# DISPARITIES IN COLORECTAL CANCER SCREENING: A GUIDELINE-BASED ANALYSIS OF ADHERENCE

**Purpose:** This study's primary objective was to describe colorectal cancer (CRC) screening disparities using a guideline-derived definition of CRC screening adherence while controlling for confounding factors associated with CRC screening.

**Methods:** This secondary data analysis of the 2000 National Health Interview Survey (NHIS) included 12,677 individuals age ≥50 years. The primary outcome assessed was adherence to CRC screening guidelines, defined as a sigmoidoscopy or proctoscopy within the last five years, colonoscopy within the last 10 years, or home fecal occult blood test within the last 12 months. Age, race/ethnicity, gender, physical disability, household income, insurance status, education level, marriage status, rural or urban geographic area, and family history of CRC were analyzed as covariates in a logistic regression model. We assessed the association between these socio-demographic variables and receipt of physician recommendation for CRC screening among those respondents not adherent to CRC screening recommendations.

**Results:** In the multivariate model, the odds for being adherent with current CRC screening recommendations were lower for Hispanics (odds ratio [OR] 0.71, 95% confidence interval [CI] 0.59–0.86) and African Americans (OR 0.82, 95% CI 0.71–0.95) than for Whites. Residents of urban areas had higher odds (OR 1.19, 95% CI 1.06–1.34) of being up-to-date than rural residents. Among subjects who were not up-to-date with CRC screening, similar disparities were noted in receipt of physician recommendation for CRC screening.

**Conclusions:** Certain groups are at increased risk of not receiving CRC screening or recommendations for screening from their physicians. Interventions to reduce these disparities should be an integral part of overall efforts to improve CRC prevention and control. (*Ethn Dis*. 2006;16:228–233)

**Key Words:** Colorectal Cancer, Cancer Screening, Sigmoidoscopy, Colonoscopy, Proctoscopy, Fecal Occult Blood Test

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## INTRODUCTION

Colorectal cancer (CRC) has the fourth highest incidence and the second highest mortality of any cancer in the United States.[1] Randomized trials and case-control studies have shown that fecal occult blood testing (FOBT) and sigmoidoscopy reduce mortality from CRC.[2–6] Several studies also suggest that colonoscopy and double-contrast barium enema may reduce both mortality and the incidence of colon cancer through early detection and the removal of precancerous polyps.[7–10]

Studies have documented differences in CRC outcomes and screening rates between various segments of the US population.[11–15] For African Americans, incidence data show higher rates of late-stage colorectal cancer diagnosis and less overall decline in colorectal deaths than Whites over the past decade.[16–18] For Hispanics, incidence rates are lower than for non-Hispanic Whites, but evidence suggests rates are rising over time.[19] Evidence also suggests that many Hispanics will be diagnosed with CRC at late stages and have poor five-year survival rates.

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*For African Americans, incidence data show higher rates of late-stage colorectal cancer diagnosis and less overall decline in colorectal deaths than Whites over the past decade.*[16–18]

This study's primary purpose was to evaluate CRC screening disparities using a multivariable analysis and with a guideline-derived definition of CRC screening adherence.

## MATERIALS AND METHODS

### Subjects and Data Collection

We identified persons ≥50 years of age who were surveyed as a part of the 2000 National Health Interview Survey (NHIS). The NHIS is a multipurpose health survey, which serves as the primary source of health information for the civilian, noninstitutionalized, household population of the United States.[20]

### Dependent Variables

The colorectal cancer section of the 2000 NHIS Cancer Control Module collected information regarding sigmoidoscopy, proctoscopy, colonoscopy, and home-based blood stool test (FOBT). Only individuals ≥50 years of age were asked these CRC screening questions. The sequence of NHIS survey questions (available from author)

asked if respondents had received any of the endoscopic tests and then asked how recently and which test was received. The FOBT questions obtained information on ever having had an exam and time since last exam. We used this set of questions to determine whether an individual was up-to-date or adherent to recommendations for each of these individual exams. Information regarding barium enemas was not collected as part of this survey.

Our primary outcome was adherence to current common elements within the American Cancer Society, American Gastroenterological Association, and US Preventive Services Task Force CRC screening guidelines.[21–23] Participants were classified as adherent or up-to-date with endoscopy recommendations if they had had a sigmoidoscopy or proctoscopy within the past five years or colonoscopy within the last 10 years. We classified participants as being adherent with FOBT if they had had a home blood stool test within the past year. All respondents who were up-to-date for sigmoidoscopy, proctoscopy, colonoscopy, or FOBT were defined as being adherent with CRC screening recommendations. Both diagnostic and screening exams were included in adherence calculations to create the most lenient definition of up-to-date with CRC screening recommendations and to be consistent with Healthy People 2010 goal measurement methods. Those who received diagnostic tests within recommended time intervals would be considered ineligible for repeat screening immediately.

Our secondary outcome variable was receipt of a physician recommendation for CRC screening within the past year among individuals who were not adherent to CRC screening guidelines. Assessing this variable required analyzing only those individuals who were not adherent to current CRC screening guidelines and who had been in contact with a physician within the past year, because only these individuals were

asked the physician recommendation question. We created a single variable for physician recommendation for CRC screening by combining a question about physician recommendation for a sigmoidoscopy or colonoscopy with a question about receiving a physician recommendation for a home blood stool test (FOBT). All respondents must have met the following criteria: 1) never had or not up-to-date with CRC screening; 2) had seen a physician within the past year; 3) answered that they had a doctor; 4) when asked why they had not received a CRC screening test, did not say it was because their doctor failed to "order" a test ($n=$ 7,295). This method created a group of respondents who had recently been in contact with their doctors, were not blaming lack of test adherence on the doctor's failure to order a test and presumably should have received a recommendation for CRC screening from their physician.

## Independent Variables

Before initiating data analysis, we identified a group of variables as potentially related to CRC screening based on reviews of the literature and prior studies.[11,12,18,24] Our reviews of the literature suggested that the Preventive Health Model (PHM)[25–28] should guide our selection of independent variables. Although this model has not been explicitly used for studies of screening disparities, we hoped to assess whether components of the model would assist in analysis of the covariates of these disparities.

## Analysis

We used weights included in the NHIS dataset in all of our analyses to account for oversampling of selected populations and design, ratio, nonresponse, and poststratification adjustments.[20] All analyses were conducted with SUDAAN (Research Triangle Institute, Research Triangle Park, NC).

We calculated univariate statistics to describe the frequency of CRC screening by using weighted estimates. Frequencies for being up-to-date with various screening tests were calculated. We also obtained frequencies for ever having had an endoscopic colorectal exam, any type of FOBT (including both a home blood stool test and an in-office fecal occult blood test after digital rectal exam), and either an endoscopic exam or any type of FOBT.

We assessed bivariate relationships between our outcome variables and each of the candidate predictor variables by using chi-square analyses. Crude odds ratios (ORs) and 95% confidence intervals (CIs) were calculated.

We performed a multivariate analysis for our primary and secondary outcome variables by constructing logistic regression models, which incorporated our candidate predictor variables. We included age, race/ethnicity, physical disability, income, health insurance coverage, education level, marriage, geographic area, family history of any type of cancer, and family history of CRC in the models. This method allowed us to predict whether an individual was adherent with CRC screening guidelines or had received a physician's advice to receive such screening after accounting for each of our candidate predictor variables.

## RESULTS

The NHIS study adult sample ≥50 years of age was 59% female, 49% ≥65 years of age, 13% African American and 11% Hispanic, and 40% with some college education or beyond. Overall 34.6% of the sample population reported being adherent with CRC screening recommendations (Table 1). Although 43.4% of respondents reported ever having had an FOBT, only 8.5% of respondents were adherent with FOBT recommendations on the basis of receiving a FOBT test alone within the

**Table 1. Percent of all respondents receiving a given type of CRC screening test (N=12,677)**

| Up-to-date for CRC screening | |
|---|---|
| **Method** | **%** |
| FOBT (alone) | 8.5 |
| Proctoscopy | 0.8 |
| Sigmoidoscopy (alone) | 5.0 |
| Colonoscopy (alone) | 13.6 |
| Proctoscopy and FOBT | 0.2 |
| Sigmoidoscopy and FOBT | 2.6 |
| Colonoscopy and FOBT | 4.1 |
| Up-to-date with any | 34.6 |

| Ever had any screening | |
|---|---|
| **Method** | **%** |
| FOBT (alone) | 43.4 |
| Endoscopy* (alone) | 30.9 |
| Both | 21.4 |
| Neither | 47.1 |

\* Endoscopy includes proctoscopy, sigmoidoscopy, or colonoscopy.
CRC=colorectal cancer; FOBT=fecal occult blood testing.

**Table 2. Adjusted odds ratios for respondents' characteristics and adherence to colorectal cancer screening guidelines**

| Characteristics | Total *n* | % Adherent with Guidelines | OR (95% CI) |
|---|---|---|---|
| **Age** | | | |
| 50–64 | 6497 | 30.8 | 1.00 (referent) |
| 65–79 | 4606 | 41.6 | 1.61 (1.44–1.79) |
| 80–85 | 1574 | 29.9 | 0.94 (0.80–1.11) |
| **Sex** | | | |
| Male | 5220 | 35.2 | 1.00 (referent) |
| Female | 7457 | 34.2 | 0.98 (0.89–1.07) |
| **Race/ethnicity** | | | |
| Non-Hispanic, White | 9412 | 37.7 | 1.00 (referent) |
| Non-Hispanic, Black | 1588 | 28.8 | 0.82 (0.71–0.95) |
| Hispanic | 1365 | 22.4 | 0.71 (0.59–0.86) |
| Non-Hispanic, other | 312 | 26.0 | 0.56 (0.42–0.76) |
| **Education level** | | | |
| No high school diploma | 3433 | 25.6 | 1.00 (referent) |
| High school diploma | 3942 | 34.4 | 1.34 (1.18–1.52) |
| Some college and beyond | 5131 | 41.3 | 1.83 (1.62–2.07) |
| **Total combined household income** | | | |
| <$15,000 | 2466 | 28.8 | 1.00 (0.86–1.16) |
| $15,000–$34,999 | 2693 | 35.9 | 1.12 (0.99–1.26) |
| $35,000–$54,999 | 1571 | 38.9 | 1.15 (1.01–1.32) |
| ≥$55,000 | 2266 | 42.8 | 1.00 (referent) |
| **Marital status** | | | |
| Married | 6213 | 38.2 | 1.31 (1.18–1.45) |
| Other | 6464 | 31.2 | 1.00 (referent) |
| **Geographic area** | | | |
| Urban | 9785 | 35.1 | 1.19 (1.06–1.34) |
| Rural | 2892 | 32.9 | 1.00 (referent) |
| **Usual source of care** | | | |
| Yes | 11,741 | 36.5 | 4.07 (3.32–5.00) |
| No | 866 | 12.4 | 1.00 (referent) |
| **Health insurance coverage** | | | |
| Yes | 11,683 | 36.4 | 1.98 (1.58–2.49) |
| No | 943 | 13.8 | 1.00 (referent) |
| **Physical disability** | | | |
| None | 7276 | 33.5 | 1.00 (referent) |
| Any | 3811 | 37.2 | 1.21 (1.09–1.34) |
| **Family history of cancer** | | | |
| Yes | 4912 | 42.0 | 1.86 (1.67–2.06) |
| No | 7765 | 29.9 | 1.00 (referent) |
| **Family history of CRC** | | | |
| Yes | 787 | 56.7 | 2.41 (2.05–2.83) |
| No | 11,890 | 33.2 | 1.00 (referent) |
| **Intercept** | | | 0.03 (0.02–0.05) |

CRC=colorectal cancer.

past year. Approximately 75% of respondents that were adherent with CRC screening guidelines had received a colonoscopy or sigmoidoscopy within the recommended timeframe (7% of these also received a FOBT within the last 12 months).

Based on our bivariate analysis, Hispanic ethnicity, non-Hispanic Black or other race, and low income level were significantly associated with lower rates of adherence to CRC screening. By contrast, physical disability, urban residence, income >$55,000 a year, a high school diploma or beyond, having a usual source of medical care, health insurance, and/or a family history of cancer or CRC were significantly associated with higher rates of adherence to CRC screening guidelines. Being married was also associated with higher rates of CRC screening. Age, however, showed a nonlinear significant relationship to CRC screening; with the highest adherence (40.8%) for respondents between 65–79, and lower rates for both younger and older respondents.

After we accounted for a group of covariates in our multivariate analysis (Table 2), several associations remained significant. Hispanic (OR 0.71, 95% CI 0.59–0.86), non-Hispanic Black (OR 0.82, 95% CI 0.71–0.95), or other ethnicity (OR 0.56, 95% CI 0.42–0.76) was associated with lower rates of adherence to CRC screening guidelines. Being married (OR 1.31, 95% CI 1.18–1.45), urban residence (OR 1.19, 95% CI 1.06–1.34), physical disability (OR 1.21, 95% CI 1.09–1.34), and having a family history of cancer (OR 1.86, 95% CI 1.67–2.06) were associated with higher rates of adherence to CRC screening. The strongest predictors of being up-to-date with CRC screening were having a usual source of medical care (OR 4.07, 95% CI 3.32–5.00), family history of CRC (OR 2.41, 95% CI 2.05–2.83), and health insurance coverage (OR 1.98, 95% CI 1.58–2.49).

Only 10.2% of respondents who had seen a physician within 12 months and were not up-to-date with CRC screening had received a physician recommendation for CRC screening. We present adjusted results from the multivariable model for physician recommendation for CRC screening in Table 3. Individuals in older age categories were less likely to report receiving a physician recommendation for screening, and those in both the 65- to 79-year-old range (OR 0.78, 95% CI 0.65–0.95) and the 80- to 85-year-old range (OR 0.46, 95% CI 0.30–0.68) were less likely than those aged 50–64 years to receive a recommendation. Although not significant, a trend toward a significantly increased likelihood of receiving a physician's recommendation for CRC among women was seen (OR 1.20, 95% CI 0.98–1.45). Those with some college education or greater were significantly more likely to have received a physician recommendation (OR 1.53, 95% CI 1.16–2.01). Non-Hispanic Blacks were less likely to receive a physician's recommendation for CRC screening (OR 0.72, 95% CI 0.54–0.96).

## DISCUSSION

This analysis showed that certain PHM background factors, such as race/ethnicity, were associated with lower odds of CRC screening adherence. In particular, both Hispanics and African Americans had significantly lower odds of CRC screening adherence in our multivariate model with Whites as the reference group. Residents living outside of metropolitan statistical areas also had lower rates of CRC screening adherence, compared to those who lived in cities, after adjusting for potential confounders. Lower adherence within these racial and geographic subgroups could explain a part of the increased rates of late-stage diagnosis and increased mortality among these groups.[29–33] These

**Table 3. Adjusted odds ratios for physician recommendation for those not up-to-date with CRC screening***

| Characteristics | N | OR (95% CI) |
|---|---|---|
| **Age** | | |
| 50–64 | 462 | 1.00 (referent) |
| 65–79 | 239 | 0.78 (0.65–0.95) |
| 80–85 | 46 | 0.46 (0.30–0.68) |
| **Sex** | | |
| Male | 259 | 1.00 (referent) |
| Female | 488 | 1.20 (0.98–1.45) |
| **Race/ethnicity** | | |
| Non-Hispanic, White | 591 | 1.00 (referent) |
| Non-Hispanic, Black | 75 | 0.72 (0.54–0.96) |
| Hispanic | 62 | 0.88 (0.61–1.26) |
| Non-Hispanic, other | 19 | 1.04 (0.61–1.76) |
| **Education level** | | |
| No high school diploma | 146 | 1.00 (referent) |
| High school diploma | 230 | 1.10 (0.81–1.49) |
| Some college and beyond | 368 | 1.53 (1.16–2.01) |
| **Total combined household Income** | | |
| <$15,000 | 120 | 0.93 (0.69–1.25) |
| $15,000–$34,999 | 143 | 0.92 (0.71–1.18) |
| $35,000–$54,999 | 125 | 1.12 (0.85–1.47) |
| ≥$55,000 | 177 | 1.00 (referent) |
| **Marital status** | | |
| Married | 385 | 0.90 (0.74–1.10) |
| Other | 362 | 1.00 (referent) |
| **Geographic area** | | |
| Urban | 625 | 1.00 (0.29–3.49) |
| Rural | 122 | 1.00 (referent) |
| **Usual source of care** | | |
| Yes | 724 | 0.92 (0.29–2.96) |
| No | 18 | 1.00 (referent) |
| **Health insurance coverage** | | |
| Yes | 712 | 1.57 (0.99–2.48) |
| No | 34 | 1.00 (referent) |
| **Physical disability** | | |
| None | 432 | 1.00 (referent) |
| Any | 223 | 1.17 (0.94–1.46) |
| **Family history of cancer** | | |
| Yes | 333 | 1.14 (0.74–1.43) |
| No | 414 | 1.00 (referent) |
| **Family history of CRC** | | |
| Yes | 63 | 1.03 (0.74–1.43) |
| No | 684 | 1.00 (referent) |
| **Intercept** | | 0.03 (0.02–0.05) |

\* All individuals were asked questions regarding physician recommendation for seeing a physician within the past year and responded that they had received a physician recommendation for CRC screening.
CRC=colorectal cancer.

screening disparities will need attention as attempts are made to reverse CRC stage-at-diagnosis and mortality disparities across racial/ethnic and geographically dispersed groups. Adjustments for socioeconomic and access-to-care variables in our analysis suggest that continued attention to subtle root causes of racial/ethnic disparities will be necessary for future interventions

that intend to reduce CRC's negative health effects equally across groups.

Disparities in CRC screening adherence suggest barriers to receipt of screening. As in previous studies, we found that lack of a usual source of care or health insurance was associated with reduced adherence to CRC screening guidelines.[15,34–37] Alternatively, we found physical disability to be associat-

> *. . . both Hispanics and African Americans had significantly lower odds of CRC screening adherence in our multivariate model with Whites as the reference group.*

ed with increased CRC screening. We believe this finding is due to increased contact between persons with physical disabilities and the healthcare system.[38] Another deterrent to adherence with CRC screening is lack of physician recommendation for screening.[35,39–41] In this study, we found that nonadherent individuals with less education and African-American race/ethnicity received fewer physician recommendations for CRC screening. African Americans were less likely to be adherent to CRC screening guidelines, and their CRC mortality is 29/100,000 as compared to 22/100,000 among Whites.[1,33] Additionally, older age decreased the likelihood of receiving a physician's recommendation for CRC screening, despite the increasing risk of CRC incidence with older age. Future studies are needed to further investigate the relationship between physician recommendation for CRC screening and disparities in CRC screening adherence. However, these findings suggest that physician recommendations may play a role in screening adherence disparities.

Our study has several limitations. First, it was cross-sectional, and we cannot establish causality for any of the associations seen. Future cohort or case-control studies are needed to assess both disparities in adherence to CRC screening guidelines and physician recommendation for CRC screening. Second, information regarding CRC screening was collected through self-report. Test terminology may be difficult for people to interpret or un-

derstand, although some studies have shown good reliability between self-report and receipt of CRC screening tests.[42,43] Third, although we did use NHIS weights to ensure that individuals responding were representative of the US population, we did not assess information regarding nonresponders to CRC screening questions. Finally, we used a timeframe of one year to determine adherence to FOBT guidelines. This method makes individuals who had FOBT testing from 12–24 months in the past not up-to-date with screening guidelines. Although some organizations recommend the one year-interval,[44] large studies have been conducted with a two-year FOBT test window.[6]

## CONCLUSION

Disparities in CRC screening and adherence rates reflect many of the disparities seen in CRC incidence and mortality. Disparities in physician's recommendations may further contribute to these inequities. By assessing these disparities in CRC screening and recommendations for CRC screening, we can begin to target groups for interventions and eventually reduce death rates from CRC.

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