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Using colorectal trends in the U.S. to identify unmet primary care needs of vulnerable populations

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Abstract

Background—Colorectal cancer screening (CRC) disparities have worsened in recent years.

Objective—To examine progress toward Healthy People 2010 goals for CRC screening among ethnic/racial groups, including disaggregated Latino groups.

Methods—Multivariate logistic regressions examined associations between ethnicity/race and primary outcomes of self-reported guideline-concordant CRC screenings considering time trends for 65,947 respondents of the Medical Expenditure Panel Survey from 2000–2007 age 50-years and older from six groups (non-Latino White, non-Latino Black, Puerto Rican, Cuban, Mexican, and Other Latino). We also tested for modification effects by education, income, and health insurance.

Results—Most groups approached Healthy People 2010 CRC screening rate goals, including non-Latino Whites (47%), non-Latino Blacks (42%) and Puerto Ricans (40%), while Mexicans remained disparately lower (28%). Higher education, income and insurance coverage, partially attenuated this lower likelihood, but Mexican rates remained significantly lower than non-Latino Whites for receiving endoscopy in the past 5 years {OR(95% CI) =0.68(0.59–0.77)} and having received any CRC screening {0.70(0.62–0.79)}.

Conclusions—Among ethnic/racial groups examined, only Mexicans met healthcare disparity criteria in CRC screening. Findings suggest that healthcare equity goals can be attained if resources affecting continuity of care or ability to pay for preventive services are available, and targeted populations are adequately identified.

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INTRODUCTION

Colorectal cancer (CRC) is the third leading cause of cancer deaths in the United States (2011). Early CRC screening is one of the most effective methods for reducing CRC mortality (Rauscher et al., 2008). The primary CRC screening tools available to healthcare providers are fecal occult blood testing (FOBT), sigmoidoscopy and colonoscopy [collectively known as endoscopy] (ACS, 2008; USPSTF, 2008). CRC screening serves as an indicator of healthcare quality and equity in national and state reports (AHRQ, 2009; D Ritley et al., 2008; Ohio; Rauscher et al., 2008; Shah et al., 2006). A national Healthy People 2010 (HP2010) objective was to “increase the proportion of adults who receive a colorectal screening examination” and that 50% of adults 50 and older have a FOBT within the preceding 2 years. Another objective was for 50% of adults 50-years and older to receive a sigmoidoscopy without specifically stated timeframes (USDHHS). However research indicates that ethnic/racial minority groups have lower rates of CRC screenings, with rates worsening in recent years (AHRQ, 2009; Irby et al., 2006; Jerant et al., 2008a; Sheinfeld Gorin and Heck, 2005). Additionally, although ethnic/racial “disparities” in CRC screening have been reported (AHRQ, 2009; Jerant et al., 2008a; Jerant et al., 2008b), few studies have used an operationalized definition of disparity (Bustamante et al., 2010).

Our study is the first to examine trends among disaggregated ethnic/racial groups’ inequalities in guideline-concordant CRC screening using an operationalized definition of a “healthcare disparity”, defined by the Institute of Medicine (IOM) as “*racial or ethnic differences in the quality of health care that are not due to access-related factors or clinical needs, preferences, and appropriateness of intervention*” (p32) (Smedley et al., 2002). Rarely are ethnic/racial groups disaggregated in studies that allow adequate examination of national trends in healthcare practices. The practice of inappropriate aggregation is carried forward into national healthcare reports and “masks” within-Latino disparities in healthcare (Bustamante et al., 2010; Gonzalez et al., 2010; Miranda et al., 2011a; Zambrana et al., 1999). Consequently, national healthcare policies set goals for reducing disparities in healthcare that have missed important healthcare parity targets among the most vulnerable populations.

In this study, we used a modified Behavioral Model of Health Services Use (Andersen, 1995), examining three major healthcare factors: predisposing (i.e. race, sex, age), enabling (i.e. education, health insurance and income) and need (i.e. the need for CRC screening). In doing so, we further examined progress toward achieving HP2010 CRC screening goals among ethnic/racial groups, considering 2020 targets (USDHHS) and focusing on American Cancer Society (ACS) and United States Preventative Services Task Force (USPSTF) CRC screening guidelines (ACS, 1993; USPSTF, 1996, 2002). Secondly, we determine which, if any, ethnic/racial group had disparate CRC screening rates consistent with the IOM operationalized definition of “healthcare disparity.” Using this modified model, we are able to examine factors that may *predispose* or *enable* an individual’s access to care.

Methods

Data collection—We used data from the yearly Medical Expenditures Panel Survey (MEPS) data files produced by the Agency for Health Care Research and Quality (AHRQ). We pooled MEPS data from all survey years (2000–2007), including consistent questions on CRC screening use to: 1) increase sample size and inference efficiency, and 2) examine and test time trends in CRC screening. We used AHRQ-generated survey design indicators to allow correct pooled data estimation using a common variance structure. Yearly person-specific probability weights, produced by MEPS staff to correct for disproportionalities and non-response bias and align the weighted sample distribution with known population estimates, allowed us to generalize findings to the U.S. non-institutionalized population. A

detailed discussion of the MEPS sample design can be found elsewhere (Ezatti-Rice et al.). Response rates for the MEPS yearly data ranged from a high of 66.3% (2001) to a low of 56.9% (2007) (2009a).

Subpopulation analysis—We focused on the subpopulation of respondents 50 and older to reflect CRC screening guidelines (n=65,947). To account for the MEPS survey design we used the linearized first order Taylor series variance estimation approach from the survey procedures in the Stata (11.1) software.

Outcomes—We examined the standard of care for CRC screening, operationalized following appropriate ACS and USPSTF guidelines for FOBT and endoscopy (ACS, 1993; USPSTF, 1996). The MEPS survey included questions on use of 1) a blood stool test using a special kit provided by a physician or healthcare professional, and 2) colonoscopy or sigmoidoscopy consequent to a brief description explaining these tests, followed by probes on the last time the tests were obtained with response options ranging from 1 (within the past year) to 5 (more than 5-years ago).

We generated three dichotomous indicators for 1) FOBT, 2) endoscopy, and 3) any CRC screening. First, respondents 50 or older reporting use of a FOBT within the past year were classified as guideline concordant. Second, respondents reporting colonoscopy or sigmoidoscopy use within the past 5 years were grouped as guideline concordant for endoscopy. Lastly, respondents who reported either use of guideline concordant FOBT or endoscopy were classified as guideline concordant for any CRC screening.

Primary Predictor—Following the Behavioral Model of Health Services Use, the *predisposing* primary predictor of ethnicity/race was measured using six groups, including non-Latino White (reference group), non-Latino Black, Puerto Rican, Cuban, Mexican, and Other Latino (Andersen, 1995; Gonzalez et al., 2010; Miranda et al., 2011a).

Covariates—To account for possible confounding effects, several covariates reflecting a modified Behavioral Model of Health Services Use *predisposing* and *enabling* factors were considered. Age was measured using a three categories indicator (50–59; 60–69; 70+), and sex using a dichotomous indicator (Male; Female). Education was measured using four categories (less than high school, high school, some college, college or more). We used an income to federal poverty level ratio generated by AHRQ including five classes [100%; <125%; <200%; <400%; 400%] (2010; Banthin and Selden, 2006). Health insurance status included three categories (private, public including all government provided insurance, uninsured). Time was accounted for using survey year.

Analytic approach—First, descriptive statistics for respondents aged 50-years and older are provided (Table 1). Second, age group and ethnicity/race specific prevalence of guideline concordant CRC screening are calculated (Table 2). Rao-Scott survey design corrected chi-square statistics are used to test for independence. Third, time specific screening prevalence estimates are provided for the overall subpopulation, as well as the considered ethnic/race groups. Corrected chi-square tests examine time effects under each considered case. Linear prediction plots for estimated yearly prevalence rates by ethnic/race groups are plotted in Figure 1. Fourth, multivariate logistic regressions, reflecting a Behavioral Model of Health Services Use and controlling for time effects, are used to model the relationship between our main *predisposing* factor of ethnicity/race and each of the CRC screening outcomes, and to test for any modification effects by our *enabling* factors, education, income, and health insurance. CRC screening specific odds ratios are generated for each model (Table 3).

Results

Descriptive statistics—Sample descriptive statistics are presented in Table 1. Ethnicity/race specific analyses (not shown) indicated that Cubans {Mean(SE)=64.8(0.68)} and non-Latino Whites {64.4(0.12)} were on average older than the other considered groups. The overall female sample skew {54%(0.2)} was particularly marked among Puerto Ricans {59.7%(2.47)} and non-Latino Blacks {57.5%(0.69)}. Mexican respondents had noticeably lower levels of education compared to all other groups, with 63.3% (SE=1.42) having less than a high school education, and 6.2% (0.58) reporting a college education or more. All the considered ethnic/racial groups had lower levels of education and income compared to non-Latino Whites. Finally, Mexicans {22.8%(1.05)} and Other Latinos {20.3%(1.9)} had the lowest insurance coverage levels while non-Latino Whites {5.1%(0.17)} and Puerto Ricans {7.6%(1.38)} were most likely to be insured.

Overall screening—Less than one-fifth of respondents reported FOBT within the past year, and close to two-fifths reported having endoscopy within the past 5-years. The overall prevalence rate for any screening was 45.4%.

Age differences—Overall, CRC screening rates were significantly associated with age with older individuals reporting higher use (Table 2). Age differences were particularly apparent when respondents younger than 60-years were compared to those 60-years and older.

Ethnic/racial differences—CRC screenings were significantly associated with ethnicity/race (Table 3). Mexicans were the least likely to report guideline concordant screening with 11.9% indicating a FOBT within the past year, 22% reporting an endoscopy within the past 5 years, and 28% reporting any screening. Other Latinos had slightly higher rates compared to Mexican respondents but consistently lower rates relative to the other considered groups. FOBT screening rates were comparable among the other considered ethnic/racial groups. Non-Latino Whites (39.8%) had the highest rates of consistent endoscopy screening followed by non-Latino Blacks (34.5%) and Puerto Ricans (32%). Non-Latino Whites (47.1%) had the highest prevalence rates for any screening, while Non-Latino Blacks, Puerto Ricans, and Cubans had lower comparable rates.

Time trends—The overall prevalence of guideline conforming FOBT declined ($\chi^2=24.44$; $P<0.0001$) from a high of 21.2% in 2000 to a low of 13.2% in 2007 (Figure 1). With the exception of non-Latino Blacks and non-Latino Whites, ethnic/race specific trends were not significant for the considered groups.

Endoscopy presented a uniform increase in yearly rates of consistent screening ($\chi^2=76.11$; $P<0.0001$) from a low of 28.3% in 2000 to a high of 46.2% in 2007 (Figure 1). Upward trends in ethnicity/race specific screening rates were statistically significant among non-Latino Whites, non-Latino Blacks, and Puerto Ricans.

The rates for any screening also showed an upward trend over the 7-year period ($\chi^2=26.93$; $P<0.0001$). With the exception of non-Latino Whites and non-Latino Blacks, ethnic specific prevalence rates were not significantly dependent on time (Figure 1). The linear plots for the estimated yearly prevalence rates by ethnic/race groups are shown in Figure 1.

Multivariate models

FOBT Predictors—Logistic regression results for FOBT indicate that, controlling for time, age, and sex, Mexican respondents presented the lowest odds {OR(95% CI)=0.69(0.60–0.81)} of guideline concordant consistent screening. Non-Latino Blacks had

marginally significant higher odds of screening {1.09(0.99–1.19)} relative to non-Latino Whites. Accounting for the effects of measured *enabling* factors (education, income, and insurance) completely attenuated the statistical differences in use between Mexican and non-Latino White respondents for FOBT screening. Adjusting for *enabling* factors, however, attenuated the odds of screening among non-Latino Blacks {1.24(1.12–1.36)} relative to non-Latino Whites. Additionally, higher education, reporting a family income that is above the set federal poverty level by 200% or higher, and insurance coverage (both private and public) increased the likelihood of guideline consistent FOBT use.

Endoscopy Predictors—Logistic regression results for endoscopy screening indicated that after adjusting for time, age, and sex, all ethnic/racial groups had lower odds of consistent screening relative to non-Latino Whites. The lower odds of endoscopy were most pronounced among Mexican respondents {0.43(0.38–0.49)}.

Adding the *enabling* factors eliminated the statistical significance of the odds of CRC screening among non-Latino Blacks, Puerto Ricans, and Cubans. The lower odds of screening remained statistically significant but were upward modified among Mexicans and Other Latinos. After controlling for *enabling* factors, Mexican respondents continued to present the lowest screening odds {0.68(0.59–0.77)}. Among the enabling factors, higher education, reporting a family income above the set federal poverty level by 400% or more, and insurance coverage (both private and public) increased the likelihood of guideline consistent endoscopy screening.

Predictors of any CRC screening—The logistic regression results for any screening were generally similar to the endoscopy results. Controlling for time, age, and sex, all the considered ethnic/racial groups had lower odds of consistent screening relative to non-Latino Whites. Mexicans presented the lowest odds {0.45(0.40–0.51)} for consistently receiving any CRC screening.

Controlling for *enabling* factors (education, income, and insurance) completely attenuated the statistical differences in receiving any CRC screening between non-Latino Black, Puerto Rican, Cuban and non-Latino White respondents. Mexicans {0.70(0.62–0.79)} and Other Latinos {0.79(0.69–0.91)} continued to present statistically significant lower, though increasing, odds of screening compared to non-Latino Whites. Higher education, reporting a family income above the set federal poverty level by 200% or more and insurance coverage (both private and public) increased the likelihood of receiving any CRC screening.

DISCUSSION

For many aged 50-years and older, Healthy People 2010 CRC endoscopy screening goals were achieved or approached between 2000 and 2007; however, annual FOBT rates have steadily drifted downward and away from the 50% screening objective. By 2007 non-Latino White, non-Latino Black, and Puerto Rican CRC endoscopy rates approached HP2010 goals (50%), whereas rates for the Mexican-origin Latinos have remained markedly lower and unchanged over the study period. Of the U.S. ethnic/racial groups examined here, only Mexicans and Other Latinos met the IOM criteria for a healthcare disparity in CRC screening consistent with ACS and USPSTF clinical guidelines.

Our findings indicate that HP2010 goals may be valuable in directing public health efforts to improve CRC screening rates for some ethnic/racial groups, particularly those groups not previously specified as vulnerable populations in national targets (Census, 2008). As our findings indicated, eliminating inequalities in factors that purportedly *enable* healthcare access has the potential for reducing some, but not all, of the observed CRC screening

differences, particularly for Mexican-origin Latinos who have low rates of insurance (2007) and high school completion rates. In 2007, the Latino high school dropout rate was 21%, compared to Blacks (8%) and whites (5%) (2009b; Aud et al., 2010), and 34% of nonelderly Latinos were uninsured, compared to 21% of Blacks and 13% of non-Latino White (2007).

Ignoring the changing ethnic/racial composition of the nation in setting healthcare quality and equity goals increases the risk that healthcare disparities will persist. Furthermore, CRC remains a leading cause of cancer death among Latinos, which suggests the need for better cancer screening methods and innovative strategies to encourage screening (ACS, 2008). As new healthcare quality and equity goals are established, appropriately targeting and implementing public health intervention strategies becomes essential.

Compared to other recent national estimates, our trends are similar. However, our estimates show higher rates of FOBT screening, and lower rates of endoscopy and receiving any CRC screening (2011). The effort to combine ACS and USPSTF guidelines to undergo the more invasive tests when resources are available may be driving this observed pattern (2011; Levin et al., 2008), as well as observed population differences. Recent SEER findings on incidence-based mortality also suggest that endoscopy may be slightly more effective than FOBT, congruent with the 2008 CRC guidelines (Zauber et al., 2012). It remains unclear if the higher costs and risks associated with endoscopy over FOBT merit its wide-spread use. Though these findings mirror a convergence of findings for this vulnerable population for breast cancer screening (Miranda et al., 2011a; Miranda et al., 2011b), diabetes (Gonzalez et al., 2009) and depression (Gonzalez et al., 2010), future studies may consider population-specific factors that may increase the odds of CRC screening, such as access to endoscopy at clinics.

Several caveats should be considered when reading our findings. CRC screening use was ascertained by self-report, which is subject to recall and social-desirability biases (Gordon et al., 1993; Jones et al., 2008), though prior research suggests that misestimates of CRC screening tends to occur less for endoscopic procedures compared to FOBT (Baier et al., 2000; Jones et al., 2008). As such, our estimates of CRC screening use may be misestimated, affecting all groups. In addition, we did not examine other contextual factors considered important in the original Behavioral Model of Health Services Use (1967). Examining contextual factors, such as familial involvement in screening decision-making may provide some additional insights into our findings. Finally, given the cross-sectional nature of the data, no causal relationships should be inferred from our findings.

In the U.S. between 2000 and 2007, we found that marked progress has been made toward achieving the Healthy People 2010 goal of CRC. For the Mexican-origin population, however, CRC rates started lower than all other ethnic/racial groups we examined and remained static over the study period. With the Healthy People 2020 CRC screening objectives largely unchanged, national healthcare priorities must accommodate the changing demography and unmet primary care needs of all who live in the United States.

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Highlights

Examines Healthy People 2010 goals for colorectal cancer screening in the U.S.

Mexicans presented a distinct pattern of lower colorectal screening rates

Factors enabling healthcare attenuated this lower likelihood.

Healthcare equity goals can be attained provided the adequate target populations.

Figure 1.

Linear prediction plots for estimated yearly prevalence rates of past year Fecal Occult Blood Test, within past 5 years endoscopy (colonoscopy/sigmoidoscopy), and mixed screening (within past year FOBT or within past 5 years endoscopy) by ethnicity/race groups in the U.S. for respondents ages 50 and over from pooled Medical Expenditure Panel Survey data (2000–2007).

(a) Fecal Occult Blood Test (FOBT); (b) Colonoscopy/Sigmoidoscopy; (c) FOBT or Colonoscopy/Sigmoidoscopy

Table 1

Sample Demographics for United States adults ages 50 in and over from pooled Medical Expenditure Panel Survey data (2000–2007).

	n	%(SE)
Year		
2000	6,247	11.3(0.8)
2001	8,482	11.9(0.2)
2002	9,545	12.1(0.2)
2003	8,083	12.4(0.3)
2004	8,251	12.6(0.2)
2005	8,352	12.9(0.2)
2006	8,879	13.2(0.2)
2007	8,108	13.6(0.3)
Ethnicity/Race		
Non-Latino Whites	46,026	82.2(0.6)
Blacks	9,676	10.0(0.4)
Puerto Ricans	919	0.9(0.1)
Cubans	800	0.6(0.1)
Mexicans	6,680	4.6(0.4)
Other Latinos	1,841	1.7(0.1)
Age		
50–59	28,241	42.4(0.4)
60–69	17,771	27.3(0.3)
70+	19,935	30.3(0.4)
Education		
Less than high school	18,563	21.0(0.4)
High school	20,984	33.7(0.5)
Some college	12,000	20.3(0.3)
College or more	13,578	25.0(0.5)
Family Income ^a		
<100%	9,216	9.2(0.2)
100%–124%	3,652	4.4(0.1)
125%–199%	9,817	13.4(0.3)
200%–399%	18,258	28.1(0.4)
400%	25,004	44.9(0.6)
Insurance Status		
Private	41,813	71.2(0.5)
Public	17,822	21.9(0.4)
Uninsured	6,312	6.9(0.2)

^aRelative to federal poverty level

Table 2

Prevalence of within past year Fecal Occult Blood Test (FOBT), within past 5 years endoscopy, and any screening (within past year FOBT *or* within past 5 years endoscopy) by age and ethnicity/race for individuals ages 50 years and older in the U.S. Results are from pooled Medical Expenditure Panel Survey data (2000–2007).

	FOBT	Colonoscopy/Sigmoidoscopy	FOBT* <i>or</i> Colonoscopy/Sigmoidoscopy
	%(SE)	%(SE)	%(SE)
Total	17.1(0.4)	38.2(0.4)	45.4(0.4)
Age			
50–59	13.1(0.3)	31.3(0.6)	37.6(0.6)
60–69	19.0(0.5)	43.7(0.6)	51(0.6)
70+	21.0(0.6)	42.9(0.6)	51.5(0.6)
	P<0.0001	P<0.0001	P<0.0001
Ethnicity/race			
Non-Latino Whites	17.3(0.4)	39.8(0.5)	47.1(0.5)
Blacks	17.9(0.6)	34.5(1.0)	41.8(1.0)
Puerto Ricans	16.1(1.8)	32.0(3.1)	40.1(3.0)
Cubans	19.1(2.4)	29.5(2.8)	40.3(2.7)
Mexicans	11.9(0.8)	22.0(1.1)	28.0(1.2)
Other Latinos	15.2(1.2)	27.9(1.5)	33.9(1.6)
Total	17.1(0.4)	38.2(0.4)	45.4(0.4)
	P<0.0001	P<0.0001	P<0.0001

*
Fecal Occult Blood Test (FOBT)

Table 3

Predictors of within past year Fecal Occult Blood Test (FOBT), within past 5 years endoscopy (colonoscopy/sigmoidoscopy), and any screening (within past year FOBT or within past 5 years endoscopy) use in the U.S. among individuals ages 50 years and older. Results are from logistic regression models using pooled Medical Expenditure Panel Survey data (2000–2007).

	Past Year FOBT ^a				Past 5 Years Endoscopy				Past Year FOBT ^a or Past 5 Years Endoscopy			
	Model 1 ^b		Model 2 ^c		Model 1 ^b		Model 2 ^c		Model 1 ^b		Model 2 ^c	
	OR ^d	95 % CI ^e	OR ^d	95 % CI ^e	OR ^d	95 % CI ^e	OR ^d	95 % CI ^e	OR ^d	95 % CI ^e	OR ^d	95 % CI ^e
Year												
2000	1.00	ref	1.00	ref	1.00	ref	1.00	ref	1.00	ref	1.00	ref
2001	0.91	0.81–1.01	0.91	0.82–1.02	1.16***	1.06–1.28	1.17***	1.07–1.28	1.10**	1.01–1.20	1.11**	1.02–1.20
2002	0.92	0.80–1.04	0.91	0.80–1.04	1.35***	1.22–1.5	1.35***	1.23–1.49	1.22***	1.10–1.34	1.21***	1.10–1.33
2003	0.91	0.80–1.05	0.90	0.79–1.04	1.59***	1.42–1.78	1.58***	1.42–1.77	1.36***	1.23–1.51	1.35***	1.22–1.49
2004	0.73***	0.63–0.85	0.72***	0.62–0.84	1.74***	1.56–1.93	1.73***	1.55–1.92	1.39***	1.25–1.55	1.38***	1.24–1.54
2005	0.61***	0.53–0.71	0.60***	0.52–0.70	1.81***	1.64–2.00	1.79***	1.63–1.96	1.40***	1.27–1.55	1.38***	1.25–1.52
2006	0.64***	0.55–0.73	0.62***	0.54–0.72	2.00***	1.80–2.22	1.98***	1.79–2.19	1.54***	1.39–1.70	1.52***	1.38–1.68
2007	0.57***	0.49–0.66	0.56***	0.48–0.64	2.25***	2.02–2.51	2.25***	2.03–2.49	1.63***	1.47–1.80	1.61***	1.46–1.78
Race/Ethnicity												
Non-Latino Whites	1.00	ref	1.00	ref	1.00	ref	1.00	ref	1.00	ref	1.00	ref
Blacks	1.09*	0.99–1.19	1.24***	1.12–1.36	0.82	0.74–0.90	1.04	0.95–1.15	0.83***	0.77–0.91	1.06	0.97–1.15
Puerto Ricans	0.98	0.75–1.28	1.15	0.88–1.52	0.71	0.54–0.94	0.95	0.71–1.26	0.76**	0.60–0.97	1.02	0.79–1.31
Cubans	1.10	0.80–1.52	1.29	0.94–1.78	0.62	0.47–0.81	0.82	0.62–1.09	0.74	0.60–0.92	0.99	0.80–1.21
Mexicans	0.69***	0.60–0.81	0.90	0.76–1.06	0.43	0.38–0.49	0.68***	0.59–0.77	0.45***	0.40–0.51	0.70***	0.62–0.79
Other Latinos	0.94	0.77–1.13	1.07	0.88–1.30	0.60	0.51–0.70	0.80***	0.69–0.94	0.60***	0.52–0.70	0.79***	0.69–0.91
Sex												
Male	1.00	ref	1.00	ref	1.00	ref	1.00	ref	1.00	ref	1.00	ref
Female	0.90***	0.85–0.95	0.92***	0.87–0.98	0.85***	0.81–0.89	0.89***	0.85–0.93	0.88***	0.84–0.92	0.92***	0.88–0.96
Age												
50–59	1.00	ref	1.00	ref	1.00	ref	1.00	ref	1.00	ref	1.00	ref

	Past Year FOBT ^a				Past 5 Years Endoscopy				Past Year FOBT ^a or Past 5 Years Endoscopy			
	Model 1 ^b		Model 2 ^c		Model 1 ^b		Model 2 ^c		Model 1 ^b		Model 2 ^c	
	OR ^d	95 % CI ^e	OR ^d	95 % CI ^e	OR ^d	95 % CI ^e	OR ^d	95 % CI ^e	OR ^d	95 % CI ^e	OR ^d	95 % CI ^e
60–69	1.55***	1.44–1.67	1.59***	1.48–1.72	1.7***	1.60–1.81	1.85***	1.74–1.97	1.71***	1.62–1.82	1.86***	1.75–1.97
70 and older	1.76***	1.62–1.91	1.86***	1.70–2.05	1.67***	1.57–1.77	2.02***	1.90–2.15	1.76***	1.66–1.87	2.09***	1.95–2.24
Education												
Less than high school			1.00	ref			1.00	ref			1.00	ref
High school			1.19***	1.10–1.30			1.26***	1.16–1.36			1.28***	1.20–1.37
Some college			1.35***	1.20–1.50			1.41***	1.31–1.53			1.46***	1.35–1.57
College or more			1.39***	1.25–1.55			1.85***	1.71–2.00			1.84***	1.70–1.99
Family Income^f												
<100%			1.00	ref			1.00	ref			1.00	ref
100%–124%			0.96	0.83–1.11			0.87**	0.78–0.97			0.87***	0.78–0.96
125%–199%			1.01	0.90–1.13			0.94	0.87–1.02			0.97	0.90–1.05
200%–399%			1.14***	1.04–1.27			1.06	0.98–1.14			1.10**	1.02–1.19
400%			1.18***	1.06–1.32			1.33***	1.22–1.44			1.31***	1.21–1.42
Insurance												
Uninsured			1.00	ref			1.00	ref			1.00	ref
Private			1.83***	1.60–2.09			2.93***	2.54–3.37			2.67***	2.36–3.01
Public			1.85***	1.59–2.16			2.46***	2.14–2.83			2.35***	2.08–2.65

^aFecal Occult Blood Test (FOBT),

^bAdjusted for year, sex and age,

^cAdditional adjustment for enabling factors (i.e. education, income and insurance),

^dOdds Ratio,

^e95% Confidence Interval,

^fRelative to federal poverty level,

*** P<0.01,
** P<0.05,
* P<0.10