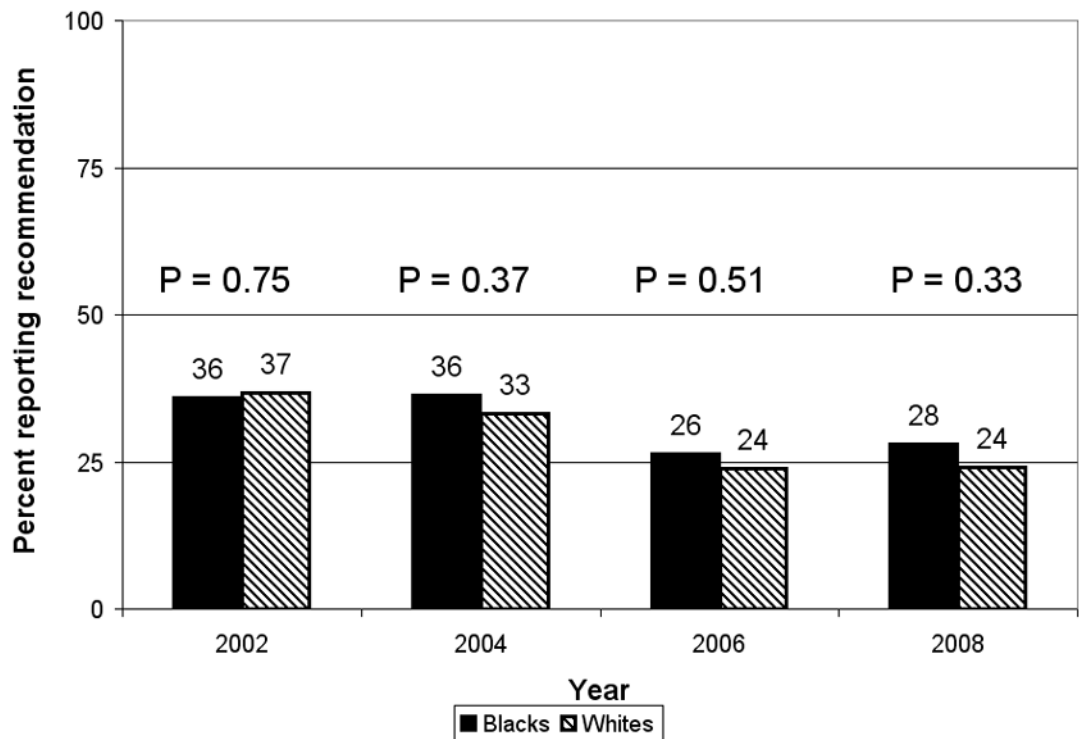
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### Highlights

- We examine self-reported colorectal cancer screening recommendations by race.
- Blacks and whites reported increasing recommendations for colonoscopy over time.
- Blacks reported 10% fewer recommendations than whites in 2002, 2004, 2006, and 2008.
- There was no difference by race for recommendations for fecal occult blood tests.
- The effect of race on the odds of reporting recommendations did not vary over time.



**Figure 1.** Percentage reporting ever receiving a health care provider recommendation for colonoscopy or sigmoidoscopy, by survey year and race, Maryland Cancer Survey 2002, 2004, 2006, and 2008. p-values derived from Chi-square test on comparison between races for each survey year. p-value for interaction between race and survey year in unadjusted model of reporting recommendations for colonoscopy/sigmoidoscopy was 0.55.



**Figure 2.** Percentage reporting receiving a health care provider recommendation for fecal occult blood test in the past year, by survey year and race, among respondents not up-to-date on colonoscopy, *Maryland Cancer Survey 2002, 2004, 2006, and 2008*. p-values derived from Chi-square test on comparison between races for each survey year. p-value for interaction between race and survey year in unadjusted model of reporting recommendations for fecal occult blood test in past year was 0.31.

**Table 1**

Characteristics by Race of Survey Sample of Marylanders Age 50 Years or Older, Maryland Cancer Survey 2002, 2004, 2006, and 2008

Respondent Characteristic	Total (n=13,863)	Blacks (n=2,495)	Whites (n=11,368)	p <sup>c</sup>
	n <sup>a</sup> (%) <sup>b</sup>	n <sup>a</sup> (%) <sup>b</sup>	n <sup>a</sup> (%) <sup>b</sup>	
Overall	13,863 (100.0)	2,495 (24.0)	11,368 (76.0)	
Survey year				0.10
2002	3,232 (22.9)	577 (21.5)	2,655 (23.3)	
2004	3,380 (24.5)	657 (23.7)	2,723 (24.7)	
2006	3,585 (25.7)	551 (26.0)	3,034 (25.6)	
2008	3,666 (26.9)	710 (28.8)	2,956 (26.3)	
<b>Demographic Characteristics</b>				
Male	4,854 (44.8)	725 (42.2)	4,129 (45.6)	0.01
Age				<0.001
50–64 years	7,549 (59.3)	1,550 (65.7)	5,999 (57.3)	
65–74 years	3,506 (23.0)	610 (22.3)	2,896 (23.2)	
75 years	2,808 (17.7)	335 (12.0)	2,473 (19.4)	
Rural	5,303 (22.6)	419 (9.8)	4,884 (26.6)	<0.001
Marital Status				<0.001
Married	7,635 (65.0)	980 (50.7)	6,655 (69.5)	
Widowed	2,963 (14.8)	551 (16.4)	2,412 (14.3)	
Other <sup>d</sup>	3,210 (20.1)	952 (32.9)	2,258 (16.1)	
Education				<0.001
Less than high school graduation	1,351 (9.7)	426 (16.7)	925 (7.5)	
High school graduation/GED	4,099 (27.8)	791 (30.5)	3,338 (26.9)	
Some college	3,127 (22.3)	584 (24.3)	2,543 (21.6)	
College graduation <sup>e</sup>	5,229 (40.2)	706 (28.5)	4,523 (43.9)	
Employment status				<0.001
Employed <sup>f</sup>	5,567 (43.7)	989 (41.9)	4,578 (44.2)	
Retired	6,619 (44.2)	1,111 (42.3)	5,508 (44.8)	
Other <sup>g</sup>	1,627 (12.1)	383 (15.8)	1,244 (11.0)	
Body Mass Index <sup>h</sup>				<0.001
Normal weight (<25.0)	4,530 (32.1)	496 (21.0)	4,034 (35.6)	
Overweight (25.0-<30.0)	5,030 (38.9)	901 (38.6)	4,129 (38.9)	
Obese (≥ 30.0)	3,779 (29.1)	1,004 (40.4)	2,775 (25.5)	
<b>Health Care Characteristics</b>				
Has health care coverage <sup>i</sup>	13,303 (95.9)	2,300 (92.1)	11,003 (97.1)	<0.001
Time since last routine check-up				<0.001
< 1 year	12,018 (87.3)	2,259 (91.0)	9,759 (86.1)	
1 – <5 years	1,279 (9.6)	162 (6.5)	1,117 (10.6)	
5 years	405 (3.1)	48 (2.6)	357 (3.2)	



Respondent Characteristic	Total (n=13,863)	Blacks (n=2,495)	Whites (n=11,368)	p <sup>c</sup>
	n <sup>a</sup> (%) <sup>b</sup>	n <sup>a</sup> (%) <sup>b</sup>	n <sup>a</sup> (%) <sup>b</sup>	
Family history of CRC <sup>j</sup>	1,748 (12.3)	271 (10.4)	1,477 (12.9)	0.004
<b>Colorectal Cancer Screening History Characteristics</b>				
Ever had colonoscopy or sigmoidoscopy	9,307 (67.3)	1,561 (62.4)	7,746 (68.8)	<0.001
Ever had fecal occult blood test	5,969 (56.2)	1,343 (53.0)	6,478 (57.3)	0.001
Up-to-date on colonoscopy <sup>k</sup>	7,641 (56.8)	1,296 (53.1)	6,345 (58.0)	<0.001
Reported <u>provider</u> recommendation for colonoscopy/sigmoidoscopy	10,016 (72.4)	1,635 (65.4)	8,381 (74.6)	<0.001
Reported <u>provider</u> recommendation for fecal occult blood test in past 12 months				
Among all respondents	4,371 (32.0)	821 (32.7)	3,550 (31.8)	0.51
Among respondents up-to-date on colonoscopy	6,345 (77.7)	2,016 (77.4)	4,329 (77.9)	0.70

GED: general educational development tests; CRC: colorectal cancer

Analysis performed accounting for stratification by geography, except results for geographic stratum.

<sup>a</sup>Unweighted sample size; sample size for some variables may not add to column total due to missing responses.

<sup>b</sup>Weighted to the Maryland population; percentages for some variables may not add to 100 due to rounding.

<sup>c</sup>p-value derived from Chi-square test on categories of all variables.

<sup>d</sup>Includes respondents who were divorced, separated, never married, or a partner of an unmarried couple

<sup>e</sup>Includes respondents with masters, doctoral or advanced professional degrees

<sup>f</sup>Includes respondents employed for wages and self employed

<sup>g</sup>Includes students, homemakers, and respondents unable to work, or out of work

<sup>h</sup>Body Mass Index is calculated as weight in kilograms/(height in meters)<sup>2</sup>

<sup>i</sup>Health care coverage includes health insurance, prepaid plans such as HMOs, or government plans such as Medicare or Medical Assistance

<sup>j</sup>Family history of CRC is defined as a reported history of a diagnosis of colon cancer in a first degree relative (parent, sibling or child)

<sup>k</sup>Up-to-date colonoscopy is colonoscopy within the preceding 10 years (up-to-date according to American Cancer Society guidelines)

**Table 2**

Odds Ratios and 95% Confidence Intervals for Health Care Provider Recommendations for Colorectal Cancer Screening Tests, from Maryland Cancer Survey 2002, 2004, 2006, and 2008 and Weighted to Represent Maryland Population

Respondent Characteristic	Recommendation for Colonoscopy/Sigmoidoscopy		Recommendation for FOBT in Past Year	
	Unadjusted <sup>a</sup> OR (95% CI)	Adjusted <sup>b</sup> OR (95% CI)	Unadjusted <sup>c</sup> OR (95% CI)	Adjusted <sup>d</sup> OR (95% CI)
Race				
Black	Reference	Reference	Reference	Reference
White	1.55 (1.39, 1.73)	1.43 (1.26, 1.63)	0.94 (0.80, 1.11)	0.90 (0.75, 1.10)
Survey year				
2002	Reference	Reference	Reference	Reference
2004	1.24 (1.10, 1.40)	1.24 (1.09, 1.41)	0.89 (0.76, 1.05)	0.86 (0.72, 1.03)
2006	1.54 (1.36, 1.74)	1.58 (1.38, 1.81)	0.56 (0.46, 0.67)	0.58 (0.47, 0.70)
2008	2.27 (1.98, 2.60)	2.37 (2.05, 2.74)	0.59 (0.48, 0.73)	0.60 (0.48, 0.74)
Gender				
Male	Reference	Reference	Reference	Reference
Female	0.94 (0.86, 1.03)	0.99 (0.89, 1.10)	1.07 (0.93, 1.23)	1.02 (0.88, 1.19)
Age				
50–64 years	Reference	Reference	Reference	Reference
65–74 years	1.55 (1.39, 1.74)	1.38 (1.20, 1.59)	1.20 (1.02, 1.41)	0.93 (0.76, 1.14)
75 years	0.95 (0.85, 1.06)	0.81 (0.69, 0.95)	0.95 (0.80, 1.14)	0.72 (0.57, 0.93)
Geographic stratum				
Rural	Reference	Reference	Reference	Reference
Urban	1.15 (1.06, 1.26)	1.16 (1.04, 1.28)	1.06 (0.93, 1.21)	0.96 (0.83, 1.12)
Marital Status				
Married	Reference	Reference	Reference	Reference
Widowed	0.66 (0.59, 0.73)	0.72 (0.63, 0.83)	0.85 (0.72, 1.00)	0.88 (0.72, 1.08)
Other <sup>e</sup>	0.61 (0.55, 0.69)	0.73 (0.64, 0.83)	0.76 (0.65, 0.90)	0.86 (0.72, 1.03)
Education				
Less than high school graduation	Reference	Reference	Reference	Reference
High school graduation/GED	1.80 (1.54, 2.10)	1.61 (1.35, 1.92)	1.25 (0.99, 1.59)	1.23 (0.95, 1.60)
Some college	2.46 (2.08, 2.90)	2.23 (1.85, 2.69)	1.36 (1.06, 1.74)	1.46 (1.11, 1.91)
College graduation <sup>f</sup>	3.49 (2.99, 4.08)	3.00 (2.50, 3.61)	1.58 (1.25, 1.98)	1.81 (1.39, 2.35)
Employment status				
Employed <sup>g</sup>	Reference	Reference	Reference	Reference
Retired	1.21 (1.10, 1.33)	1.33 (1.16, 1.51)	1.16 (1.01, 1.34)	1.26 (1.04, 1.54)
Other <sup>h</sup>	0.67 (0.58, 0.78)	0.99 (0.83, 1.17)	0.73 (0.59, 0.91)	0.91 (0.71, 1.15)
Body Mass Index <sup>i</sup>				
Normal weight (<25.0)	Reference	Reference	Reference	Reference
Overweight (25.0–<30.0)	0.99 (0.89, 1.10)	0.95 (0.85, 1.07)	1.07 (0.92, 1.26)	1.10 (0.93, 1.30)
Obese (≥ 30.0)	1.01 (0.90, 1.13)	1.10 (0.97, 1.25)	1.20 (1.01, 1.42)	1.23 (1.03, 1.48)

Respondent Characteristic	Recommendation for Colonoscopy/Sigmoidoscopy		Recommendation for FOBT in Past Year	
	Unadjusted <sup>a</sup> OR (95% CI)	Adjusted <sup>b</sup> OR (95% CI)	Unadjusted <sup>c</sup> OR (95% CI)	Adjusted <sup>d</sup> OR (95% CI)
Health care coverage <sup>j</sup>				
No	Reference	Reference	Reference	Reference
Yes	4.74 (3.79, 5.91)	2.66 (2.05, 3.44)	2.31 (1.64, 3.24)	1.47 (1.01, 2.15)
Time since last routine check-up				
< 1 year	Reference	Reference	Reference	Reference
1 – <5 years	0.56 (0.48, 0.64)	0.52 (0.44, 0.61)	0.29 (0.23, 0.38)	0.28 (0.21, 0.36)
5 years	0.14 (0.11, 0.18)	0.16 (0.12, 0.21)	0.15 (0.09, 0.25)	0.16 (0.10, 0.26)
Family history of CRC <sup>k</sup>				
No	Reference	Reference	Reference	Reference
Yes	1.71 (1.46, 2.00)	1.75 (1.46, 2.10)	1.16 (0.91, 1.47)	1.19 (0.92, 1.56)

FOBT: fecal occult blood test, OR: odds ratio, CI: confidence interval, GED: general educational development tests, CRC: colorectal cancer

Analysis performed accounting for stratification by geography, except results for unadjusted analysis of geographic stratum, and weighted to the Maryland population.

<sup>a</sup>Due to missing data, n for unadjusted models ranges from 13,339 to 13,863.

<sup>b</sup>Adjusted for all listed variables; n = 13,038

<sup>c</sup>Among the subset of respondents not up-to-date with colonoscopy (within the preceding 10 years). Due to missing data, n for unadjusted models ranges from 5,539 to 5,801.

<sup>d</sup>Among the subset of respondents not up-to-date with colonoscopy (within the preceding 10 years) and adjusted for all listed variables; n = 5,387

<sup>e</sup>Includes respondents who were divorced, separated, never married, or a partner of an unmarried couple

<sup>f</sup>Includes respondents with masters, doctoral or advanced professional degrees

<sup>g</sup>Includes respondents employed for wages and self employed

<sup>h</sup>Includes students, homemakers, and respondents unable to work, or out of work

<sup>i</sup>Body Mass Index is calculated as weight in kilograms/(height in meters)<sup>2</sup>

<sup>j</sup>Health care coverage includes health insurance, prepaid plans such as HMOs, or government plans such as Medicare or Medical Assistance

<sup>k</sup>Family history of CRC is defined as a reported history of a diagnosis of colon cancer in a first degree relative (parent, sibling or child)