

# Health disparities in colorectal cancer among racial and ethnic minorities in the United States

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**Abstract:** In the 2010 Census, just over one-third of the United States (US) population identified themselves as being something other than being non-Hispanic white alone. This group has increased in size from 86.9 million in 2000 to 111.9 million in 2010, representing an increase of 29 percent over the ten year period. Per the American Cancer Society, racial and ethnic minorities are more likely to develop cancer and die from it when compared to the general population of the United States. This is particularly true for colorectal cancer (CRC). The primary aim of this review is to highlight the disparities in CRC among racial and ethnic minorities in the United States. Despite overall rates of CRC decreasing nationally and within certain racial and ethnic minorities in the US, there continue to be disparities in incidence and mortality when compared to non-Hispanic whites. The disparities in CRC incidence and mortality are related to certain areas of deficiency such as knowledge of family history, access to care obstacles, impact of migration on CRC and paucity of clinical data. These areas of deficiency limit understanding of CRC's impact in these groups and when developing interventions to close the disparity gap. Even with the implementation of the Patient Protection and Affordable Healthcare Act, disparities in CRC screening will continue to exist until specific interventions are implemented in the context of each of racial and ethnic group. Racial and ethnic minorities cannot be viewed as one monolithic group, rather as different segments since there are variations in incidence and mortality based on natural history of CRC development impacted by gender, ethnicity group, nationality, access, as well as migration and socioeconomic status. Progress has been made overall, but there is much work to be done.

**Keywords:** Disparities; race; ethnicity; minorities; colorectal cancer (CRC)

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## Introduction

In the 2010 Census, just over one-third of the United States (US) population identified themselves as being something other than being non-Hispanic white (nHw) alone. This group has increased in size from 86.9 million in 2000 to 111.9 million in 2010, representing an increase of 29 percent over the ten year period. Per the American Cancer Society, racial and ethnic minorities are more likely

to develop cancer and die from it when compared to the general population of the US. This is particularly true for colorectal cancer (CRC). The primary aim of this review is to highlight the disparities in CRC among racial and ethnic minorities in the USA. The secondary aim of the review is to provide a greater understanding on why these disparities exist and means to close the incidence and mortality gap in CRC among racial and ethnic minorities.

## CRC among African-Americans (AA)

### *Incidence and mortality*

Disparities in incidence and mortality in CRC continue to persist between AA and nHws, despite the provision of widespread screening and improved treatments for CRC. The reduction in CRC mortality has been more significant for both nHw males and females when compared to all other racial groups in the USA (1-6). Even with the reported declines in incidence and mortality among AA, incidence and mortality from CRC is higher among AA when compared with other racial and ethnic groups (7). The disparity in CRC mortality between AA and nHw is particularly evident in distant stage CRC. Robbins *et al.* observed a 28% difference in incidence in the diagnosis of distant stage CRC between AA and nHw. In the same study, it was observed that this difference accounted for more than 60% of the total mortality disparity from CRC (6). In addition, AA have an earlier median age at CRC diagnosis when compared to nHw (8).

The cause for the disparity in incidence and mortality is multifactorial. Inequalities in screening and the understanding of family history have been implicated and will be discussed later in the article. Epidemiological studies have identified disparities in protective factors and risk factors for CRC. It is thought that environmental risk factors account for the majority of CRC risk which is understood to be approximately 65% (9). Risk factors for CRC include but are not restricted to smoking, obesity, consumption of a either a high fat/calorie/red meat diet, alcohol use, low consumption of calcium or fish oils, decreased exposure to vitamin D, and low selenium (10-13). The microbiome and its products have been implicated in contributing to the risk of CRC development (14). When data prior to the use of widespread CRC Screening is evaluated, an imbalance between protective factors and risk factors were noted among AA which led to increased mortality from CRC compared to nHw (2). It is unclear what the imbalance between protective and increased risk factors currently plays in the observed CRC disparity among AA versus nHw.

### *Disparities in CRC treatment*

Even though the efficacy of treatment for CRC appears to be similar between AA and nHw among equal access systems and participants in adjuvant chemotherapy trials (15,16), there continues to be differences in care after the diagnosis

and treatment of CRC (17-19). Multiple investigators have shown that independent of CRC resection and post-operative adjuvant chemotherapy, physical activity and diet play significant roles in affecting mortality (20-22). Tehranifar *et al.* also reported that cancer survival disparities between AA and nHw has widened as cancers become more amenable to medical interventions (23). AA may be less likely to receive newer chemotherapeutic agents and are less likely to be treated in high quality or high volume facilities, which have better outcomes (24,25). AA have an identified mistrust of medical research and researchers as their primary resistance to participation in medical research resulting in decreased participation in clinical trials (26). Further study needs to be dedicated to understanding why AA are not receiving or do not have access to similar medical and pharmaceutical technologies as nHw which can improve mortality outcomes.

### *Disparities in understanding family history of CRC*

Family members of CRC patients have been identified as a risk group requiring increased focus on the correct timing of CRC screening *vs.* surveillance and more intensive surveillance when compared to those without a family history of CRC. Approximately 25 percent of patients with CRC have a family history in one or more family members (27). For example, having one or two first degree relatives with CRC is associated with a 1.72 and 2.75 fold increased risk for the development of CRC (28). Patients with a significant family history of CRC should be screened at an earlier age should be placed under more frequent surveillance intervals to determine the presence of potential adenomas and/or cancers (29). Overall, patients with a family history of CRC are more likely than those without to undergo CRC screening, but this trend has not been uniform among all races and ethnicities. AA and Hispanics with a family history of CRC have the lowest likelihood of participation in screening (30). In addition, AA are less likely than nHw to know their paternal history of cancer or have inaccuracies in knowledge of their family history of cancer (31,32). Screened AA family members are less likely to tell their relatives about the finding of colon polyps (33). Thus, lack of information, knowledge, or transmittal of medical information as well as understanding of factual information from the patient, has the potential to incorrectly place a patient in the sporadic CRC screening category instead of the family history category, affecting correct timing of screening and potentially placing the patient at increased

risk for the development of CRC.

### *Disparities in screening*

Screening for CRC is a cost-effective strategy to reduce the CRC prevalence in the general population and can reduce the morbidity and mortality of CRC (7,34). Lack of CRC screening has also been shown to delay the diagnosis in CRC among AA (35,36). National Health Interview Survey results from 1987–2008 showed screening among adults older than 50 years of age increased significantly for both AA and nHw (33,37–39). Screening for CRC in AA continues to lag behind nHw irrespective of whether endoscopy or fecal occult blood testing was the screening approach used (40).

Studies have suggested that when compared to nHw, AA are more likely to be diagnosed with CRC at younger ages, present with proximal tumors and be diagnosed with advanced neoplasia (16–18,41–45). A significant number of CRCs are diagnosed before the recommended screening age of 50. For example, approximately 5.5% of all CRCs occur prior to the age of 50 years in nHw, whereas for AA, approximately 10.6% of CRCs occur prior to age 50 (34). Based on the aforementioned percentages, if screening started at age 45 years for AA, it has been postulated that approximately 95% of CRCs would occur after that screening age which would be equivalent to screening nHw at age 50 (46). Even though the widely adopted recommendation is to begin CRC screening from 50 years of age for average risk individuals in the US, there are multiple societies stating AA should undergo CRC screening before the age of 50 (30,47). Evidence points to reasons for decreased screening between AA and nHw even in equal access settings. Initial work within an equal access system indicated no difference between AA and nHw in CRC screening program participation, however in a recent study by May *et al.* found different results. AA were less likely to undergo CRC screening by any method and colonoscopy use for CRC screening was significantly lower when compared to nHw (48,49). As stated earlier, previous studies reported AA have decreased trust in healthcare professionals when compared to nHw (50). Decreased levels of trust results in AA having less healthcare encounters than nHw and a reduced opportunity to engage in effective physician-patient communication (51–53). AA are also less likely to experience continuity of care and is more likely to be uninsured (54). AA are more likely to be of lower socioeconomic status (SES) than nHw. Lower SES is

associated with a reduced screening rate and individuals who live in lower socioeconomic neighborhoods are less likely to undergo a colonoscopy, even among insured subjects receiving care in integrated healthcare system (55,56).

### *Means to improve CRC screening rates*

Real and perceived barriers have been identified as reasons for AA not undergoing CRC screening at the same rate as nHw. Other racial groups such as Hispanic Americans (HA) have similar socioeconomic, environmental backgrounds and behavioral tendencies as AA but are noted to have lower CRC incidence and mortality rates when compared to AA. This may be suggestive of differences in healthcare care utilization, biology of CRC between the two groups or other risk factors (57). A number of methods have been studied to improve screening rates among AA. The interventions include but are not limited to, emphasis on physician recommendation, improved health care coverage and patient navigators. These have met with varied success. Physician recommendation has been determined to be an important factor for completion of CRC screening (58,59). However, increasing availability of primary care physicians and colonoscopy providers has not closed the disparity in CRC screening between AA and nHw. Instead, the opposite has occurred, colonoscopy rates increased among nHw and decreased among minorities (60,61). Therefore, it has been suggested that an urgent unmet need exists to increase participation of minorities as care providers in biomedical fields and to improve cultural competencies of all care providers (61,62). Studies have suggested a higher completion rate of CRC screening when the underserved are offered fecal occult blood tests (63,64). It appears that there are wide geographic variations in availability of colonoscopy to the population and the acceptability of fecal based tests to the underserved. Further studies will be required to determine if AA would be more receptive to fecal occult testing and if this affects CRC screening rates when compared to colonoscopy as well as improves CRC mortality compared to nHw.

AA are less likely to have healthcare insurance when compared to nHw (54). Even though this gap may close under the Patient Protected Affordable Care Act (PPACA), White *et al.* observed that despite expansion of Medicare coverage for CRC screening tests, racial and ethnic differences in CRC screening persisted over time among this insured population (65,66). Improved health care access by expansion of insurance is important to increase

preventative care utilization, but cannot be the sole means to reduce the racial disparity observed in CRC screening. A meta-analysis performed by Naylor *et al.* provider-directed multi-modal interventions which comprised of education sessions, reminders and pure educational interventions were found to be effective in raising CRC screening rates in minorities by 10–15% (67). Tailored patient education combined with patient navigation services, and physician training in communicating with patients of low health literacy, can modestly improve adherence to CRC screening. It is unknown if the use of a patient navigator affects CRC mortality. Nevertheless, these interventions will not capture all patients who are in need of CRC screening or who are non-adherent to patient navigator programs. Sly *et al.* found that there are certain intrapersonal and interpersonal characteristics of non-adherent navigated AA patients. Intrapersonal characteristics such as fear/anxiety about colonoscopy, lack of knowledge of CRC, believing the CRC results in death played a role in non-adherence in receipt of colonoscopy. In addition, inadequate explanation of colonoscopy, social burden and life circumstances were found to be reasons for non-adherence (68). Further studies will be needed to determine if addressing such issues will result in improved CRC screening rates and help reduce CRC mortality gap between AA and nHw.

## CRC in Hispanics

### Introduction

The term Hispanic refers to individuals of Mexican, Puerto Rican, Cuban, Dominican, and additional Central/South American as well as other Spanish ancestry based on self-identification on the 2010 USA Census (69). In 2013, the American Community Survey estimated the national Hispanic population at 55 million or 17.1% of the US total (70). The majority of Hispanics are of Mexican (64.0%), Puerto Rican (9.5%) or Cuban (3.7%) descent (70). Additionally, the Hispanic population is unique relative to the remainder of the nation with regard to SES and immigration history. For 2013, 24.3% of Hispanics were uninsured and 34% foreign-born compared to 12.7% and 10% of nHw and 15.7% and 10.9% of AA respectively (71). Furthermore, Hispanics are an admixture of Amerindian, African and European individuals, the contribution of each racial genotype may vary among subgroups impacting CRC. The goal of this segment of the review is to illustrate what is known about the epidemiology, screening, endoscopic

findings at colonoscopy, and outcome of CRC in the Hispanic population of the USA.

### Incidence of CRC

In both Hispanic males and females, CRC is the second most common cancer identified (72). Nationally, incidence rates in Hispanics are less than those observed in both nHw and AA (72-76). In spite of decreasing overall incidence, rates appear to be increasing in younger individuals (<50 years old) of all racial and ethnic groups (77,78). Interestingly, the greatest increase in incidence rates from 1993-2007 occurred among young Hispanics (45%) compared to nHw (27%) and AA (15%) (77). In addition, incidence rates vary based on Hispanic subgroup as well as migrant status to the mainland 48 states (79-87). Initial studies on incidence were based on older data [1958-1990] and only evaluated Puerto Ricans (PR) and Mexican Americans (MA) (79-85). The primary findings of this initial work indicated that cancer risk varied dependent on location for PRs and migrant status for MAs. Residents of Puerto Rico had the lowest incidence of CRC with mainland (continental 48 states) PR intermediate and nHw the highest rate (79,82-85). A similar pattern was observed between immigrant MAs, US born MA and nHw (80,81). Recent data indicates this circumstance has continued in both PR and MA Hispanic subpopulations with some notable variation (86-88). Monroe and associates reported among MA, residing in Los Angeles CA and participants of the prospective multiethnic cohort study, striking variation in CRC incidence rates (86). Immigrant MA continued to have a lower incidence rate of CRC compared to nHw. However, following generations had higher incidence rates than nHw with the greatest comparative increase (86% for MA males and 61% for MA females) in the generation following migration to the USA (86). Ho and colleagues evaluated CRC incidence rates in island PR, mainland PR and US nHw from 1998-2002 (87). As noted in previous literature, lowest CRC incidence rates were seen among island PR and highest in nHw. The incidence rates for mainland PR males and females were between the groups listed above (87). Interestingly, the mainland PR male and female rate approached the nHw rate rather than the island PR rate. This trend may suggest greater acculturation of the mainland PR group (residents of New York, New Jersey and Connecticut) adopting the lifestyle and chronic disease patterns of their new location in comparison to island PR (88-90).

In a unique evaluation of cancer in Florida residents,

Pinheiro *et al.* assessed cancer incidence rates, including CRC, among Hispanic, nHw and AA from 1999–2001 (91). Also determined were incidence rates, including CRC, in the state's Hispanic subgroups: Cuban Americans (Cub), PR, MA and a 4th category of new Latinos (consisting of individuals from the Dominican Republic, Spain, as well as other Central and South American Spanish speaking nations). Of note, CRC incidence of the composite Hispanic group (male 67.8/100,000, female 52.9/100,000) was either equivalent or greater than to that seen in nHw (male 68/100,000, female 48.9/100,000). Both were less than AA. However, when examining Hispanic subpopulations, Florida Cub (44.2/100,000) and PR (46.9/100,000) had higher CRC incidence compared to Florida nHw (42.5/100,000) and place or origin (Cub 13.4/100,000; PR 26.6/100,000). MA CRC incidence (21.8/100,000) was lower than FL PR, Cub and nHw but higher than observed in Mexico (7.9/100,000). These findings also suggest an acculturation effect for PR and Cub in Florida that has not occurred for MA or new Latinos.

### *Colon cancer screening among Hispanics*

Multiple studies indicate that CRC screening decreases incidence, improves survival and mortality (46,92–96). In 2010, CRC screening among adults >50 years old varied by ethnicity, with the lowest rate occurring in Hispanics (47%) when compared to nHw (62%) and AA (56%) (40,72). Regarding use of endoscopy for CRC screening, again Hispanics (45.3%) lagged behind both AA (53%) and nHw (58.5%) (76). In addition, screening rates appear to vary according to location of origin with PR having higher rates of screening compared to MA, Cub, Dominican or Central/South American Hispanics (72). Finally, screening rates for the uninsured are less for Hispanics and nHw compared to the insured of both groups; screening is less frequent in uninsured Hispanics (19.5%) compared to nHw (21.6%) (72).

Interventions to improve screening rates include direct access endoscopy, patient navigation as well as physician/patient counseling and education. Direct access endoscopy allows for primary care physicians to refer patients meeting specific criteria to colonoscopy without a pre-procedure visit (97). Patient navigators are individuals trained to guide patients through the process of obtaining colonoscopy post physician referral (98). This includes scheduling, transportation, procedure date reminders as well as answer questions that may arise. Physician counseling or education

of patients with low health literacy has also been shown to increase CRC screening rates (99). The combination of direct access endoscopy, physician/patient education and patient navigation in New York City led to elimination of disparities in timely colonoscopy between insured, nHw, AA and Hispanics (100). Also, use of similar combined efforts in the uninsured and underinsured can be successful in obtaining screening colonoscopy as well (101).

### *Findings at screening*

Multiple studies have evaluated either screening flexible sigmoidoscopy or colonoscopy in Hispanic individuals with variable outcomes indicating Hispanics have either lower, equivalent or higher risk compared to nHw (102–108). Higher prevalence of adenomas among Hispanics compared to nHw have been reported by two groups (102,103). This occurred in the distal and proximal colon as well as for polyps with any advanced feature (>10 mm in size, or exhibiting advanced histologic features such as either villous or tubulovillous characteristics as well as high grade dysplasia). Equivalent prevalence was seen in three studies between Hispanic and nHw patients with regard to prevalence of adenomas overall, proximal adenomas, polyps  $\geq 10$  mm, proximal polyps  $\geq 10$  mm, or advanced features although one study had limited power due to small sample size (101,104,105). Lower prevalence was observed from a national endoscopic database as well as a university medical center from the Northeast USA (106,107). Finally, comparisons between Hispanics and AA have also occurred with either equivalent findings between the two groups or AA having an increased prevalence (108,109). Interestingly, all of these studies did not evaluate by Hispanic subgroup or migration status, limiting applicability to the entire population.

### *Care after CRC screening*

Hispanics are less likely to be diagnosed with early stage CRC compared to nHw (76,109,110). This is most likely due to reduced screening rates and access to care as stated above (40,72). Of note, overall five-year CRC survival rates are equivalent between Hispanics and nHws (72,76). However, Hispanics have not seen increases in survival when compared to nHw for metastatic CRC (111). In addition, migrant or subgroup analysis of the Hispanic population with regard to staging or survival has not occurred to date.

## CRC in Asian American and Pacific Islanders

### Epidemiology of CRC

In the US, the Asian and Pacific Islander (AAPI) population represents the fastest growing group, with 2010 US census data estimating 17.4 million (5.5% of population) living in the US; a growth rate of 46% since 2000 (112). CRC is the second leading cause of cancer related mortality, behind lung cancer. The incidence rate of CRC for AAPI in 2011 was estimated to be 32.4 per 100,000 persons (39.9 all races). A higher incidence of CRC is seen in AAPI men 38.3 per 100,000 persons (46.1 all races), compared to AAPI women, 27.8 (34.9 all races). The annual death rate is estimated to be 10.7 per 100,000 persons (15.1 all races). Separation by sex showed that AAPI males had a death rate of 12.7 per 100,000 persons (18.1 all races), and women 9.3 (12.8 all races) in 2011 (113). Giddings *et al.* (114) reported that despite an overall decrease in CRC incidence of AAPI from 1988-2007, subgroups of the AAPI population had an increase in CRC incidence when disaggregated by race and gender. Korean males had the highest annual percentage change (APC) at 3.6% and were the only group to experience a significant increase in CRC incidence. Among females, South Asians (Asian Indian and Pakistani), Koreans, and Filipinos experienced significant increases with APC of 2.8%, 2.7% and 1.6% respectively (115). In a review of literature by Hwang, Korean and Japanese populations were noted to have similar rates of CRC (116). In a prospective multi-ethnic cohort, Japanese Americans showed a higher incidence in both men (RR 1.27) and women (1.49), when compared to nHw (115).

### Location of CRC

When compared to AA, nHw, and Hispanics, AAPI may have a predilection towards left sided CRC. One study focused on an urban, underserved population, and AAPI were more likely to present with left sided and advanced CRC (stage III) (117). Ladabaum *et al.* also reported that proximal colon cancer was proportionally more common among nHws (42.2%) than among all Asian subgroups (24.8-33.9%) (118). Using the National Cancer Institute SEER database, Yi *et al.*, showed that Asians also had a predilection of developing proximal colon lesions, but less so than nHw (39.4% *vs.* 50.1%). Asians did have a higher distribution of cancers compared to nHw in the sigmoid colon (27.8% *vs.* 21.3%), and rectum (30.5% *vs.* 25.5%). Of

the Asian subgroups, Japanese (43.2%) and Chinese (42.1%) had the highest rates of proximal colon lesions. Rectal cancers were highest in Korean patients (35.2%). AAPI had a higher percentage of advanced CRC when compared to nHw, 49.6% *vs.* 45.1%; Korean patients were diagnosed with the highest rate (32.9%) of stage III cancer within the group (119).

### CRC screening

CRC screening behaviors of AAPI are varied. Overall rates of screening can mask subgroups with excellent or poor rates, as estimates indicate there are up to 23 AAPI sub-populations (120). Lee *et al.* examined differences in CRC screening by disaggregating AAPI into seven subgroups (121). When AAPI were compared to nHw, they demonstrated a lower screening rate (46.8% *vs.* 57.7%). When disaggregated, Koreans had the lowest CRC screening rates (32.7%). Japanese had the highest (59.8%) rate of screening, better than that of nHw (121). The use of screening method (fecal occult testing, FOBT/FIT, flexible sigmoidoscopy, or colonoscopy) varies among the Asian sub-populations. Using NCI SEER data, of the groups never having any of the above screening methods, Vietnamese (47.8%) were the highest. Chinese had the highest screening rate (81.3%). Flexible sigmoidoscopy (4.7-11.5%) and fecal occult blood testing FOBT (22.7-45.6%) were used less often than colonoscopy (45.5-66.2%) (119). Common prohibitive factors among the groups analyzed were financial issues, employment status, and fear of the procedure or possible results of the procedure (114).

### CRC among Indian and Pakistani nationalities

In an analysis of the SEER database, patients of Indian and Pakistani nationality have been found to be diagnosed at a younger age when compared to other Asian sub-populations and nHw, despite a lower screening rate seen in other studies (119,121). Indian and Pakistani made up 3% of the Asian population developing CRC. Also, people of Indian and Pakistani nationality showed a better disease specific survival when compared to other Asian sub-populations and nHw, which may be attributed to education, cultural behaviors, or SES (119).

Although CRC rates have improved in this population as a whole, there are subgroups with worsening rates of disease. At diagnosis, AAPI have a rate of advanced disease

worse than nHw (117,119). Recently, significant associations between CRC incidence and nativity, living in an ethnic enclave, and SES have been seen (118). This suggests there is a substantial effect of acquired environmental factors, which may be attributed to cultural factors, language barriers, SES and access to screening, and acculturation or “Westernization” (diet changes, physical activity changes, obesity) as possible variables (118). Education about various methods of CRC screening and an increased awareness may improve incidence of CRC and stage at diagnosis. AAPI are the most rapidly growing population in the US, ongoing study in this area will be valuable to determine if this group should adhere to USA versus Asian CRC screening guidelines in the future.

## CRC among American Indian and Alaskan Natives

### *Epidemiology of CRC*

CRC is a leading cause of morbidity and mortality among Native Americans and Alaskan Natives (AI/AN) (76,122). Furthermore, there are significant gender and ethnic variances of CRC incidence and mortality among AI. Between AI subpopulations, those from the Northern Plains have the highest age-adjusted cancer mortality, possibly due to poor utilization of available screening modalities (123). Limited data exists on CRC screening among AI/AN populations. Data indicates that AI have a lower incidence of CRC as compared to the other US population groups, perhaps confounded by underreporting (122).

### *Regional and gender variance in CRC*

Among AI/AN, both gender and regional variances in CRC incidence have been seen. CRC rates were highest among men from the Northern Plains and Alaska compared to nHw men (124). Furthermore, Alaskan native women had the highest regional incidence of CRC compared to nHw women (125). This disparity could be explained by genetic predisposition or by a higher prevalence of risk factors (heavy alcohol consumption, tobacco abuse) as compared to nHw (125). A study examining linked data between the Indian Health Service and national cancer registry from 1999 to 2009 found that these groups had a higher incidence of CRC and higher risk of death from CRC in the Northern Plains, Southern Plains, Alaska, and the Pacific Coast as compared to nHw. However, regional CRC incidence was lower in the East and Southwest regions, and

risk of death from CRC was not found to be statistically significant in these regions (126).

### *Stage at diagnosis at CRC*

The majority of previous studies have predominantly focused on AA, nHw, or HA CRC incidence and mortality. However, a SEER analysis found that AI were not only presenting with CRC at younger ages than nHw, but that their disease was more advanced at the time of diagnosis (127). Another study found that AI/AN had a 9% higher rate of early stage CRC and 25% higher rate of late stage CRC (gender combined, age-adjusted) compared to nHw (128). This underscores the importance of early detection via access to screening tests and early education of modifiable risk factors, such as tobacco abuse, obesity, dietary changes, and sedentary lifestyle.

### *Barriers to CRC screening*

CRC screening rate among AI has been noted to be much lower when compared to nHw. Day *et al.* found CRC screening rates of AI receiving Indian Health Service to be much lower than previous reported studies. Only 4.0% of asymptomatic, average-risk AI/AN underwent recommended CRC screening between 1996 and 2004 (128). Women and residents of the Alaska region were more likely to have been screened, but even among women in this region screening was only undertaken 10.8% of the time. Causes for decreased CRC screening among AI may be similar to other minority groups. There are some causes that are unique to AI especially among AN, such as access to colonoscopy secondary to geography. Efforts to include training rural mid-level providers in flexible sigmoidoscopy, provision of itinerant endoscopy services at rural tribal health facilities, the creation and use of a CRC first-degree relative database to identify and screen individuals at increased risk, and support and implementation of screening navigator services have shown success (129). Even though, AI from the Northern Plains had the lowest rates of CRC screening within the Indian Health Service regions (128).

## Conclusions

Despite overall rates of CRC decreasing nationally and within certain racial and ethnic minorities in the US, there continue to be disparities in incidence and mortality when compared to nHw. The disparities in incidence

and mortality are related to areas of deficiency such as knowledge of family history, access to care, understanding migration patterns and a paucity of clinical data. These areas of deficiency are presently limiting true understanding of the impact of this disease and in developing interventions to close the disparity gap. Even with the implementation of the PPACA, disparities in CRC screening will continue to exist until specific interventions are implemented in the context of each of racial and ethnic group. Racial and ethnic minorities cannot be viewed as one monolithic group, but instead as multiple different populations since there are differences in incidence and mortality based on the natural history of CRC impacted by gender, ethnicity, nationality, access to care as well as migration and SES. Progress has been made, but there is much work to be done.

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### Footnote

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