Growing Disparity in the Incidence of Colorectal Cancer among Non-Hispanic American Indian and Alaska Native Populations—United States, 2013–2017

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Abstract

Background: American Indian and Alaska Native (AI/AN) populations have experienced regional variation and disparities in colorectal cancer incidence rates.

Methods: We examined colorectal cancer incidence (2013–2017) and colorectal cancer incidence trends (1999–2017) among AI/AN persons. Incidence data were linked to Indian Health Service enrollment records, and analyses were restricted to Purchased/Referred Care Delivery Areas. Incidence rates of colorectal cancer among AI/AN and White persons were analyzed in six geographic regions; Hispanic persons were excluded. Incidence trends were analyzed using linear modeling.

Results: During 2013–2017, colorectal cancer incidence was 41% higher among AI/AN than among White persons. AI/AN incidence rates per 100,000 varied regionally from 34.4 in the East to 96.1 in Alaska. Compared with White persons, AI/AN persons had higher colorectal cancer incidence rates among all age strata and were more likely to have late-stage diagnoses. Incidence rate trends indicated significant increases among both AI/AN and White persons ages <50 years and among AI/AN persons ages 50–64 years. The colorectal cancer incidence rate trend increased among AI/AN persons in the Southwest.

Conclusions: The disparity of colorectal cancer incidence rates between AI/AN and White persons has widened since 2005–2009. AI/AN populations have higher colorectal cancer incidence compared with White populations, especially in the Alaska region.

Impact: Our finding of increased colorectal cancer incidence disparities suggests that enhanced screening efforts and culturally appropriate clinical and public health interventions are needed among AI/AN persons overall, and especially in regions and age groups in which colorectal cancer rates are increasing.

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Introduction

An estimated 1 in 23 American Indian and Alaska Native (AI/AN) persons (4.3%) may develop colorectal cancer during their lifetime, according to 2012–2016 data (1). The true incidence rate of colorectal cancer among AI/AN persons has often been underestimated because of high rates of race misclassification of AI/AN people in medical records (2), and large variation in incidence rates among AI/AN popuations by geographic area (3, 4). As a result, disparities in colorectal cancer between AI/AN and other populations are not fully understood or recognized.

By linking Indian Health Service (IHS) patient registration data with National Cancer Registry data, new databases that provide more accurate colorectal cancer incidence estimates for AI/AN persons have been created (5). When applied in a study using 2005–2009 colorectal cancer incidence data, this approach revealed that AI/AN persons had higher incidence rates than non-Hispanic White persons in every age group, and that significant variation existed among regional AI/AN rates (6). The purpose of this current study is to examine disparities in colorectal cancer incidence rates by age and stage at diagnosis, and trends over time among AI/AN populations in six regions by using race-corrected data covering the most recent years available (through 2017) in our AI/AN Incidence Analytic Database (7). By identifying the disparities in colorectal cancer incidence rates and trends among various regions, we can highlight areas that may benefit most from enhanced cancer control measures among AI/AN persons.

Materials and Methods

Population estimates

As described in a previous study, the 2010 bridged, intercensal population estimates significantly overestimated the number of AI/AN persons of Hispanic origin (8). We used these census population estimates as our denominator when calculating incidence rates. For this reason, we excluded Hispanic AI/AN from our analyses, to avoid having an inflated AI/AN population in our denominator, which would have led to an underestimation of colorectal cancer incidence rates among AI/AN persons. As a result, we limited our analyses to non-Hispanic AI/AN populations and used non-Hispanic White persons as the referent group. To be concise, non-Hispanic AI/AN and non-Hispanic White persons will be referred to as AI/AN and White persons, respectively, throughout the remainder of this article.

Incidence data

Colorectal cancer cases from 2013 to 2017 were obtained from records at cancer registries which make up the National Program of Cancer Registries (NPCR; ref. 9) at the Centers for Disease Control and Prevention and the Surveillance, Epidemiology, and End Results (SEER) program (10) at the NCI. These registries must meet data quality criteria developed for the U.S. Cancer Statistics data publication (7) in any given year and they utilize the Third Edition of the International Classification of Diseases for Oncology (ICD-O-3; ref. 11) to determine primary cancer sites.

To identify colorectal cancer cases among AI/AN persons in which a racial category had been incorrectly assigned, cancer registry records were linked with IHS patient registration data using methods that have been described in detail by Espey and colleagues (5). The SEER summary staging system was used to classify cancer stage at diagnosis: localized (tumor confined to colon or rectum); regional (tumor extension to adjacent organs or tissues and/or invasion of regional lymph nodes); distant (tumor spread to distant organs or lymph nodes); and unstaged (12).

Geographic coverage

Analyses were restricted to IHS Purchased/Referred Care Delivery Areas (PRCDA), which are U.S. counties that include all or part of a reservation, or have a common boundary with a reservation. The IHS previously referred to these counties as Contract Health Service Delivery Area (CHSDA) counties (6). PRCDA residence is used by the IHS to determine eligibility for health care services that are not directly available through IHS. Linkage studies have indicated that there is less racial misclassification of AI/AN persons in PRCDA counties (2, 13). PRCDA counties also have higher proportions of AI/AN populations, in relation to the total population, than non-PRCDA counties. Although the 651 PRCDA counties represent only 20.7% of the 3,141 counties in the United States, 53.3% of all AI/AN persons resided in those PRCDA-designated counties from 2013 to 2017. By restricting analyses to the PRCDA counties, we can improve the accuracy of colorectal cancer incidence rates among AI/AN populations.

Analyses were completed for all regions combined and for six individual IHS regions, as described by Espey and colleagues (13). By IHS region, the percentages of AI/AN persons living in PRCDA counties during this time were: Alaska (100%); Pacific Coast (60.3%); Southwest (83.9%); Northern Plains (54.3%); Southern Plains (56.7%); and East (16.8%) (7). Identical or similar regional configurations have been used for other health-related publications focusing on AI/AN populations (14–16).

Statistical methods

All rates were expressed as number of cases per 100,000 population and directly age adjusted to the 2000 U.S. standard population (Census P25–1130) by using SEER*Stat software (17). Comparisons with published incidence rates using other population standards could be biased because of differing population age distribution adjustments.

From these age-adjusted incidence rates, standardized rate ratios (RR) were calculated for AI/AN compared with White persons. Confidence intervals for age-adjusted rates and RR were calculated by using SEER*Stat 8.0.2, based on methods described by Tiwari and colleagues (18). Changes in annual age-adjusted incidence rates over time, including the average annual percent change (AAPC), were assessed with Joinpoint software (19). We used AAPC to report trends over the entire period since the number of cancers in AI/AN populations are more sparse and may not allow for stable estimates of annual percent change joinpoints. Statistical significance was set at $P < 0.05$.

Results

Incidence

During 2013–2017, a total of 3,742 AI/AN persons and 125,115 White persons were diagnosed with colorectal cancer (Table 1). The colorectal cancer incidence rate for AI/AN persons from all PRCDA counties combined was 41% higher ($P < 0.05$) than the comparable rate for White persons (51.2 vs. 36.3 per 100,000 population, respectively). Differences in rates and RRs by race were similar among both males and females.

Colorectal cancer incidence among AI/AN persons varied regionally (Table 1). Colorectal cancer incidence rates for both sexes combined ranged widely among AI/AN persons (34.4 in the East to 96.1 in Alaska), whereas less regional variation was seen in rates among White persons (33.4 in the Southwest to 39.9 in Southern Plains). Regional rates among AI/AN persons were significantly higher ($P < 0.05$) than among White persons in five regions: Alaska (RR = 2.68), Northern Plains (RR = 1.71), Southern Plains (RR = 1.64), Pacific Coast (RR = 1.22), and Southwest (RR = 1.08). Rates were similar in the East region. Among females, the AI/AN rates were higher than White rates in all regions except the Southwest and East, where rates were similar. Among males, the incidence rates for AI/AN persons were significantly higher than White rates in every region except the Pacific Coast region (no significant rate difference), and the East region, where the rate among AI/AN males was significantly lower than the rate among White males (RR = 0.80).

Age at diagnosis

When analyzing data from all regions combined by age categories, AI/AN populations had an increased risk of colorectal cancer compared with White persons in every age category: 43% higher among AI/AN persons ages younger than 50 years; 56% higher among those ages 50–64 years; 45% higher among those ages 65–74 years; 29% higher among those ages 75–84 years; and 20% higher among those ages 85 years or older. (all $P < 0.05$; see Table 2).

Regionally, AI/AN men and women combined in Alaska and the Southern Plains had higher colorectal cancer incidence rates than White persons in every age strata. In the Northern Plains region, there were significantly higher rates among AI/AN persons in every age group, except among persons ages 85 years or older. In the Pacific Coast region, the colorectal cancer incidence rate was significantly higher among AI/AN persons ages 50–74 years. In the Southwest region, the rate was higher only among AI/AN persons ages 50–64 years, with no significant rate differences among other age categories. In the East region, incidence rates were also similar between AI/AN and White persons among most age categories, except for a significantly lower incidence rate among AI/AN persons ages 75–84 years.

The proportion of colorectal cancer cases diagnosed among AI/AN persons ages younger than 50 years was larger than it was among White persons (15.8% and 9.5%, respectively), whereas 63.6% of all cases among AI/AN persons and 55.5% of all cases among White persons were ages 50–74 years at time of diagnosis, and the remaining 20.7% of cases among AI/AN persons were ages 75 years or older compared with 35% of cases among White persons (Table 2).

Stage at diagnosis

Among AI/AN persons, the rate of early-stage, localized colorectal cancer was 24% higher, regional-stage colorectal cancer was 43% higher, and distant-stage colorectal cancer was 51% higher, compared with rates among White persons at each stage of diagnosis (Table 3). In the Northern Plains, Alaska, and Southern Plains regions, rates were consistently elevated among AI/AN persons at all stages of diagnosis compared with White persons, except unstaged in the Alaska region.

For all AI/AN combined, 33.3% were diagnosed at a localized stage (regions ranged from 29.4% in the Southern Plains to 39.4% in Alaska), compared with 36.7% of all cases among White persons (regions ranged from 35.4% in Southern Plains to 38.2% in the East; Table 3). The proportion of cases diagnosed at a distant stage was higher among AI/AN persons than White persons (22.4% vs. 20.5%, respectively).

Trends

We assessed colorectal cancer incidence trends among AI/AN and White persons in PRCDA counties from 1999 to 2017, by age groups, and reported the AAPC in the age-adjusted rates (Table 4). For AI/AN persons of all ages in all regions combined, the overall AAPC in the colorectal cancer incidence rate was −0.5%, compared with a steeper decline of −2.4% AAPC among White persons. There was an increasing trend in colorectal cancer incidence rates among AI/AN persons ages younger than 50 years (AAPC = +3.7%) and those ages 50–64 years (AAPC = +1.1%). There was a decreasing trend among AI/AN persons ages 65 years or older. Among White persons, colorectal cancer incidence rates increased only among those ages younger than 50 years (AAPC = +2.5%) and decreased among those ages 50 years or older.

Colorectal cancer incidence rate increased among AI/AN and White persons ages younger than 50 years in every region except the East, where data were not available (Table 4). The Southern Plains and the Southwest showed increasing rate trends among AI/AN persons ages 50–64 years—no other region showed a significant rate trend change among AI/AN persons in this age group. Among White persons, there was a decreasing trend in colorectal cancer rates for those ages 50–64 years in every region except Alaska. There was a decreasing trend in colorectal cancer incidence rates among AI/AN persons ages 65–74 years and 75 years or older in all regions except the Southwest. Among White persons, there was a decreasing trend in every region for those ages 65 years or older. For all ages combined, the Southwest was the only region with an increasing trend in colorectal cancer incidence rates among AI/AN persons (2.9% average annual increase from 1999 to 2017), whereas every region had a decreasing colorectal cancer incidence trend among White persons from 1999 to 2017 (Table 4).

Discussion

Among AI/AN persons, the highest regional colorectal cancer incidence rates were found in Alaska, followed by Southern Plains and Northern Plains regions. There was a nearly 3-fold difference in rates between AI/AN persons in the Alaska region and AI/AN persons

in the region with the lowest rate (East). Several risk factors that influence colorectal cancer include inadequate physical activity, commercial tobacco use, alcoholic beverage consumption, dietary patterns that include eating red and processed meat, and having excess body weight (20). The wide variation in regional AI/AN colorectal cancer rates may be influenced by differences in the prevalence of these risk factors, or other environmental factors, among AI/AN populations, which has been noted in prior research (21, 22). These regional differences in colorectal cancer rates and risk factor prevalence among AI/AN populations suggest the need for further research to identify clinical and community-based interventions that can be adapted to the unique context of AI/AN populations to reduce the prevalence of colorectal cancer risk factors among AIAN persons.

From 2013 to 2017, colorectal cancer incidence rates were significantly higher among AI/AN than White persons in five of six regions. In a previous study, which examined incidence from 2005 to 2009 (using the same methods as our current study), the colorectal cancer incidence rate among AI/AN persons in all CHSDA (now called PRCDA) counties combined was 21% higher than the rate among White persons in those same counties (6). In a study by May and colleagues, the disparity in colorectal cancer incidence between White and Black persons was at its peak in 2004, when the incidence rate for Black persons was 21% higher than the rate for White persons, followed by a decreased disparity in incidence from 2004 to 2012 (23). The disparity in colorectal cancer incidence rates widened in our current study; AI/AN persons from all regions combined experienced a 41% higher incidence rate compared with White persons. Our trend data revealed that although colorectal cancer incidence rates were decreasing in most regions among both AI/AN and White populations, they decreased at a slower pace among AI/AN populations compared with the steeper decrease among White populations. This resulted in increased RRs between AI/AN and White persons in the Alaska, Southern Plains, Northern Plains, and Pacific Coast regions (Table 1), compared with RRs found during the previous study period (6).

Trend analyses also showed that the rate of colorectal cancer incidence among AI/AN persons in one region, the Southwest, increased significantly, while decreasing among White persons in that region. The Southwest was the only region that experienced an increasing trend in colorectal cancer incidence rate among either AIAN or White populations, with a 2.9% average annual percent increase in colorectal cancer incidence rate from 1999 to 2017. As a result of this trend, the colorectal cancer incidence rate among Southwest AI/AN persons, which was 21% lower than that of White persons during the previous study period (2005–2009), was 8% higher than the rate among White persons during 2013–2017. One contributor to the observed trend may be a lack of access to health care among AI/AN persons in the region. From 2000 to 2010, the Southwest had the lowest percentage of any region of AI/AN persons to report having health care coverage or a personal health care provider (68.8% and 61.3%, respectively; ref. 21). Providing AI/AN persons with equal access to health care, especially cancer screening, could help reduce the colorectal cancer incidence disparity between AI/AN and White persons in all regions.

In a study by Lansdorp-Vogelaar and colleagues, differences in colorectal cancer screening accounted for 42% of the disparity in colorectal cancer incidence between their study populations (24). Lower colorectal cancer screening prevalence among AI/AN persons may

account for some of the colorectal cancer incidence disparity we observed between AI/AN and White populations. AI/AN persons often live in areas that have large gaps in the availability of, the use of, and the distance to health care providers, compared with other areas (25). Our results showed that a substantial proportion of colorectal cancer cases are occurring among AI/AN persons ages 50–74 years, which is similar to other subpopulations. Data from the 2015 National Health Interview Survey, which uses self-reported data, showed 63.7% of White persons were up-to-date with colorectal cancer screening compared with 48.4% of AI/AN persons (26). Screening estimates from the IHS, which utilize administrative data, are even lower. In 2019, only 31.5% of AI/AN men and women served by the IHS were up-to-date with colorectal cancer screening (27). The screening prevalence in the IHS administrative areas that make up the Southwest region (which has an increasing colorectal cancer incidence rate trend), ranged from 25.9% in the Phoenix Area to 35.1% in the Navajo Area in 2019. Continued efforts are needed to improve colorectal cancer screening uptake among AI/AN populations.

Past studies have indicated that AI/AN persons are often diagnosed with colorectal cancer at younger ages than White persons (28, 29). In general, the colorectal cancer incidence rate is low among persons ages younger than 50 years, but has been increasing (30, 31). Our study results corroborate this, revealing an increasing trend in rates among both AI/AN and White persons ages younger than 50 years, with a higher average annual percent increase among AI/AN than White persons (+3.7 vs. +2.5, respectively). Overall, during 2013–2017, more than 1 in 7 colorectal cancer cases among AI/AN persons were diagnosed among persons ages younger than 50 years, compared with less than 1 in 10 cases among White persons. The U.S. Preventive Services Task Force has revised its colorectal cancer screening recommendation to state that average-risk individuals should begin screening at 45 years of age (32). Health care facilities can inform their average-risk patients and providers of the importance of initiating screening at the recommended age. This is especially true for AI/AN persons, because our results show that colorectal cancer incidence has increased among persons ages younger than 50 years and among adults ages 50–64 years in many regions.

Initiation of colorectal cancer screening at the recommended age also increases the chances of detecting cancer at an early stage. The 5-year survival estimate for persons diagnosed with colorectal cancer at an early stage is over 90%, but falls sharply to 14% for those diagnosed with distant-stage disease (33). In our study, Alaska was the region with the highest proportion of AI/AN persons diagnosed in the localized stage of disease (39.4%), which might have been influenced by the decision of the Alaska Native Medical Center in 2013 to begin screening average risk individuals at age 40 (34, 35).

Our study has some limitations. The percentage of AI/AN persons in the United States living in the PRCDA-designated counties used in our analyzes was 53.3%, and the percentage varied by region, ranging from 100% residing in PRCDA counties in Alaska to 16.8% in the East region. Our results cannot be generalized to the entire AI/AN population. The IHS provides care to 2.6 million of the estimated 5.2 million AI/AN persons in the United States (36), and our study approach could not correct racial misclassification for AI/AN persons in PRCDA counties who did not receive care through IHS. This includes AI/AN persons

from nonfederally recognized tribes and persons who did not have direct tribal ties, or lived long distances from IHS and tribal health facilities. It is possible that our reported colorectal cancer incidence rates among AI/AN persons were underestimated. Our analyses were also limited to non-Hispanic AI/AN and White persons, which could have also impacted cancer incidence rates, particularly in regions that may have higher percentages of Hispanic persons.

We found that the disparity in colorectal cancer incidence rates between AI/AN and White populations increased during the past decade, as rates among AI/AN populations declined at a slower pace than rates among White populations. Regional variation in colorectal cancer rates persists among AI/AN populations, with the highest rate in Alaska, and with an increasing rate in the Southwest region. Future emphasis should be placed on determining which risk factors contribute the most to the regional rate differences and addressing those factors, especially among AI/AN persons in the Southwest where the colorectal cancer incidence rate is increasing. With increased colorectal cancer rates among persons ages younger than 50 years, more urgency is needed for increased colorectal cancer screening, and initiation of screening at the recommended age. All of these actions can help reduce the disparity of colorectal cancer incidence experienced among AI/AN populations in the United States.

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Table 1.

Colorectal cancer incidence rates by IHS region and sex for AI/AN[a,b] and White[a] persons in PRCDA counties, United States, 2013–2017.

IHS region		AI/AN		White		AI/AN:White	
		Cases	Rate[c]	Cases	Rate[c]	RR[d]	CI
Northern Plains	Both sexes	687	63.7	19,498	37.3	1.71[e]	1.57–1.85
	Male	365	75.7	10,286	42.0	1.80[e]	1.60–2.02
	Female	322	54.5	9,212	33.1	1.65[e]	1.46–1.85
Alaska	Both sexes	419	96.1	890	35.9	2.68[e]	2.36–3.03
	Male	197	93.4	505	38.4	2.43[e]	2.02–2.91
	Female	222	98.0	385	33.0	2.97[e]	2.48–3.53
Southern Plains	Both sexes	1,016	65.3	7,814	39.9	1.64[e]	1.53–1.75
	Male	546	77.1	4,180	46.0	1.68[e]	1.52–1.84
	Female	470	55.6	3,634	34.6	1.61[e]	1.45–1.78
Pacific Coast	Both sexes	626	43.4	37,245	35.6	1.22[e]	1.12–1.32
	Male	300	44.8	19,467	39.7	1.13	0.99–1.28
	Female	326	42.3	17,778	32.0	1.32[e]	1.18–1.48
East	Both sexes	214	34.4	42,722	37.3	0.92	0.80–1.06
	Male	97	34.1	22,248	42.5	0.80[e]	0.64–0.99
	Female	117	35.4	20,474	32.8	1.08	0.89–1.30
Southwest	Both sexes	780	36.0	16,946	33.4	1.08[e]	1.00–1.16
	Male	418	43.7	9,129	37.4	1.17[e]	1.05–1.30
	Female	362	29.9	7,817	29.6	1.01	0.90–1.12
All regions	Both sexes	3,742	51.2	125,115	36.3	1.41[e]	1.36–1.49
	Male	1,923	57.9	65,815	41.0	1.41[e]	1.35–1.48
	Female	1,819	45.8	59,300	32.2	1.42[e]	1.35–1.49

Note: The percentage of the AI/AN population living in a PRCDA-designated county from 2013–2017 was 53.3% for the United States; by IHS region, these percentages were: Alaska = 100%; Pacific Coast = 60.3%; Southwest = 83.9%; Northern Plains = 54.3%; Southern Plains = 56.7%; and East = 16.8%.

Abbreviations: AI/AN, American Indian/Alaska Native; CI, confidence interval; IHS, Indian Health Service; PRCDA, Purchased/Referred Care Delivery Area; RR, rate ratio.

[a] Analyses are limited to persons of non-Hispanic origin.

[b] AI/AN race for incidence data is reported by NPCR and SEER registries or through linkage with the IHS patient registration database.

[c] Rates are per 100,000 persons and are age adjusted to the 2000 U.S. standard population (19 age groups—Census P25–1130).

[d] Rate ratios are calculated in SEER*Stat prior to rounding of rates and may not equal rate ratios calculated from rates presented in table.

[e] Indicates rate ratio is statistically significant ($P < 0.05$).

Source: National Program of Cancer Registries and Surveillance, Epidemiology, and End Results SEER*Stat Database: U.S. Cancer Statistics American Indian and Alaska Native Incidence Analytic Database - 1998–2017. U.S. Department of Health and Human Services, Centers for Disease Control and Prevention. Released June 2020, based on the 2019 submission.

IHS regions are defined as follows: Alaska*; Northern Plains (IL, IN*, IA*, MI*, MN*, MT*, NE*, ND*, SD*, WI*, WY*); Southern Plains (OK*, KS*, TX*); Southwest (AZ*, CO*, NV*, NM*, UT*); Pacific Coast (CA*, ID*, OR*, WA*, HI); East (AL*, AR, CT*, DE, FL*, GA, KY, LA*, ME*, MD, MA*, MS*, MO, NH, NJ, NY*, NC*, OH, PA*, RI*, SC*, TN, VT, VA*, WV, DC); * identifies states with at least one county designated as PRCDA.

Table 2.

Colorectal cancer incidence by IHS region and age at diagnosis for AI/AN[a,b] and White[a] residents of PRCDA counties, both sexes combined, United States, 2013–2017.

IHS region	Age at diagnosis	AI/AN N	AI/AN %	AI/AN Rate[c]	White N	White %	White Rate[c]	RR[d]	CI
Northern Plains	<50 years	114	16.60	13.9	1,899	9.70	8.2	1.69[e]	1.38–2.05
	50–64 years	286	41.60	124.8	5,575	28.60	62.5	2.00[e]	1.77–2.25
	65–74 years	153	22.30	207.5	4,880	25.00	124.7	1.66[e]	1.40–1.96
	75–84 years	112	16.30	377.3	4,524	23.20	215.3	1.75[e]	1.44–2.11
	85+ years	22	3.20	277.2	2,620	13.40	265.6	1.04	0.65–1.58
Alaska	<50 years	70	16.70	21.5	112	12.60	7.6	2.85[e]	2.07–3.87
	50–64 years	158	37.70	168.9	348	39.10	63.6	2.66[e]	2.19–3.22
	65–74 years	97	23.20	327.1	250	28.10	132.1	2.48[e]	1.93–3.16
	75–84 years	75	17.90	573.2	136	15.30	204.5	2.80[e]	2.09–3.74
	85+ years	19	4.50	507.9	44	4.90	190.7	2.66[e]	1.47–4.66
Southern Plains	<50 years	155	15.30	14.2	771	9.9	8.9	1.60[e]	1.34–1.90
	50–64 years	395	38.90	128.6	2,316	29.60	72.0	1.79[e]	1.60–1.99
	65–74 years	256	25.20	231.3	2,284	29.20	151.7	1.52[e]	1.33–1.74
	75–84 years	147	14.50	300.2	1,680	21.50	203.7	1.47[e]	1.24–1.75
	85+ years	63	6.20	451.6	763	9.80	225.4	2.00[e]	1.52–2.59
Pacific Coast	<50 years	90	14.40	9.7	3,557	9.60	7.8	1.24	0.99–1.53
	50–64 years	242	38.70	80.6	11,252	30.20	64.4	1.25[e]	1.10–1.42
	65–74 years	161	25.70	153.3	9,509	25.50	115.0	1.33[e]	1.13–1.56
	75–84 years	92	14.70	212.8	8,054	21.60	196.4	1.08	0.87–1.33
	85+ years	41	6.50	296.8	4,873	13.10	252.9	1.17	0.84–1.59
East	<50 years	32	15.00	8.7	4,145	9.70	8.5	1.02	0.70–1.45

IHS region	Age at diagnosis	AI/AN			White			AI/AN:White Rate Ratio	
		N	%	Rate[c]	N	%	Rate[c]	RR[d]	CI
	50–64 years	93	43.50	78.4	12,364	28.90	65.9	1.19	0.96–1.46
	65–74 years	52	24.30	116.0	10,961	25.70	125.0	0.93	0.69–1.22
	75–84 years	23	10.70	123.0	9,506	22.30	202.9	0.61[e]	0.38–0.91
	85+ years	14	6.50	206.2	5,746	13.40	252.0	0.82	0.45–1.37
Southwest	<50 years	130	16.70	8.3	1,438	8.50	7.1	1.16	0.96–1.39
	50–64 years	311	39.90	74.3	4,941	29.20	63.6	1.17[e]	1.04–1.31
	65–74 years	175	22.40	120.3	4,760	28.10	110.4	1.09	0.93–1.27
	75–84 years	119	15.30	173.7	3,953	23.30	178.0	0.98	0.81–1.17
	85+ years	45	5.80	202.9	1,854	10.90	218.1	0.93	0.68–1.25
All regions	<50 years	591	15.80	11.6	11,922	9.50	8.1	1.43[e]	1.31–1.55
	50–64 years	1,485	39.70	101.2	36,796	29.40	64.9	1.56[e]	1.48–1.64
	65–74 years	894	23.90	175.6	32,644	26.10	121.1	1.45[e]	1.35–1.55
	75–84 years	568	15.20	255.8	27,853	22.30	198.9	1.29[e]	1.18–1.40
	85+ years	204	5.50	298.2	15,900	12.70	248.3	1.20[e]	1.04–1.38

Note: The percentage of the AI/AN population living in a PRCDA-designated county from 2013–2017 was 53.3% for the United States; by IHS region, these percentages were: Alaska = 100%; Pacific Coast = 60.3%; Southwest = 83.9%; Northern Plains = 54.3%; Southern Plains = 56.7%; and East = 16.8%.

Abbreviations: AI/AN, American Indian/Alaska Native; CI, confidence interval; IHS, Indian Health Service; N, number; RR, rate ratio.

[a] Analyses are limited to persons of non-Hispanic origin.

[b] AI/AN race is reported by NPCR and SEER registries or through linkage with the IHS patient registration database.

[c] Rates are per 100,000 persons and are age adjusted to the 2000 U.S. standard population (19 age groups—Census P25–1130).

[d] Rate ratios are calculated in SEER*Stat prior to rounding of rates and may not equal rate ratios calculated from rates presented in table.

[e] Indicates rate ratio is statistically significant ($P < 0.05$).

Source: National Program of Cancer Registries and Surveillance, Epidemiology, and End Results SEER*Stat Database: U.S. Cancer Statistics American Indian and Alaska Native Incidence Analytic Database - 1998–2017. U.S. Department of Health and Human Services, Centers for Disease Control and Prevention. Released June 2020, based on the 2019 submission.

IHS regions are defined as follows: Alaska*; Northern Plains (IL, IN*, IA*, MI*, MN*, MT*, NE*, ND*, SD*, WI*, WY*); Southern Plains (OK*, KS*, TX*); Southwest (AZ*, CO*, NV*, NM*, UT*); Pacific Coast (CA*, ID*, OR*, WA*, HI); East (AL*, AR, CT*, DE, FL*, GA, KY, LA*, ME*, MD, MA*, MS*, MO, NH, NJ, NY*, NC*, OH, PA*, RI*, SC*, TN, VT, VA*, WV, DC); * identifies states with at least one county designated as PRCDA.

Table 3.

Colorectal cancer incidence by IHS region and stage at diagnosis for AI/AN[a,b] and White[a] residents of PRCDA counties, both sexes combined, United States, 2013–2017.

IHS region	Stage at diagnosis	AI/AN			White			AI/AN:White Rate Ratio	
		N	%	Rate[c]	N	%	Rate[c]	RR[d]	CI
Northern Plains	Localized	223	32.5	19.6	7,081	36.3	13.5	1.45[e]	1.25–1.67
	Regional	267	38.9	25.9	7,138	36.6	13.7	1.89[e]	1.65–2.15
	Distant	161	23.4	14.5	3,967	20.3	7.7	1.88[e]	1.58–2.22
	Unstaged	36	5.2	3.7	1,312	6.7	2.4	1.57[e]	1.07–2.22
Alaska	Localized	165	39.4	35.3	317	35.6	12.3	2.86[e]	2.33–3.50
	Regional	138	32.9	34.1	298	33.5	11.9	2.86[e]	2.29–3.56
	Distant	101	24.1	22.9	206	23.1	8.4	2.72[e]	2.09–3.51
	Unstaged	15	3.6	3.8	69	7.8	3.2	1.20	0.61–2.14
Southern Plains	Localized	299	29.4	19.3	2,765	35.4	14.0	1.38[e]	1.21–1.56
	Regional	333	32.8	21.4	2,546	32.6	13.0	1.64[e]	1.45–1.85
	Distant	230	22.6	14.5	1,616	20.7	8.4	1.74[e]	1.50–2.01
	Unstaged	154	15.2	10.1	887	11.4	4.5	2.26[e]	1.88–2.70
Pacific Coast	Localized	216	34.5	14.8	13,459	36.1	12.8	1.15	0.99–1.33
	Regional	236	37.7	16.3	13,478	36.2	13.0	1.26[e]	1.09–1.44
	Distant	134	21.4	9.1	7,680	20.3	7.4	1.22[e]	1.01–1.46
	Unstaged	40	6.4	3.2	2,628	7.1	2.4	1.32	0.92–1.82
East	Localized	71	33.2	11.0	16,306	38.2	14.2	0.78[e]	0.60–0.99
	Regional	81	37.9	13.4	14,776	34.6	12.9	1.04	0.82–1.30
	Distant	51	23.8	7.8	8,743	20.5	7.7	1.01	0.75–1.35
	Unstaged	11	5.1	2.1	2,897	6.8	2.4	0.89	0.43–1.61
Southwest	Localized	271	34.7	12.0	6,025	35.6	11.7	1.03	0.90–1.16

IHS region	Stage at diagnosis	AI/AN			White			AI/AN:White Rate Ratio	
		N	%	Rate^c	N	%	Rate^c	RR^d	CI
	Regional	256	32.8	11.8	5,492	32.4	10.9	1.09	0.95–1.24
	Distant	162	20.8	7.7	3,377	19.9	6.8	1.14	0.96–1.34
	Unstaged	91	11.7	4.4	2,052	12.2	4.0	1.12	0.89–1.39
All regions	Localized	1,245	33.3	16.6	45,953	36.7	13.3	1.24^e	1.17–1.32
	Regional	1,311	35.0	18.2	43,728	35.0	12.8	1.43^e	1.35–1.51
	Distant	839	22.4	11.4	25,589	20.5	7.5	1.51^e	1.41–1.62
	Unstaged	347	9.3	5.1	9,845	7.9	2.7	1.85^e	1.65–2.07

Note: The percentage of the AI/AN population living in a PRCDA-designated county from 2013–2017 was 53.3% for the United States; by IHS region, these percentages were: Alaska = 100%; Pacific Coast = 60.3%; Southwest = 83.9%; Northern Plains = 54.3%; Southern Plains = 56.7%; and East = 16.8%.

Abbreviations: AI/AN, American Indian/Alaska Native; CI, confidence interval; IHS, Indian Health Service; N, number; PRCDA, Purchased/Referred Care Delivery Area; RR, rate ratio.

a Analyses are limited to persons of non-Hispanic origin.

b AI/AN race is reported by NPCR and SEER registries or through linkage with the IHS patient registration database.

c Rates are per 100,000 persons and are age adjusted to the 2000 U.S. standard population (19 age groups—Census P25–1130).

d Rate ratios are calculated in SEER*Stat prior to rounding of rates and may not equal rate ratios calculated from rates presented in table.

e Indicates rate ratio is statistically significant ($P < 0.05$).

Source: National Program of Cancer Registries and Surveillance, Epidemiology, and End Results SEER*Stat Database: U.S. Cancer Statistics American Indian and Alaska Native Incidence Analytic Database - 1998–2017. U.S. Department of Health and Human Services, Centers for Disease Control and Prevention. Released June 2020, based on the 2019 submission.

IHS regions are defined as follows: Alaska*; Northern Plains (IL, IN*, IA*, MI*, MN*, MT*, NE*, ND*, SD*, WI*, WY*); Southern Plains (OK*, KS*, TX*); Southwest (AZ*, CO*, NV*, NM*, UT*); Pacific Coast (CA*, ID*, OR*, WA*, HI); East (AL*, AR, CT*, DE, FL*, GA, KY, LA*, ME*, MD, MA*, MS*, MO, NH, NJ, NY*, NC*, OH, PA*, RI*, SC*, TN, VT, VA*, WV, DC); * identifies states with at least one county designated as PRCDA.

Table 4.

Incidence rate trends (1999–2017) for colorectal cancer with joinpoint[a] analyses for AI/AN[b,c] persons compared to White[b] persons in PRCDA counties, both sexes combined, United States.

IHS region	Race	AAPC[d]				
		<50 years	50–64	65–74	75+ years	All ages
Northern Plains	White	+3.0[e]	−1.4[e]	−4.2[e]	−3.3[e]	−2.3[e]
	AI/AN	+3.6[e]	+0.6	−3.8[e]	−2.4[e]	−1.2[e]
Alaska	White	+3.5[e]	−0.1	−4.5[e]	−4.8[e]	−2.8[e]
	AI/AN	+3.7[e]	−1.4	−2.4[e]	−1.3	−1.1[e]
Southern Plains	White	+2.3	−0.9[e]	−2.5[e]	−3.4[e]	−1.5[e]
	AI/AN	+2.8[e]	+1.2[e]	−1.9[e]	−2.2[e]	−0.6
Pacific Coast	White	+2.9[e]	−0.8[e]	−4.2[e]	−3.6[e]	−2.4[e]
	AI/AN	+4.5[e]	+0.4	−2.8[e]	−4.6[e]	−1.3[e]
East	White	No value	−2.0[e]	−4.2[e]	−4.2[e]	−2.8[e]
	AI/AN	No value	+3.1	−5.1[e]	−3.8[e]	−0.9
Southwest	White	+2.5[e]	−0.7[e]	−3.9[e]	−3.7[e]	−2.3[e]
	AI/AN	+3.4[e]	+2.4[e]	+1.8	+1.2	+2.9[e]
All regions	White	+2.5[e]	−1.3[e]	−4.1[e]	−3.8[e]	−2.4[e]
	AI/AN	+3.7	+1.1[e]	−2.1[e]	−2.0[e]	−0.5[e]

Note: The percentage of the AI/AN population living in a PRCDA-designated county from 2013–2017 was 53.3% for the United States; by IHS region, these percentages were: Alaska = 100%; Pacific Coast = 60.3%; Southwest = 83.9%; Northern Plains = 54.3%; Southern Plains = 56.7%; and East = 16.8%.

Abbreviations: AI/AN, American Indian/Alaska Native; AAPC, average annual percent change; IHS, Indian Health Service; PRCDA, Purchased/Referred Care Delivery Area.

[a] Joinpoint analyses are based on rates per 100,000 persons and are age adjusted to the 2000 U.S. standard population (11 age groups, Census P25–1130).

[b] Analyses are limited to persons of non-Hispanic origin.

[c] AI/AN race is reported by NPCR and SEER registries or through linkage with the IHS patient registration database.