

# Race and Colorectal Cancer Screening: A Population-based Study in North Carolina

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## Abstract

**Objective:** National and state data document racial differences in colorectal cancer (CRC) mortality and incidence. Screening for CRC reduces cancer incidence and deaths. Racial differences in colorectal cancer screening behavior may contribute to the racial disparity in incidence and mortality. The purpose of this study was to determine if colorectal cancer screening rates are different between blacks and whites while controlling for potential confounders.

**Study Design:** Cross-sectional survey.

**Data Source(s)/Study Setting:** We used data from the North Carolina Colon Cancer Study, a population-based case-control study conducted in 33 counties of North Carolina. We analyzed data from 598 control subjects who were eligible for colorectal cancer screening.

**Methods:** Trained nurses conducted face-to-face interviews from October 1996 through October 2000.

**Results:** Overall, 50% of the respondents were compliant with CRC screening guidelines. In the multivariable logistic regression model having a regular doctor and participation in a general medical exam were significantly associated with current screening status with odds ratios (OR) (95% confidence interval (CI)) of 3.8 (1.7-8.3) and 3.7 (2.1-6.7), respectively. Older age was a significant predictor of current screening status with an OR (95% CI) of 2.9 (1.7-4.8) for those 60-69 compared to respondents 50-59 and OR 3.2 (1.9-5.5) for those 70 and older compared to respondents 50-59. After adjusting for age, having a regular doctor and participation in general medical exams, race was not significantly associated with current CRC screening status, with an OR of 1.1 (95% CI 0.7-1.6).

**Conclusion:** CRC screening rates in North Carolina were low. Race was not a significant determinant of screening behavior and therefore does not explain the racial disparity in incidence or survival. Older age, having a regular doctor and participating in general medical exams were significant predictors of CRC screening.

**Relevance:** This study reinforces the fact that screening rates in North Carolina are low despite the strong evidence that colorectal cancer screening reduces cancer deaths.

Nationally, colorectal cancer incidence and mortality is higher for blacks than whites.<sup>1</sup> State-level data in North Carolina also reveal this racial disparity.<sup>2</sup> The American Cancer Society and other organizations have endorsed several screening strategies<sup>3,4</sup> because colorectal cancer screening decreases col-

orectal cancer mortality and incidence.<sup>5,6,7,8,9</sup> Racial differences in colorectal cancer screening behavior may contribute to the racial disparity in incidence and mortality. Other possible predictors of colorectal cancer screening behavior include income, insurance status, education, participation in regular

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medical exams, current screening for other cancers, family history, and non-smoking status.<sup>10,11,12,13,14,15</sup> The purpose of this study was to determine if colorectal cancer screening rates are different between blacks and whites while controlling for potential confounders.

## Methodology

We used information from the North Carolina Colon Cancer Study (NCCCS), a population-based case-control study conducted in 33 contiguous counties of central and eastern North Carolina from October 1996 to October 2000. Control subjects younger than 65 were selected from Department of Motor Vehicle Registry tapes. Control subjects age 65 and older were selected from the Centers for Medicare and Medicaid Service's tapes. Trained nurses conducted face-to-face interviews with the subjects. Questions about screening tests included the total number of each test [fecal occult blood test (FOBT), colonoscopy, flexible sigmoidoscopy, and barium enema] done in the past 10 years, the date of the most recent test and whether the most recent test was for screening or a problem. The interviewers also asked about physical activity, tobacco use, family history, occupation, income, health insurance, source of health care, health seeking behavior and health status.

We considered a subject "current" for colorectal cancer screening if he or she had been tested within the time frame endorsed by the American Cancer Society and others at the time of the study: FOBT within one year, flexible sigmoidoscopy within five years, barium enema within five years, or colonoscopy within 10 years beginning at age 50.<sup>3,4</sup> We restricted the study sample to individuals eligible for screening. Thus, we only used data from the control subjects. In addition, we excluded subjects younger than age 50 and those who had tests performed for symptoms or problems. Individuals in the latter category would be at a higher risk for colorectal cancer and therefore would be surveillance candidates and not screening candidates who are, by definition, at average risk for a condition.

## Analysis

Logistic regression modeling was the primary analytic technique. We performed all analyses using PC-SAS Version 8.2 for Windows (SAS Institute, Cary, NC).

We constructed unadjusted and adjusted logistic regression models with colorectal cancer screening status as the dependent variable and race as the independent variable. We developed the adjusted model by first including race and any predictor variables with a p value <0.1 in univariate analysis (chi-square test). We reduced the model by stepwise backward regression. We chose, *a priori*, p<0.05 as the level of significance for the models.

We categorized variables as follows: age (50-59, 60-69, 70 and older), education level (less than high school graduate,

**Table 1.**  
**Characteristics of Study Sample N=598**

Age mean (SD)	67.1	(8.0)
White	353	(59%)
Men	305	(51%)
Education		
<High school graduate	186	(31%)
High school graduate	155	(26%)
Some college	124	(21%)
College graduate	130	(22%)
Insurance		
Government only	121	(20%)
HMO or private	459	(77%)
None	18	(3%)
Annual Household Income		
Less than \$20,000	236	(39%)
\$20-50,000	209	(35%)
Greater than \$50,000	153	(26%)
Married	385	(64%)
Smoking status		
Current	102	(17%)
Former	236	(40%)
Never	258	(43%)
Had a Regular Doctor	552	(92%)
Rural	469	(79%)
<i>SD = standard deviation</i>		

high school graduate, at least some college, college graduate), insurance status [government (Medicare, Medicaid, CHAMPUS, CHAMPVA), private/HMO, none], income (< \$20,000, \$20-50,000, >\$50,000), residence (rural, urban), marital status (married, not married), health status (mental component summary and physical component summary from the Short Form-1216, smoking status (never, former, current), physical activity (MET-minutes per day by quartile) and participation in a general medical exam (yes, no).

The University of North Carolina at Chapel Hill Institutional Review Board approved this study. All subjects gave written informed consent.

## Results

Sixty-two percent of the subjects screened agreed to participate in the NCCCS for a total of 1,051 subjects. After elimination of patients younger than 50 and those with a history of colorectal cancer testing for symptoms, 700 subjects remained. We further excluded 102 subjects with missing data for a response or explanatory variable, leaving 598 subjects. Approximately half all of the patients were men, 59% were white and 41% black. Table 1 lists additional characteristics of the study sample. Univariate analysis revealed associations between current colorectal cancer screening and the following predictor variables at the p<0.1 level: age, income, health insur-

ance type, education, having a regular doctor, marital status, and participation in a general medical exam. In the unadjusted model, race (black vs. white) was not significantly associated with current screening status with an odds ratio (OR) of 0.74 (95% confidence intervals (CI) 0.53-1.02). The adjusted logistic regression model included race (black vs. white), age (50-59, 60-69, (70), income (< \$20,000, \$20-50,00, >\$50,000), having a regular doctor (yes, no) and participation in general medical exams (yes, no). Having a regular doctor, participation in a general medical exam, higher income and older age were significantly associated with current screening status (Table 2). Race was not

Similarly, 55% of those who had participated in a general medical exam were current with colorectal cancer screening while only 20% of those who had not participated in a general medical exam were current. In multivariate analysis, the odds of being up-to-date with colorectal cancer screening were reduced by 74% for those without a regular doctor and for those who had not participated in general medical exams.

Other large survey studies have examined predictors of fecal occult blood testing or lower endoscopy and none have found a clear association between race and participation in the tests. An analysis of the 1997 Behavioral Risk Factor Surveillance System (BRFSS) data, a national telephone survey, found no difference in colorectal cancer screening rates between blacks and whites. Having health insurance and increasing age (up to 79), income, and education were associated with screening status. Healthy behaviors were examined and non-smoking status, seatbelt use, physical activity, increased fruit and vegetable intake and recent cholesterol screening were all associated with current colorectal cancer screening. Participation in medical examinations and having a regular doctor were not examined in this study.<sup>14</sup> Analysis of the 1998 National Health Interview Survey data (NHIS), a face-to face national survey, again found increased education and having insurance predict colorectal cancer screening status. The NHIS study found no association

**Table 2.**  
**Independent predictors of current participation in colorectal cancer screening\***

Variable	Odds Ratio	95% Confidence Intervals
<b>Race</b>		
Black vs White	0.98	0.67-1.43
<b>Household income</b>		
>\$50,000 vs \$20-50,000 per year	2.38	1.47-3.85
>\$50,000 vs <\$20,000 per year	2.86	1.69-4.76
<b>Age</b>		
≥70 vs 60-69	2.84	1.68-4.78
≥70 vs 50-59	3.17	1.89-5.32
<b>Had a Regular Doctor</b>		
Yes vs No	3.79	1.67-8.63
<b>Participated in General Medical Exam</b>		
Yes vs No	3.79	2.13-6.71

\* each item was simultaneously controlled for other items in the table

significantly associated with current CRC screening status, with an OR of 0.98 (95% CI 0.67-1.43).

The sample size was insufficient to construct logistic regression models for gender subsets to explore the relationship between participation in breast or cervical cancer screening and colorectal cancer for women or participation in prostate cancer screening and colorectal cancer screening for men. Gender, itself, was not significantly associated with current colorectal cancer screening at the p<0.1 level in univariate analysis, and therefore, was not included in the logistic regression model.

## Discussion

This North Carolina population study of subjects eligible for colorectal cancer screening confirms other reports of low colorectal cancer screening rates.<sup>13,14,17</sup> Race, however, was not a significant determinant of current screening participation. Income and age were associated with colorectal cancer screening behavior, but the strongest predictors of adherence to colorectal screening guidelines were having a regular doctor and participation in general medical exams. While 53% of the patients with a regular doctor were current with colorectal cancer screening only 17% of those without a regular doctor were current.

between race and colorectal cancer screening. The strongest predictor of colorectal cancer screening was having a usual source of care, which, while not identical to continuity of care (i.e. having a regular doctor), is related.<sup>18</sup> Another analysis of the same 1998 NHIS data did find a small but statistically significant association of white race compared to black race or "other race" and reported colorectal cancer screening. One explanation for the discrepancy was that different screening intervals were used in the two studies.<sup>17</sup> A face-to-face interview study performed in the Mid-West found that having had a physician visit in the prior year was a strong predictor of ever having had a FOBT and ever having undergone sigmoidoscopy. Higher education was also a predictor of having had each test. Smoking status was only associated with the FOBT and increased income was only associated with sigmoidoscopy. The sample was over 98% white and therefore racial differences in screening behavior could not be addressed.<sup>15</sup>

While our study does not provide an explanation for the racial gap in colorectal cancer incidence or mortality, it does offer insights to increase colorectal cancer screening participation for the general population. Our results suggest that health maintenance visits and continuity of a primary care provider may be facilitators of colorectal cancer screening participation. The association of higher income and screening behavior is

likely related to an increased ability to afford the tests, both the costs associated with the test itself and the costs of missing work, traveling to the doctor's office and related expenses. Even in an insured study sample (97%), colorectal cancer screening is not without expense because of variable insurance coverage for colorectal cancer screening and the indirect costs listed above. Increased ability to afford colorectal cancer screening should increase compliance with provider screening recommendations. Additionally, subjects with higher incomes may have been more likely to request screening, knowing that they had the financial resources if the screening was not covered by their health insurance. Ensuring adequate coverage and educating consumers about their colorectal cancer screening benefits are important to increase colorectal cancer screening participation.

The strengths of our study include identification of test indication, determination of all endorsed screening strategies, use of a representative population sample and adequate response rate. The use of radiologic and endoscopic tests for diagnosis or therapy is important, but the accuracy of predictors of screening behavior relies on determination of the test indication. In contrast to the Behavioral Risk Factor Surveillance System (BRFSS) survey, we distinguished between CRC testing for screening and for diagnostic purposes.<sup>2,14</sup> Further, we asked about all recom-

mended screening options allowing us to correctly identify screened patients who may have been missed using surveys, such as the BRFSS and National Health Interview Survey (NHIS) that only asked about certain screening modalities.<sup>14,17</sup> This study has the limitation of using self-reported data without validation from another source. However, a study in a community family practice setting found high correlations for fecal occult blood testing (0.78) and sigmoidoscopy (0.90) when comparing chart audit with patient survey.<sup>19</sup> In addition, two studies in the managed care setting investigating the relative sensitivity of patient survey compared to medical record audit found a 92-96% sensitivity of the survey to detect fecal occult blood testing, 79%-95% sensitivity to detect flexible sigmoidoscopy and an 89% sensitivity for detecting colonoscopy.<sup>20,21</sup>

In conclusion, older age, higher income, having a regular physician and participation in general medical exams were associated with colorectal cancer screening behavior. Several patient, provider and system level factors are likely to be responsible for the low colorectal cancer screening rates in North Carolina and nationally. Our study demonstrates that there are continued financial barriers. It also supports the importance of factors related to the primary care setting. Future directions include testing interventions that increase continuity of primary care and health maintenance visits.

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