

# United States Colorectal Cancer Screening Practices Among American Indians/Alaska Natives, Blacks, and Non-Hispanic Whites in the New Millennium (2001 to 2010)

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**BACKGROUND:** The objectives of this study were to describe, examine, and compare prevalence estimates of colorectal cancer (CRC) screening practices and to determine whether disparities exist for American Indians/Alaska Natives (AIANs) and blacks compared with whites. **METHODS:** Behavioral Risk Factor Surveillance System (2001-2010) data from respondents aged  $\geq 50$  years ( $n = 356,073$ ) were used. The primary outcome was self-reported CRC screening according to US Preventive Services Task Force guidelines for endoscopy (colonoscopy or sigmoidoscopy), fecal occult blood test (FOBT), or mixed screening (endoscopy or FOBT). **RESULTS:** From 2001 to 2010, endoscopy screening increased in the AIAN population by 44.8% ( $P < .001$ ) compared with black respondents (51.7%) and white respondents (26.5%). AIANs were less likely to report endoscopy screening (45%) compared with both blacks (56%) and whites (55%). For mixed CRC screenings, AIAN rates increased by 34.5%, compared with 29.7% for blacks and 15% for whites. In 2010, AIANs (51%) had the lowest prevalence of mixed CRC screening compared with blacks (61%) and whites (60%;  $P < .001$ ). Factors that enabled health care attenuated the lowered likelihood of CRC screenings, but disparities remained for AIAN CRC screening. In contrast, once enabling factors were controlled, the odds ratios of CRC screening among blacks were higher compared with whites. **CONCLUSIONS:** Between 2001 and 2010, AIANs had the lowest CRC screening rates in the United States compared with blacks and whites, presenting a CRC disparity, as rigorously defined. The current findings indicate that, although considerable progress has been made to increase CRC screening for blacks and whites, progress for AIANs continues to lag behind in the first decade of 21st century. *Cancer* 2014;000:000-000. © 2014 American Cancer Society.

**KEYWORDS:** colorectal cancer, health disparities, American Indian, black, African American..

## INTRODUCTION

Colorectal cancer (CRC) remains among the leading causes of US cancer mortality, but prevention mechanisms have been identified.<sup>1-4</sup> It has been demonstrated through the use of CRC screenings that early CRC detection is effective in reducing mortality rates and improving CRC therapy outcomes.<sup>5</sup> Hence, a national health goal is to increase the proportion of Americans receiving CRC screenings, especially among those with higher CRC risk factors (eg, Healthy People 2010 and 2020).<sup>6,7</sup> The primary recommended screening methods include fecal occult blood testing (FOBT) and/or endoscopy (ie, colonoscopy or sigmoidoscopy).<sup>5</sup> Moreover, the US Preventive Services Task Force (USPSTF) recommends with “high certainty” that the “net benefit” of CRC screening is substantial for adults ages 50 to 75 years. Improving CRC screening rates in this age group could substantially lower CRC death rates for all Americans. However, it is reported that CRC screening differs among US racial/ethnic groups, and these racial/ethnic CRC screening “disparities”<sup>8-10</sup> are likely contributors to higher CRC mortality rates. The Institute of Medicine Unequal Treatment Committee defines a *health care disparity* as racial or ethnic differences in health care quality not caused by access-related factors or clinical needs, preferences, and appropriateness of intervention.<sup>11</sup> Few studies have defined or tested whether CRC screening racial/ethnic differences met rigorous criteria for a disparity or whether this was because of health care access factors, especially among the AIAN population.

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The objective of this study was to examine progress toward the national goals of CRC screening with a focus on the standard-of-care CRC rates between AIAN and black populations compared with white populations between 2001 and 2010. Also, we wished to understand whether disparate CRC rates persisted for AIANs compared with other racial groups. National-level studies examining CRC rates within AIAN populations and/or examining changes in CRC rates over time remain scarce. For this, we used well established methods for ethnic/racial health care disparities based on Institute of Medicine Unequal Treatment criteria.<sup>11,12</sup>

## MATERIALS AND METHODS

### Data

We combined yearly data ( $n = 356,073$ ) of noninstitutionalized US respondents aged  $\geq 50$  years identifying as AIAN ( $n = 4969$ ), black ( $n = 28,161$ ), and non-Latino white ( $n = 322,943$ ) from the 2001 ( $n = 79,236$ ) and 2010 ( $n = 276,837$ ) Behavioral Risk Factor Surveillance System (BRFSS). We further investigated the progress in CRC screening rates between 2001 and 2010 for those aged  $\geq 50$  years in concordance with CRC guidelines.

The BRFSS is a yearly telephone surveillance survey that has covered all 50 states in addition to the District of Columbia, Puerto Rico, Guam, and the Virgin Islands since 2001. The BRFSS is a collaborative project between the Centers for Disease Control and Prevention and state health departments in the United States and territories. Detailed information on the survey and sampling designs, as well as the field operations and management procedures of the BRFSS, are published elsewhere.<sup>13,14</sup>

Briefly, the BRFSS is based on a complex sample design that includes disproportionate stratified sampling and poststratification weighting. Calculated weights adjust for the disproportionate selection of population subgroups as well as variations in respondents' probability of selection, noncoverage, and nonresponse. The survey is designed to generalize estimates to the adult US population aged  $\geq 18$  years living in households. Current prevalence estimates from the BRFSS have demonstrated good correspondence with findings from in-person surveys conducted by the National Center for Health Statistics.

### Measurements

The primary outcomes were self-reported CRC screening that satisfied the 2001 USPSTF guidelines for endoscopy, FOBT, and mixed screening (ie, endoscopy or FOBT) for the years 2001 and 2010.<sup>15,16</sup> Guideline-concordant endoscopy was defined as self-reported colonoscopy or sig-

**TABLE 1.** Sample Descriptive Statistics and Estimates for Respondents Aged  $\geq 50$  Years Using Data From the Combined 2001 and 2010 Behavioral Risk Factor Surveillance System

| Characteristic                        | Percentage of Respondents |       |                              |       |
|---------------------------------------|---------------------------|-------|------------------------------|-------|
|                                       | White                     | Black | American Indian <sup>a</sup> | Total |
| Sex                                   |                           |       |                              |       |
| Men                                   | 45.7                      | 40.9  | 49.8                         | 45.3  |
| Women                                 | 54.3                      | 59.1  | 50.2                         | 54.7  |
| Education                             |                           |       |                              |       |
| <High school                          | 9                         | 22.2  | 24.8                         | 10.5  |
| High school or equivalent             | 31.4                      | 31.9  | 31                           | 31.4  |
| Some college                          | 26                        | 23.8  | 26.6                         | 25.8  |
| $\geq$ College                        | 33.4                      | 21.5  | 17.4                         | 32    |
| Refused to answer                     | 0.3                       | 0.6   | 0.3                          | 0.3   |
| Income                                |                           |       |                              |       |
| <\$15,000                             | 7.6                       | 18.7  | 19.1                         | 8.8   |
| \$15,000-<\$50,000                    | 39.4                      | 45.1  | 44.9                         | 40.1  |
| \$50,000-<\$75,000                    | 14                        | 9.6   | 9.8                          | 13.5  |
| $\geq$ \$75,000                       | 22.8                      | 11    | 10.6                         | 21.5  |
| Don't know/not sure/refused to answer | 16.2                      | 15.6  | 15.5                         | 16.1  |
| Insurance                             |                           |       |                              |       |
| No                                    | 4.6                       | 10.4  | 10.6                         | 5.3   |
| Yes                                   | 95.4                      | 89.6  | 89.4                         | 94.7  |
| Survey year                           |                           |       |                              |       |
| 2001                                  | 45.4                      | 42.8  | 44                           | 45.1  |
| 2010                                  | 54.6                      | 57.2  | 56                           | 54.9  |
| Mean age, y                           | 64.4                      | 62.5  | 62.5                         | 64.2  |

<sup>a</sup>American Indian was defined as American Indian/Alaska Native.

moidoscopy within the past 5 years for those aged  $>50$  years. We considered a self-report of an FOBT within the past year as guideline-concordant. Finally, guideline-concordant mixed screening was defined as satisfying criteria for either an endoscopy within the past 5 years or an FOBT within the past year.

### Analytic Approach

All analyses accounted for the BRFSS' sample design and weights and were conducted using Stata (version 12.1) survey procedures (StataCorp, College Station, Tex). The analyses were done in 3 steps. First, we generated descriptive statistics to illustrate the distributions of the covariates by racial background (Table 1). We examined group differences in these variables using Rao-Scott survey design-adjusted Pearson chi-square tests. Second, we computed prevalence rates of the outcomes of interest for the 3 racial groups and tested for differences using Rao-Scott survey design-corrected chi-square tests (Table 2). We also examined changes in the prevalence of CRC screening outcomes between 2001 and 2010 and computed pairwise contrasts for each of the considered racial groups (Fig. 1). Third, we fit 3 sets of logistic regression models (1 for

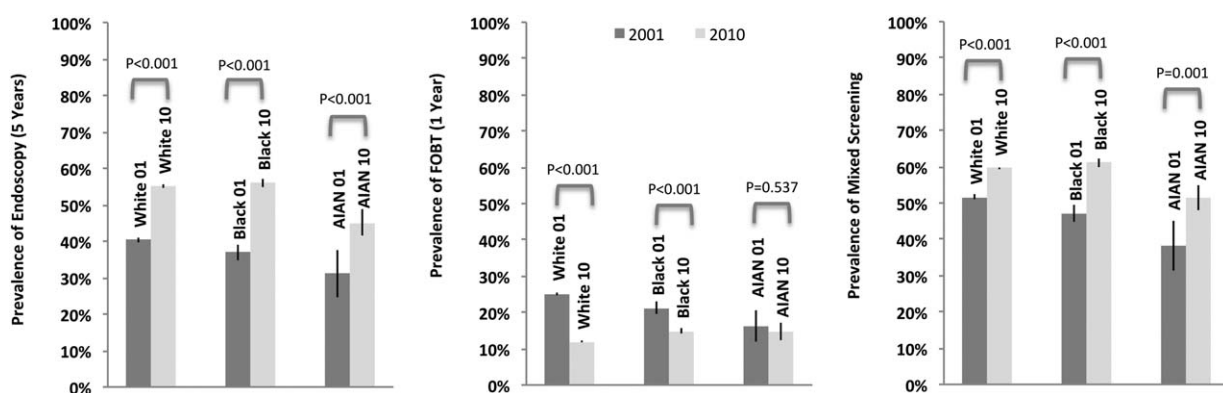
**TABLE 2.** Prevalence Rates for Endoscopy (Either Sigmoidoscopy or Colonoscopy), Fecal Occult Blood Testing, and Mixed Screening (Either Endoscopy or Fecal Occult Blood Testing) Among Respondents Aged  $\geq 50$  Years by Racial Background<sup>a</sup>

| Screening Prevalence                                   | Percentage of Respondents |       |                              |       | Chi-Square <i>P</i> |
|--|---------------------------|-------|------------------------------|-------|---------------------|
|  | White                     | Black | American Indian <sup>b</sup> | Total |                     |
| Endoscopy  |                           |       |                              |       |                     |
| Never or >5 y  | 51.7                      | 52.1  | 61.1                         | 51.8  | .0000               |
| <5 y   | 48.3                      | 47.9  | 38.9                         | 48.2  |                     |
| FOBT   |                           |       |                              |       |                     |
| Never or >1 y  | 82.1                      | 82.4  | 84.5                         | 82.1  | .1496               |
| Within the past year                                   | 17.9                      | 17.6  | 15.5                         | 17.9  |                     |
| Mixed screening (guideline-specific endoscopy or FOBT) |                           |       |                              |       |                     |
| No   | 44                        | 44.8  | 54.4                         | 44.2  | .0000               |
| Yes  | 56                        | 55.2  | 45.6                         | 55.8  | —                   |

Abbreviations: FOBT, fecal occult blood testing.

<sup>a</sup> Estimates are based on data from the combined 2001 and 2010 Behavioral Risk Factor Surveillance System.

<sup>b</sup> American Indian was defined as American Indian/Alaska Native.



**Figure 1.** Changes in the prevalence of “guideline-concordant” colorectal cancer screening outcomes are illustrated among respondents aged  $\geq 50$  years between 2001 and 2010. Results are based on data from the 2001 and 2010 Behavioral Risk Factor Surveillance System. FOBT indicates fecal occult blood testing; AIAN, American Indian/Alaska Native.

each of the screening outcomes) to model the relation between racial background and screening and incrementally controlled for the specified covariates. Each set included 3 models (Table 3). Model 1 tested the bivariate relation between race and the screening outcome. Model 2 adjusted for age, sex, and survey year. Model 3 added income, education, and insurance status. For each model, we computed and presented odds ratios (OR) and their 95% confidence intervals (CIs). In addition, to facilitate the interpretation of our models, we estimated and graphed unadjusted probabilities (using model 1) and adjusted probabilities (using model 3) of screening and their 95% CIs (Fig. 2). Figure 2 allows the reader to observe the differences between the considered groups and the influence of controlling for health care-enabling factors.

## RESULTS

### Descriptive Statistics

Descriptive statistics indicated that white respondents had higher levels of education ( $P < .001$ ) and income ( $P < .001$ ) compared with AIAN and black respondents. White respondents also were less likely ( $P < .001$ ) to report being uninsured (4.6%) compared with AIAN (10.6%) and black (10.4%) respondents. In addition, on average, white respondents were slightly older (mean age, 64.4 years) than AIAN and black respondents (mean age, 62.5 years and 62.4 years, respectively).

### Screening Prevalence

In Table 2, we present average CRC screening rates for the combined BRFSS samples (2001 and 2010) and racial

**TABLE 3.** Estimated Odds Ratios According to Racial Group for “Guideline-Specific” Endoscopy, Fecal Occult Blood Testing, and Mixed Screening Among Respondents Aged  $\geq 50$  Years<sup>a</sup>

| Racial Group                 | OR (95% CI) <sup>b</sup>      |                               |                               |
|------------------------------|-------------------------------|-------------------------------|-------------------------------|
|                              | Model 1                       | Model 2                       | Model 3                       |
| Endoscopy                    |                               |                               |                               |
| White                        | 1.00 (1.00-1.00)              | 1.00 (1.00-1.00)              | 1.00 (1.00-1.00)              |
| Black                        | 0.98 (0.94-1.03)              | 1.02 (0.97-1.07)              | 1.25 (1.19-1.32) <sup>c</sup> |
| American Indian <sup>d</sup> | 0.68 (0.59-0.79) <sup>c</sup> | 0.69 (0.60-0.81) <sup>c</sup> | 0.83 (0.71-0.97) <sup>e</sup> |
| FOBT                         |                               |                               |                               |
| White                        | 1.00 (1.00-1.00)              | 1.00 (1.00-1.00)              | 1.00 (1.00-1.00)              |
| Black                        | 0.98 (0.92-1.05)              | 1.04 (0.97-1.12)              | 1.16 (1.08-1.25) <sup>c</sup> |
| American Indian <sup>d</sup> | 0.84 (0.70-1.01)              | 0.87 (0.71-1.06)              | 0.98 (0.80-1.20)              |
| Mixed screening              |                               |                               |                               |
| White                        | 1.00 (1.00-1.00)              | 1.00 (1.00-1.00)              | 1.00 (1.00-1.00)              |
| Black                        | 0.97 (0.92-1.02)              | 1.01 (0.96-1.06)              | 1.24 (1.17-1.30) <sup>c</sup> |
| American Indian <sup>d</sup> | 0.66 (0.57-0.77) <sup>c</sup> | 0.68 (0.58-0.79) <sup>c</sup> | 0.82 (0.70-0.96) <sup>e</sup> |

Abbreviations: CI, confidence interval; FOBT, fecal occult blood testing; OR, odds ratio.

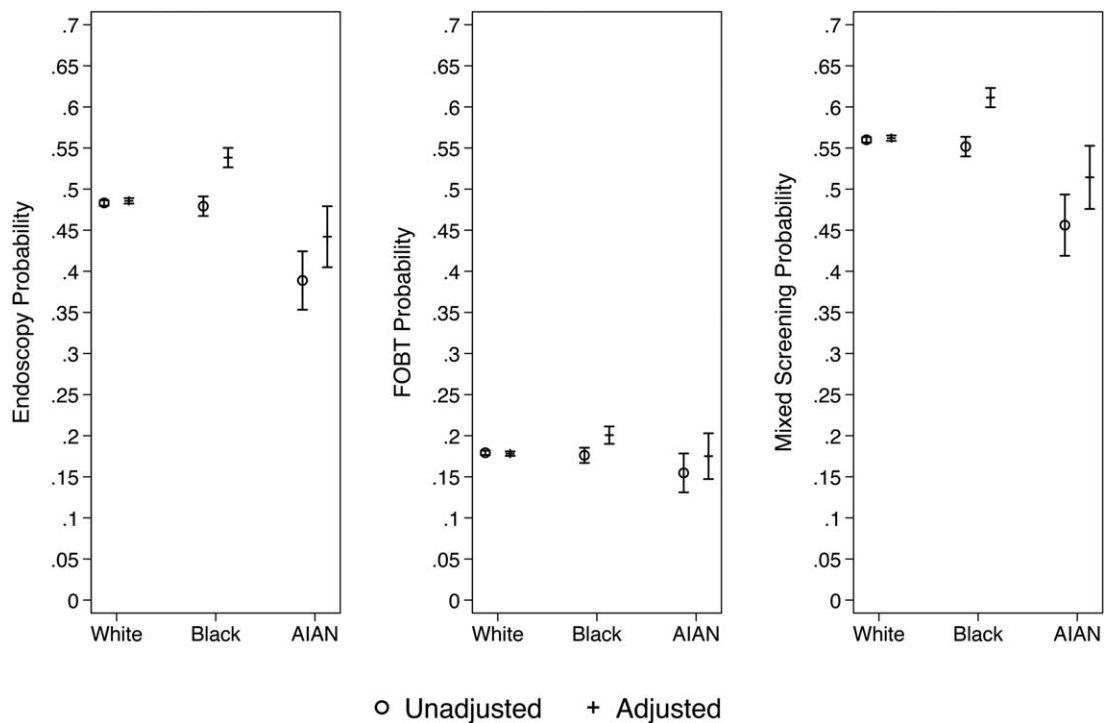
<sup>a</sup> Results are from logistic regression models that used combined 2001 and 2010 data from the Behavioral Risk Factor Surveillance System.

<sup>b</sup> Model 1 was unadjusted; model 2 was adjusted for survey year, age, and sex; and model 3 was adjusted for survey year, age, sex, income, education, and insurance.

<sup>c</sup>  $P < .001$ .

<sup>d</sup> American Indian was defined as American Indian/Alaska Native.

<sup>e</sup>  $P < .05$ .



**Figure 2.** Estimated unadjusted and adjusted probabilities of “guideline-concordant” colorectal cancer screening with 95% confidence intervals are illustrated among respondents aged  $\geq 50$  years. Results are based on data from the 2001 and 2010 Behavioral Risk Factor Surveillance System. Adjusted models included survey year, age, sex, and income. FOBT indicates fecal occult blood testing.

group differences in screening modality among AIAN, black, and white respondents.

### Endoscopy

Close to half of respondents in the combined samples (48.2%) indicated that they underwent guideline-concordant endoscopy within the past 5-years preceding their survey. AIAN respondents (38.9%) had a distinctly lower prevalence of endoscopy screening ( $P < .001$ ) compared with black respondents (47.9%) and white respondents (48.3%).

### FOBT

The overall reported prevalence for guideline-concordant FOBT screening within the past year was 17.9%. Racial group prevalence rates were 15.5% for AIANs, (17.6%) for blacks, and 17.9% for whites. We observed no significant differences in FOBT screening rates among the 3 considered race groups.

### Mixed screening

Finally, the overall prevalence of mixed screening (either endoscopy within 5 years or FOBT within the past year) was 55.8%. Following the pattern observed for endoscopy screening, AIAN respondents presented the lowest prevalence of mixed screening (45.6%) compared with black respondents (55.2%) and white respondents (56%;  $P < .001$ ).

### Changes Over Time

Significant changes over time in the rates of guideline-concordant screening were reported from 2001 to 2010 for the examined racial groups, as illustrated in Figure 1.

### Endoscopy

Between 2001 and 2010, AIAN (45%), black (52%), and white (37%) respondents evidenced statistically significant increases in rates of guideline-concordant endoscopy. However, in 2010, AIAN respondents (45%) remained less likely to report endoscopy screening compared with black respondents (56%) and white respondents (55%).

### FOBT

Between 2001 and 2010, black (−30%) and white (−53%) respondents had significant decreases in rates of guideline-specific FOBT. AIAN respondents did not have a significant change. In addition, in 2010, white respondents were least likely to report having an FOBT within the past year compared with AIAN and black respondents.

### Mixed screening

Finally, all 3 groups had significant increases between 2001 and 2010 in rates of guideline-specific mixed screen-

ing (AIANs, 34.5%; blacks, 29.6%; whites, 15.3%). However, in 2010, the prevalence of mixed screening remained lowest among AIAN respondents (51%), followed by white respondents (60%) and black respondents (61%).

### Multivariable Models

#### Endoscopy predictors

The OR of guideline-specific endoscopy screening among AIAN respondents was 31% lower compared with that among white respondents after controlling for age, sex, and survey year, as indicated in Table 3. The OR for blacks was not statistically different from that for whites. Additional adjustment for income, education, and insurance partially attenuated the statistical difference between AIANs (OR, 0.83; 95% CI, 0.71-0.97) and whites. However, controlling for these covariates accentuated the OR for black respondents (1.25; 95% CI, 1.19-1.32) relative to the referent racial group.

#### FOBT/endoscopy predictors

Adjusting for the demographic and survey year indicators of FOBT and endoscopy did not affect the lack of statistical difference in ORs among black and AIAN respondents relative to white respondents. Similar to the endoscopy results detailed above, our additional adjustment for socioeconomic and insurance status accentuated the OR among blacks (1.16; 95% CI, 1.08-1.25) relative to whites.

#### Predictors of combined screening

Similar results emerged from the combined screening models. The initial OR differences between AIAN and white respondents (OR, 0.66; 95% CI, 0.57-0.77) were partially attenuated by adjusting for survey year, age, sex, socioeconomic status, and insurance indicators (OR, 0.82; 95% CI, 0.70-0.96). The OR for black respondents (1.24; 95% CI, 1.17-1.30) relative to white respondents was accentuated by this adjustment.

### DISCUSSION

Our study indicates that, in the first decade of the 21st century, AIANs reported the lowest CRC screening rates in the United States compared with blacks and whites. Despite a considerable increase in CRC screening rates according to USPSTF guidelines between the years 2001 and 2010, AIANs were the least likely group to receive endoscopy and mixed screenings in both 2001 and into 2010.<sup>15,16</sup> More specifically, by 2010, AIANs barely reached the Healthy People 2010 goal of mixed screening by 1%, and they remained below the 50% threshold for



endoscopy. Our findings indicate that, although considerable progress has been made to increase CRC screening for different race groups in the United States, AIANs continue to lag behind other groups.

In the context of Healthy People 2010 goals, we sought to describe, examine, and compare prevalence estimates of CRC screening practices among AIANs, blacks, and whites in the United States between the years 2001 and 2010. Overall, we observed that, among individuals aged  $\geq 50$  years, all examined racial groups experienced a significant increase in guideline-concordant CRC screening. However, we observed a consistent racial disparity in CRC screening for AIANs. In particular, AIANs received significantly less guideline-concordant endoscopy and less combined endoscopy/FOBT screening compared with whites, although some of these disparities were attenuated when enabling factors for health care were considered. We observed no racial disparities for FOBT screening among our examined groups. However, our findings indicate that FOBT rates have decreased since 2001 for blacks and whites but have remained consistently low for AIANs. This decrease may be related to increases in endoscopy as a preferred screening procedure among whites or blacks.<sup>17</sup> FOBT screening rates among AIANs may have remained the same because of associated cultural factors that have been correlated with a preference for FOBT over endoscopies, such as speaking their tribal language<sup>18,19</sup> and preferring less invasive procedures.<sup>18</sup> Because this is beyond the scope of our current study, more research is needed to explore possible variables, such as access to endoscopy and FOBT, among AIANs.

### **CRC Screening Disparities Among AIANs**

For AIANs, CRC screening disparities persisted after statistically controlling for factors that enabled health care access. AIANs had the lowest CRC screening rates compared with whites and blacks, supporting previous research.<sup>8,20,21</sup> However, our study differed from that by the Agency for Health Care Quality, which reported that AIAN CRC screening rates fell from 41% to 37% between 2000 and 2008.<sup>22</sup> We did observe that AIANs increased their CRC screening rates between 2001 and 2010; nonetheless, this increase remained well below the rates for whites and blacks.

Health knowledge and education may play a role in CRC screening disparities among AIANs. The extant literature indicates that AIANs report having limited knowledge and fewer discussions with their primary care providers regarding CRC screenings but would prefer more information.<sup>19,23</sup> Consequently, several researchers

have advocated for culturally tailored CRC screenings, conducted in a patient's tribal language, which may improve CRC health outcomes.<sup>18,19,23</sup> To date, a paucity of data exists to demonstrate the efficacy of culturally tailored CRC screenings and health education interventions for improving screening practices among AIANs.

### ***Borrowing From the Relative Success in CRC Screening Among Blacks***

Our results indicate that black individuals have made important strides in increasing CRC screening rates. Furthermore, controlling for enabling factors such as health care access and socioeconomic factors, black respondents exceeded whites' guideline-concordant CRC screening rates. These findings are consistent with recent research demonstrating an increase of CRC screening among blacks.<sup>1,10,24,25</sup> Targeted interventions may explain the success in elevating CRC screening among black communities in the United States.<sup>26</sup> Recent work suggests that improved knowledge about the importance of CRC screening facilitates such increases.<sup>27</sup> Advances in successful health interventions targeting black communities provide a pathway that could guide interventions among AIANs and other racial groups that experience continued CRC screening disparities. However, unmeasured factors in our study, such as primary care provider settings and characteristics (eg, years in practice, specialty), that contribute to screening behavior,<sup>28</sup> also may have contributed to the evidenced differences.

Given evidence linking culturally sensitive, community-based, and clinically based interventions to improvements in CRC screening rates among blacks,<sup>26,29</sup> similar models could be adopted for a continued improvement in screening rates among AIANs. However, the large intragroup variability within AIANs, with approximately 560 federally recognized tribes and more than 200 spoken languages with distinct cultural views, presents an added challenge. Yet many AIANs share cultural health beliefs that embrace a biopsychosocial-spiritual approach based on the mind, body and spirit; which could provide a guiding framework for culturally-tailored health interventions.<sup>30,31</sup> In fact, some evidence suggests that social networks can provide important mechanisms to increase CRC knowledge and promote CRC screenings among AIANs.<sup>23,32</sup>

Overall, this study had several limitations because of the nature of the aggregated, large national sample used. Tribal differences between AIAN groups in health care availability, education, and unique health care beliefs were not examined. Although these data were not available for

our study, the consideration of tribal differences may introduce more complexity into targeting cancer screening for AIANs. It is noteworthy that such complexity would likely guide efforts to improve CRC screening rates while Healthy People 2020 goals are pursued. Like most national surveys, institutionalized individuals (eg, armed service member) were not sampled, which could affect our estimates. Furthermore, it also has been demonstrated that screening access varies for urban and rural AIAN populations,<sup>19</sup> perhaps because of clinical resources. Second, these data relied on self-reported screening, which is subjective and may inflate CRC screening reports.<sup>33</sup> Hence, actual CRC screenings may be lower than reported. Third, psychosocial and cultural factors, such as primary language, primary care provider home, cultural health beliefs, and social support, were not considered in our study. Thus, our findings may be limited to the health care-enabling factors that we included in our models. A more comprehensive adjustment for other health care enabling, predisposing, and need factors is needed in future research.

In summary, we observed that AIANs reported the lowest CRC screening rates compared with blacks and whites in the United States. Cancer remains the second leading cause of death among AIANs.<sup>34</sup> To our knowledge, this study is among the first to test a rigorous definition of CRC health care disparities within AIANs over time. Although CRC screening improved for blacks, AIANs lagged behind. Lessons may be learned from the successful promotion of CRC screening among blacks that may be applicable to AIANs, including culturally sensitive, community-based interventions. Future research needs to focus on the possible barriers to care and cultural health beliefs that may influence CRC screening behaviors among AIANs.

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## CONFLICT OF INTEREST DISCLOSURES

The authors made no disclosures.

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