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Socioeconomic and Racial Patterns of Colorectal Cancer Screening among Medicare Enrollees in 2000 to 2005

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Abstract

Background: **Lower rates of screening among minorities and low-income populations contribute to colorectal cancer health disparities. Therefore, we examined patterns of colorectal cancer screening and associations with race-ethnicity, education, and income over time.**
Methods: **Repeated cross-sectional data from the Medicare Current Beneficiary Survey of noninstitutionalized colorectal cancer–free Medicare enrollees ages 65 to 80 years interviewed in 2000 (n = 8,355), 2003 (n = 7,922), and 2005 (n = 7,646). We examined rates of colonoscopy/sigmoidoscopy use within 5 years (recent endoscopy), colonoscopy/sigmoidoscopy use >5 years previously, or fecal occult blood test (FOBT) within 2 years.**
Results: **Among those included in the analyses, there was a steady increase in recent endoscopy rates and decrease in FOBT use over the 6-year period among all racial, educational, and income groups. During each of the survey years, those less educated or in lower-income groups were less likely to undergo colorectal cancer screening in a dose-response fashion. In multinomial regression analyses that adjusted for factors including health insurance, there were no significant differences in recent endoscopy or FOBT rates between Blacks or Hispanics and Whites, but differences by education and income remained. Compared with those in higher-income group, lower-income enrollees had lower rates of screening, and differences by income were larger for enrollees residing in metropolitan areas.**
Conclusion: **Among Medicare beneficiaries, there are persistent colorectal cancer screening disparities due to a complex combination of socioeconomic disadvantages from lower education and income, place of residence, and inadequate insurance. However, insurance alone does not eliminate socioeconomic differences in colorectal cancer screening.** (Cancer Epidemiol Biomarkers Prev 2009;18(8):2170–5)

Background

In the United States, racial and socioeconomic disparities for colorectal cancer persist (1, 2). Evidence shows that colorectal cancer screening can reduce the mortality rate from this potentially preventable disease (3-9). However, nearly half of eligible adults have not been screened and the rates are disproportionally low among racial and ethnic minorities and persons from socioeconomically disadvantaged populations (2, 10, 11). Although existing data suggest steady increasing trends in colorectal cancer screening in recent years, rates are tracking lower than the current U.S. public health goal, particularly among persons from low socioeconomic backgrounds (12). However, the patterns of colorectal cancer screening over time in these vulnerable groups are not well known.

Among the competing guideline-recommended tests for colorectal cancer (13), existing studies suggest that in recent years there has been an increasing use of colonoscopy, in tandem with decreasing use of the fecal occult blood test (FOBT; refs. 10, 14, 15). Only a small percentage of eligible adults currently undergo flexible sigmoidoscopy, and barium enema is seldom used (16). These changing patterns of screening are occurring in a weak national economy and in health-care systems with limited capacity to provide colonoscopy services to the U.S. population (17). Screening colonoscopy is usually done by specialists generally through a referral and is more expensive and complex than FOBT testing (18, 19). Thus, the current changing patterns may widen existing gaps in colorectal cancer health outcomes for socioeconomically disadvantaged populations (1).

Existing reports show that racial-ethnic minorities and persons of low socioeconomic status have lower rates of colorectal cancer screening (11, 20). However, factors related to socioeconomic disadvantage are often intertwined and tend to occur together in the same persons (21). For those in Medicare, benefits for colorectal cancer screening were expanded to include reimbursement for screening colonoscopy in 2001, but enrollees who do not have supplemental insurance are responsible for up to 25% of the cost of this test (18). Medicare beneficiaries from socioeconomically disadvantaged backgrounds,

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who are less likely to have supplemental insurance, may be adversely affected by the current changing patterns of colorectal cancer screening in the United States. However, there are limited data on the relationships of colorectal cancer screening patterns with race and socioeconomic status in the period before and after the Medicare policy change.

The objective of this report was to use nationally representative samples of Medicare beneficiaries to examine the relationship between race-ethnicity, education, and income and the patterns of colorectal cancer screening from 2000 to 2005.

Materials and Methods

The data for this study were derived from the Medicare Current Beneficiary Survey (MCBS), an ongoing annual survey of nationally representative samples of those in Medicare identified using a complex multistage stratified sampling scheme. The methods and data collected for the MCBS have been described in detail (22). Our study population was composed of colorectal cancer–free noninstitutionalized beneficiaries ages 65 to 80 years who were enrolled at the beginning of the 2000, 2003, and 2005 survey years. Therefore, those on Medicare due to disability and the oldest old were excluded. The upper age cutoff is consistent with prevailing colorectal cancer screening guidelines (13, 23). The increasing prevalence of competing medical risks with advancing age may undermine the benefits of screening. Of the eligible sample, those with missing information on colorectal cancer screening (n = 157) were excluded.

Data Elements. The MCBS collects extensive demographics and geographic data on beneficiaries. We categorized information on marital status as married, widowed, divorced or separated, and never married, and race-ethnicity was categorized as non-Hispanic White (Whites), non-Hispanic Blacks (Blacks), Hispanics, or others. We used the primary language of the interview as a proxy for English proficiency (English versus other languages).

Data were also collected on socioeconomic characteristics, supplemental insurance, and access to health services. We categorized the educational level as less than high school graduate, high school graduate, and higher than high school. The annual household income of study participants was recorded as <$10,000, $10,000 to $20,000, $20,000 to $40,000, or >$40,000. The survey also asked respondents if household income was <$25,000 or >$25,000 per year. We defined an indicator for delay in seeking care due to cost based on if the associated cost caused a beneficiary to delay care in the previous year or to not have a usual place of health care, see a doctor for a medical problem, or fill a prescription. Data on the type of health insurance were categorized as Medicare only, or dual eligibles (Medicaid), Medicare health maintenance organization plans (health maintenance organization), or private employer-sponsored or self-purchased insurance. The MCBS also collected data on having a usual source of health care and the specialty of the physician that usually provides the care, which we categorized as primary care physicians, other physicians, or none (no usual place of health care).

Data were collected on health status and utilization of Medicare-approved services including colorectal cancer screening. Participants were asked how they rated their general health compared with others in their age group and about a history of non–skin cancers. Body mass index was computed from self-reported height and weight.

Measures of Colorectal Cancer Screening. Participants in the survey reported on the time of their most recent screening sigmoidoscopy or colonoscopy or home FOBT test (possible responses: "<1 year ago" to "≥5 years ago"). Therefore, we defined three mutually exclusive colorectal cancer screening outcomes: lower gastrointestinal endoscopy within 5 years with or without FOBT (recent endoscopy), FOBT alone within 2 years, and endoscopy >5 years previously. The comparison group was composed of enrollees who had never before been screened or only reported FOBT >2 years previously.

Data Analyses. We used the Student's t test and the χ^2 test to summarize continuous and categorical variables, respectively. Single and multiple predictor multinomial regression models were used to examine trends in patterns of colorectal cancer screening and relationships with race-ethnicity and socioeconomic indicators. Trends in FOBT and lower gastrointestinal endoscopy use over the 6-year period were assessed using the Wald χ^2 test (24) with pooled data from the three survey years. We restricted our multinomial models analyses of the associations with colorectal cancer screening to the 2000 and 2005 survey years to compare patterns for the most recent year (2005) to those for the year before Medicare's expansion of benefits (2000). Separate regression models analyses were done for each survey year.

The primary predictors in the analyses were race-ethnicity, educational achievement, and household income. Candidate covariates in the multivariable models included census division, residence in a metropolitan service area (MSA), gender, marital status, age, body mass index, insurance type, usual place of health care, delayed care due to cost, language of the interview, self-reported general health status, and history of non–skin cancer. Covariates that were significantly associated with colorectal cancer screening and/or improved model fit were retained. We assessed model fit with goodness-of-fit statistics using procedures designed for complex survey data and multinomial models (25, 26). Plausible two-way interactions between covariates were carefully studied. The two-way interactions between insurance and educational attainment and income and residence in a MSA were significant and thus included in the multivariable models. We used the binary income variable (<$25,000 versus ≥$25,000 per year) in our multivariable regression analyses for ease of interpretation of the interaction terms. Missing data replacement with dummy variables were done on income (n = 32), education (n = 89), race-ethnicity (n = 28), marital status (n = 21), and general health status (n = 214). This did not change the findings.

Cross-sectional survey weights were used in all analyses and variance estimation were done using Taylor series linearization to account for the complex survey design. The analyses were done using STATA version 10.

Results

Characteristics. Of those included in the analyses, 8,355 were interviewed in 2000, 7,922 in 2003, and 7,646

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in 2005. These represented an estimated 22,387,246, 22,680,969, and 22,639,738 Medicare enrollees in the respective years. Hispanics and Blacks were younger and had a higher proportion of women than Whites; almost all of the interviews among Whites or Blacks were conducted in English compared with 56% to 58% among Hispanics. Both Blacks and Hispanics had lower levels of education and household income than Whites: over the 6-year period, about 19% to 25% of Whites had less than high school education compared with 45% to 55% among Blacks and 55% to 61% among Hispanics; 43% to 53% of Whites earned ≤$25,000 per year compared with 73% to 82% of Blacks and 76% to 82% Hispanics. Non-White enrollees and those with lower income or education were more likely to have been on Medicaid, delayed care due to cost, or lacked a usual place of health care (data not shown).

Trends in Patterns of Screening. Over the 6-year period, there was a steady increase in the proportion of enrollees who underwent endoscopy and a decrease in FOBT use among all racial-ethnic (Fig. 1), educational (Fig. 2), and income (Fig. 3) groups. However, Black and Hispanic enrollees or those with lower education or income had lower rates for each of the test at each time point.

The gap in recent endoscopy between Blacks and Whites narrowed in 2003 but widened again in 2005. Among Blacks, the recent endoscopy rates for 2003 (45%) and 2005 (47%) were similar (P_{trend} = 0.89; Fig. 3). Blacks had lower FOBT rates and had a slower decline in FOBT use than Whites during the study period. The recent endoscopy gap between Hispanics or the "other" racial group and Whites persisted throughout the study period. Hispanics had a similar FOBT rate as Whites during 2000 and 2003 but had a lower rate in 2005. Although the "other" racial group had a similar FOBT rate as Whites in 2000, that group had lower rates of FOBT screening in 2003 and 2005. Non-White enrollees also had lower rates of endoscopy >5 years previously.

There was a dose-response pattern in the rates of endoscopy or FOBT according to educational (see Fig. 2) and income (see Fig. 3) levels. The rates of screening particularly for recent endoscopy lagged behind by about 6 years for each lower level of education or income. The recent endoscopy rate in 2005 among those with less than high school was similar to the 2000 rates among high school graduates. The recent endoscopy rate in 2005 among those with household incomes of $20,000 to $40,000 was similar to the 2000 rates among those earning ≥$40,000 per year.

Associations with Colorectal Cancer Screening Patterns over Time. Table 1 shows the unadjusted estimates of the associations with the patterns of colorectal cancer screening for the 2000 and 2005 study years. For each year, non-White enrollees had significantly lower rates of FOBT, recent endoscopy, and endoscopy >5 years previously than Whites. Rates of colorectal cancer screening decreased with lower levels of education and income in a dose-response fashion. There were no substantive changes in the estimates after adjustment for age and gender in each model (data not shown).

Table 2 compares the adjusted estimates of the associations with patterns of colorectal cancer screening for the 2000 and 2005 study years. The multivariable models were adjusted for selected covariates and included interaction terms between education and insurance and income and MSA residence. In these models, we used the dichotomous income variable and dichotomized educational level (less than high school graduation versus others) for ease of interpretation of the interaction effects.

For both survey years, there were no significant differences in recent endoscopy or FOBT use between Blacks or Hispanics and Whites. In 2005, Hispanics or Blacks had significantly lower rates of endoscopy >5 years previously. The "other" racial group had significantly lower recent endoscopy rates in both years than Whites.

In the adjusted analyses for each survey year, educational and income levels were each independently associated with use of colorectal cancer screening tests (see Table 2). Those with less than high school diploma had significantly lower testing rates in both study years irrespective of the type of insurance. However, the differences by educational level varied by the type of insurance coverage. In both survey years, the differences in FOBT use by education were smaller among enrollees in self-purchased plans. However, the differences in recent endoscopy rates among those with supplemental insurance widened in 2005.

Those in the lower-income group were significantly less likely to have undergone recent endoscopy, endoscopy >5 years previously, or FOBT for each survey year (see Table 2). Low-income enrollees living in a MSA had significantly lower rates of FOBT and recent endoscopy in both survey years.

Discussion

In this study, we found complex patterns of socioeconomic disparities in colorectal cancer screening among Medicare enrollees. We found significant differences in use of both lower gastrointestinal endoscopy and FOBT testing for colorectal cancer screening by education and income

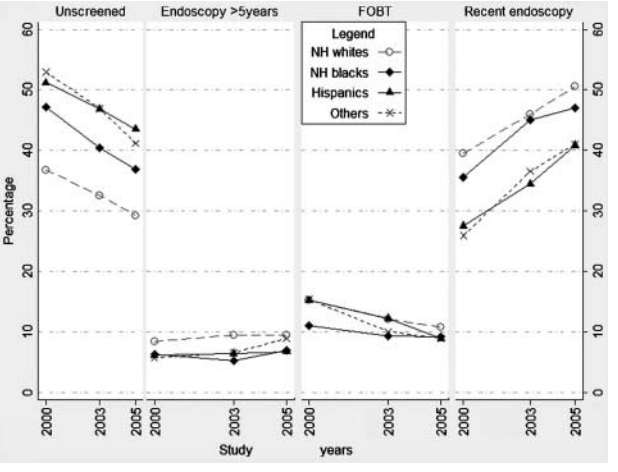

Figure 1. Patterns of colorectal screening by race and ethnicity among Medicare enrollees ages 65 to 80 y: MCBS 2000 to 2005. Abbreviations: FOBT, home FOBT alone within 2 y; Unscreened, enrollees who had never before been screened or only reported FOBT >2 y previously; Endoscopy, sigmoidoscopy or colonoscopy; Recent endoscopy, endoscopy within 5 y with or without FOBT; NH, non-Hispanic.

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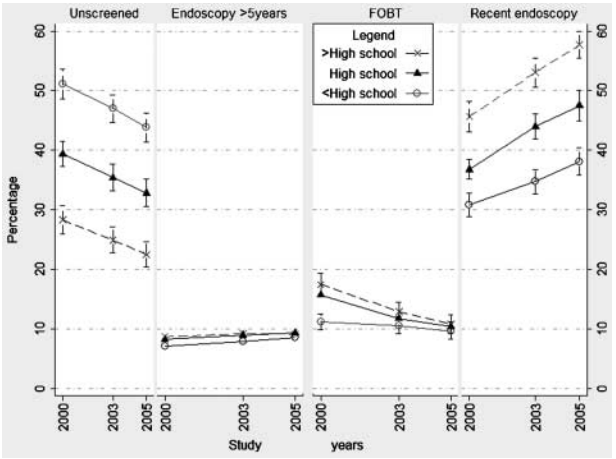

Figure 2. Patterns of colorectal cancer screening by education among Medicare enrollees ages 65 to 80 y: MCBS 2000 to 2005. Some of the point estimates are shown with 95% confidence interval of the percentage.

levels, which persisted over the 6-year study period. The differences in rates of testing among less educated persons varied according to the type of health insurance coverage. Among the income groups, low-income enrollees residing in a MSA had the lowest rates of endoscopy and FOBT testing. However, there were no significant differences between Hispanics or Blacks and Whites after adjustment for other factors including socioeconomic differences.

Racial minorities and persons in lower-income groups have a higher burden of colorectal cancer (1, 2, 27). For instance, Blacks may be more likely to be diagnosed with colorectal cancer at an advanced stage, with tumors that are located in the right colon, or larger precursor lesions (2, 28-30). Differences in screening patterns particularly use of colonoscopy may contribute to these differences. In this study, we found limited racial-ethnic differences in use of endoscopy or FOBT after controlling for socioeconomic inequality and restricted access to health care. This finding is similar to findings from previous studies on colorectal cancer screening (10, 31-34). Non-White enrollees are less likely to have supplemental insurance, are more likely to delay care due to cost, or lack a usual source of health care, which has contributed to a delayed uptake of newer screener technologies (15, 35). These differences likely contributed to the unadjusted differences observed in this study between Blacks and Hispanics and Whites. The significantly lower rates among the "other" racial group suggest the presence of differences for some minority subpopulations that are independent of socioeconomic factors.

Low socioeconomic status is a known barrier to cancer screening. In addition, factors related to socioeconomic position are intertwined, compounding the disadvantages experienced (21). Thus, the persistent disparities in use of endoscopy by income and education are not surprising. Lower gastrointestinal endoscopy is expensive and not fully reimbursed by Medicare (18). Thus, it is likely beyond the means of low-income populations who may not have supplemental health insurance. In this study, we found persistent differences in endoscopy rates by education and income even after controlling for other factors including indicators for access to health care. However, the colorectal cancer screening disadvantage from lower education was not mitigated by having supplemental insurance particularly in the most recent study period. Although health insurance may improve access to screening (34, 36, 37), it may not eliminate other potential barriers experienced by those less educated. We also found an interaction between place of residence and income. Low-income enrollees in a MSA had lower rates of testing than those in higher-income groups. The differences by income among enrollees in non-MSA were attenuated in 2005, suggesting narrowing of the screening gap by education in those areas. Higher-competing financial and social demands in urban areas may negatively affect the use of colorectal cancer screening among low-income populations. The effect of these interactions on use of other cancer screening tests such as mammography will need further study.

We were surprised by the persistent income disparities in FOBT use over the 6-year period. FOBT is both inexpensive and fully reimbursed by Medicare (18). This suggests that additional factors including cultural differences, patients' mistrust, patient-physician communication problems and limited health-care access, and difficulty navigating complex health-care systems likely contributed to the observed differences (38-40).

Strengths of this study include data collected from in-person survey of Medicare beneficiaries that is generalizable to enrollees ages 65 to 80 years. This study provides data that can be used in planning for the screening needs of vulnerable elderly populations. However, the survey did not distinguish between flexible sigmoidoscopy and colonoscopy. Therefore, we used a 5-year cutoff to define sigmoidoscopy/endoscopy use and provided information about endoscopies done >5 years previously. In addition, some of the endoscopies may have been done for diagnostic (including diagnostic evaluation of abnormal FOBT) rather than for screening purposes in asymptomatic

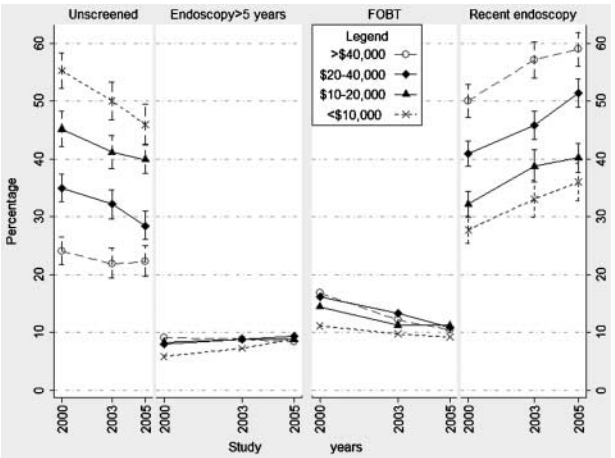

Figure 3. Patterns of colorectal cancer screening by income among Medicare enrollees ages 65 to 80 y: MCBS 2000 to 2005. Some of the point estimates are shown with 95% confidence interval of the percentage.

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Table 1. Unadjusted associations of socioeconomic indicators with patterns of colorectal cancer screening among Medicare enrollees: MCBS 2000 to 2005

Characteristics	Study year: odds ratios (95% confidence interval)*							
	2000 (n = 8,344)				2005 (n = 7,644)			
	n†	Endoscopy >5 y	FOBT	Recent endoscopy	n†	Endoscopy >5 y	FOBT	Recent endoscopy
Race-ethnicity								
Whites	6,705	1.00 (reference)	1.00 (reference)	1.00 (reference)	6,023	1.00 (reference)	1.00 (reference)	1.00 (reference)
Blacks	761	0.58 (0.41-0.82)	0.56 (0.42-0.74)	0.70 (0.57-0.86)	636	0.58 (0.40-0.84)	0.67 (0.45-1.01)	0.74 (0.57-0.96)
Hispanics	583	0.52 (0.33-0.82)	0.71 (0.46-1.10)	0.50 (0.36-0.69)	617	0.48 (0.35-0.65)	0.56 (0.41-0.76)	0.54 (0.44-0.67)
Others	301	0.47 (0.26-0.86)	0.70 (0.49-1.01)	0.46 (0.33-0.63)	358	0.67 (0.43-1.02)	0.59 (0.38-0.93)	0.58 (0.44-0.76)
Highest educational achievement								
More than high school	2,694	1.00 (reference)	1.00 (reference)	1.00 (reference)	2,801	1.00 (reference)	1.00 (reference)	1.00 (reference)
High school graduate	2,996	0.68 (0.55-0.85)	0.65 (0.55-0.76)	0.58 (0.50-0.67)	2,837	0.70 (0.57-0.86)	0.66 (0.54-0.80)	0.56 (0.49-0.65)
Less than high school	2,639	0.45 (0.35-0.58)	0.35 (0.29-0.42)	0.37 (0.33-0.43)	1,987	0.48 (0.37-0.62)	0.46 (0.36-0.59)	0.34 (0.29-0.40)
Annual household income, ×$1,000								
>40	1,463	1.00 (reference)	1.00 (reference)	1.00 (reference)	1,742	1.00 (reference)	1.00 (reference)	1.00 (reference)
20-40	2,623	0.61 (0.47-0.79)	0.66 (0.53-0.82)	0.56 (0.48-0.66)	2,579	0.88 (0.71-1.10)	0.82 (0.63-1.05)	0.68 (0.58-0.80)
10-20	2,228	0.48 (0.36-0.65)	0.46 (0.36-0.58)	0.34 (0.29-0.40)	1,753	0.58 (0.45-0.75)	0.60 (0.45-0.80)	0.38 (0.31-0.47)
<10	1,495	0.28 (0.20-0.39)	0.29 (0.23-0.37)	0.24 (0.20-0.29)	997	0.52 (0.38-0.70)	0.43 (0.31-0.58)	0.30 (0.24-0.36)

Abbreviations: FOBT, home FOBT alone within 2 y; Endoscopy, sigmoidoscopy or colonoscopy; recent endoscopy, lower gastrointestinal endoscopy within 5 y with or without FOBT.
*Estimates derived from single predictor multinomial logistic regression models analyses with those who had only FOBT >2 y previously or have never previously been screened as the reference group.
†n = sample sizes within each category of study population by survey year.

individuals. Although diagnostic endoscopies provide a screening benefit, inclusion of tests that may have been done for diagnostic indications may overestimate screening rates and/or underestimate the differences in patterns of screening. This further supports the significance of our findings.

In conclusion, persistent socioeconomic disparities in colorectal cancer screening are due in part to a lower uptake of lower gastrointestinal endoscopy among those in low education and income groups. There were no significant racial differences after controlling for socioeconomic factors. All racial, educational, and income groups in Medicare are increasingly undergoing colorectal cancer screening using lower gastrointestinal endoscopy with decreasing numbers of them using FOBT.

Decreasing interest in FOBT among health-care providers in regions with more limited access to colonoscopy may result in wider disparities in overall screening rates and requires attention from health-care policymakers. The apparent stagnation in endoscopy rates among Blacks in the most recent study years is also concerning and requires careful follow-up. Greater attention to increasing access to and use of affordable colorectal cancer screening for socioeconomically disadvantaged populations is needed if colorectal cancer health disparities are to be eliminated.

Table 2. Adjusted associations of socioeconomic indicators with patterns of colorectal cancer screening among Medicare enrollees in 2000 and 2005: MCBS

Characteristics	Study year: odds ratios (95% confidence interval)					
	2000 (n = 8,355)			2005 (n = 7,646)		
	Endoscopy >5 y	FOBT	Recent endoscopy	Endoscopy >5 y	FOBT	Recent endoscopy
Race-ethnicity						
Whites	1.00 (reference)	1.00 (reference)	1.00 (reference)	1.00 (reference)	1.00 (reference)	1.00 (reference)
Blacks	0.83 (0.57-1.19)	0.84 (0.62-1.13)	1.06 (0.88-1.30)	0.69 (0.47-1.02)	0.80 (0.54-1.20)	1.11 (0.86-1.45)
Hispanics	0.94 (0.56-1.57)	1.08 (0.69-1.70)	1.06 (0.72-1.55)	0.71 (0.52-0.98)	0.83 (0.56-1.24)	0.89 (0.68-1.15)
Others	0.59 (0.33-1.08)	0.88 (0.61-1.25)	0.61 (0.43-0.85)	0.78 (0.51-1.18)	0.67 (0.41-1.07)	0.74 (0.55-1.00)
Less than high school diploma vs higher (reference) stratified on health insurance*						
Part B only	0.37 (0.20-0.70)	0.57 (0.33-0.96)	0.55 (0.40-0.77)	0.86 (0.49-1.50)	0.58 (0.34-0.99)	0.66 (0.44-0.98)
Medicaid	0.47 (0.24-0.90)	0.48 (0.31-0.76)	1.30 (0.88-1.94)	0.75 (0.43-1.31)	0.77 (0.46-1.27)	0.82 (0.56-1.19)
Health maintenance organization	0.72 (0.49-1.08)	0.46 (0.32-0.68)	0.58 (0.44-0.76)	0.54 (0.33-0.90)	0.65 (0.40-1.06)	0.48 (0.35-0.67)
Employer-sponsored	0.87 (0.61-1.23)	0.59 (0.43-0.80)	0.68 (0.55-0.85)	0.69 (0.47-1.01)	0.72 (0.46-1.13)	0.49 (0.38-0.64)
Self-purchased	0.85 (0.54-1.34)	0.74 (0.57-0.98)	0.67 (0.53-0.85)	0.76 (0.47-1.21)	0.77 (0.48-1.23)	0.64 (0.48-0.87)
Income <$25,000 compared with those earning ≥$25,000 (reference) stratified on place of residence†						
Residence in a non-MSA	1.07 (0.76-1.48)	0.67 (0.45-0.99)	0.68 (0.55-0.84)	0.93 (0.73-1.19)	1.04 (0.69-1.57)	0.74 (0.58-0.95)
Residence in a MSA	0.64 (0.50-0.83)	0.70 (0.57-0.86)	0.52 (0.44-0.61)	0.82 (0.63-1.05)	0.71 (0.56-0.91)	0.68 (0.57-0.80)

*Estimates derived from multinomial logistic regression models analyses with those who had only FOBT >2 y previously or have never previously been screened as the reference group. The models were simultaneously adjusted for insurance type, usual place of health care, delayed care due to cost, language of the interview, residence in a MSA, race-ethnicity, gender, marital status, age, educational achievement, household income, self-reported general health status, and history of non–skin cancers.
†Estimates for the beneficiaries income stratified on place of residence with income >$25,000 as reference within each place of residence stratum.

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Disclosure of Potential Conflicts of Interest

No potential conflicts of interest were disclosed.

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