HHS Public Access

Author manuscript

Cancer Causes Control. Author manuscript; available in PMC 2024 August 01.

Published in final edited form as:

Cancer Causes Control. 2023 August ; 34(8): 657–670. doi:10.1007/s10552-023-01705-y.

Disparities in incidence and trends of colorectal, lung, female breast, and cervical cancers among non-Hispanic American Indian and Alaska Native people, 1999–2018

Stephanie C. Melkonian[1], **Laura Chen**[2], **Melissa A. Jim**[1], **Donald Haverkamp**[1], **Jessica B. King**[3]

[1]Division of Cancer Prevention and Control, Centers for Disease Control and Prevention, 500 Gold Ave SW, 9th Floor, Suite 9222, Albuquerque, New Mexico 87102, USA

[2]University of Chicago, Chicago, IL, USA

[3]Division of Cancer Prevention and Control, Centers for Disease Control and Prevention, Atlanta, Georgia, USA

Abstract

Purpose—This study is the first to comprehensively describe incidence rates and trends of screening-amenable cancers (colorectal, lung, female breast, and cervical) among non-Hispanic AI/AN (NH-AI/AN) people.

Methods—Using the United States Cancer Statistics AI/AN Incidence Analytic Database, we, calculated incidence rates for colorectal, lung, female breast, and cervical cancers for NH-AI/AN and non-Hispanic White (NHW) people for the years 2014–2018 combined. We calculated age-adjusted incidence rates (per 100,000), total percent change in incidence rates between 1999 and 2018, and trends over this time-period using Joinpoint analysis. Screening prevalence by region was calculated using Behavioral Risk Factor Surveillance System data.

Results—Rates of screening-amenable cancers among NH-AI/AN people varied by geographic region and age at diagnosis. Over half of all lung and colorectal cancers in NH-AI/AN people were diagnosed at later stages. Rates of lung and colorectal cancers decreased significantly between 1999–2018 among NH-AI/AN men, but no significant changes were observed in rates of screening-amenable cancers among NH-AI/AN women.

Conclusion—This study highlights disparities in screening-amenable cancers between NH-AI/AN and NHW people. Culturally informed, community-based interventions that increase access to preventive health services could reduce cancer disparities among AI/AN people.

✉Stephanie C. Melkonian, mzv3@cdc.gov.

Supplementary Information The online version contains supplementary material available at https://doi.org/10.1007/s10552-023-01705-y.

Conflict of interest The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention. No conflicts of interest to disclose.

Ethical approval Because the study did not involve human participants, institutional review board approval was not required.

Keywords

Cancer incidence; American Indian; Alaska Native; Screening; Trends; Health disparity

Introduction

Screening-amenable cancers, which include colorectal, lung, female breast, and cervical, are cancers for which the U.S. Preventive Services (USPSTF) has found sufficient evidence that early detection through screening tests, together with follow-up of abnormal tests and treatment, is beneficial in improving cancer-related outcomes, including mortality [1–4]. Screening uptake and incidence rates of these cancers vary substantially by race and ethnicity [5–9]. Access to healthcare remains a challenge among American Indian and Alaska Native (AI/AN) people, who continue to experience systematic racism, discrimination, and other social determinants of health that result in differential access to preventive services [10–12]. However, for certain groups such as American Indian and Alaska Native (AI/AN) people, accessing cancer screening services can be especially cumbersome due to lack of health service availability, distance to care, and financial and cultural barriers [13–15].

This is the first study to use cancer incidence data corrected for racial misclassification and regional screening prevalence data to provide a comprehensive description of disparities in four screening-amenable cancers for NH-AI/AN people. Studying specific cancers for which access to screening services is especially consequential for outcomes may offer insights into potential means for reducing cancer disparities among AI/AN people.

Methods

Cancer cases

Cases of four screening-amenable cancers- colorectal, lung, female breast, and cervical- were obtained from U.S. Cancer Statistics data [16], which includes cancer registry data from Centers for Disease Control and Prevention's (CDC) National Program of Cancer Registries (NPCR) [17] and the National Cancer Institute's (NCI) Surveillance, Epidemiology, and End Results (SEER) Program [18]. Prostate cancer was not included in this study, as the USPSTF does not currently recommend screening for prostate cancer unless men express preference for screening after being informed of and understanding the benefits and risks [19]. Incidence data from both NPCR and SEER registries must meet rigorous quality control standards each year. During the period covered by this study (2014–2018 for incidence rates, 1999–2018 for trends), tumor histology, tumor behavior, and primary cancer site were classified according to the Third Edition of the International Classification of Disease for Oncology (ICD-O-3).

Previous data has shown that racial misclassification of AI/AN people in cancer registry data can lead to underestimation of cancer incidence rates [20]. To reduce this misclassification, cancer registry data were linked with the Indian Health Service (IHS) patient registration database using previously established and validated techniques that improve accuracy of

cancer incidence estimates among AI/AN populations [20, 21]. All case records from each state were linked with the IHS patient registration database to identify AI/AN cases that had been misclassified as non-AI/AN in the central cancer registry data. These linkages are a routine part of annual registry operations [22]. Data from both registry programs are combined to create the *U.S. Cancer Statistics AI/AN Incidence Analytic Database* (USCS AIAD), the analytic database used for this study [23].

In addition to the data linkages, racial misclassification is addressed in two additional ways [23]. Firstly, to avoid underestimating incidence rates in AI/AN people, all analyses were limited to NH-AI/AN people. Previous analyses revealed that the updated bridged intercensal population estimates substantially overestimated AI/AN people of Hispanic origin [24]. NHW was chosen as the most homogenous reference population [20]. This is consistent with prior publications and allows for the assessment of disparities [21]. Therefore, all the analyses in the present study are limited to non-Hispanic people.

Secondly, analyses were restricted to purchased/referred care delivery area (PRCDA) counties, which contain, or are adjacent to, federally recognized tribal lands. Racial misclassification of AI/AN people is lower in PRCDA counties. [20]. These counties are grouped by state into six geographic regions: the Northern Plains, Alaska, Southern Plains, Pacific Coast, East, and Southwest. These counties and regions have been described previously [21, 25].

Screening and health care access data

We described up-to-date screening prevalence in the Behavioral Risk Factor Surveillance System (BRFSS) for colorectal [26], female breast [27], and cervical [28] cancers, consistent with USPSTF recommendations at the time of the data [19, 29]. Up-to-date screening was defined as the following: received one or more of the recommended CRC tests-fecal occult blood test, colonoscopy or sigmoidoscopy-within the recommended time interval: yes/no; mammogram within the last 2 years: yes/no; and received a Pap test within the past 3 years or received an HPV test within the past 5 years: yes/no). We also described the prevalence of health care access (health care coverage status in the past 12 months; continuously insured for the past 12 months versus uninsured for part or all of the past 12 months) [30]. The BRFSS questionnaire contains a core set of questions that are asked annually and two sets of questions (rotating core) that are alternated biannually [31]. We included only BRFSS data from the years of the study period that had available screening prevalence data; 2014, 2016 and 2018. Lung cancer screening was not included due to the limited number of states that included lung cancer screening in the optional module [32]. Screening variables were limited to individuals meeting the age criteria for USPSTF recommendations for routine screening of adults at average risk from 2014–2018 (CRC 50–75, breast 50–74, cervical cancer 21–65).

Statistical analyses

Cancer incidence rates among NH-AI/AN and NHW people were expressed per 100,000 population and were directly age-adjusted, using 19 age groups, to the 2000 US standard population using SEER*Stat software, version 8.3.9 [33]. We calculated confidence intervals

(CIs) for age-adjusted rates and rate ratios (RRs) on the basis of methods described by Tiwari et al. [34].

Sub-analyses included age-adjusted incidence rates by IHS region, age group, and by cancer stage at diagnosis. Age was divided into groups: < 50, 50–64, 65–74, and 75 + for colorectal, lung, and female breast cancer, and < 20, 20–34, 35–54, 55–74, and 75 + for cervical cancer. The cutoff for the youngest group was based on, or was as close as possible to, ages of the United States Preventive Services Task Force (USPSTF) screening recommendations. Cancer cases diagnosed during 2014–2018 were staged using the following *Merged Summary Stage (Derived SS2000 and SEER Summary Stage 2000)* [23, 35] categories: *localized* for disease limited to the organ of origin, *regional* for disease that has extended beyond the limits of the organ of origin via direct extension or lymph nodes, *distant* for disease metastasized to parts of the body not directly adjacent to the organ of origin, and *unstaged* for instances where stage was undocumented in the medical record or when there was insufficient documentation in the medical record to determine the stage at diagnosis.

Total percent change in incidence rates from 1999 to 2018 was calculated for each cancer site. Additionally, cancer incidence trends (1999 to 2018) were estimated by Joinpoint regression using software developed by the NCI (Joinpoint Regression Program version 4.9.0.0). Average annual percent change (AAPC) for the time period was calculated for each cancer site by sex and region for NH-AI/AN and NHW people.

In order to adjust the sampling bias from BRFSS data, raking or iterative proportional fitting was used to weight the data. The proc surveyfreq function in SAS (version 9.4, Research Triangle Institute, Research Triangle Park, NC) was used to calculate the weighted prevalence of screening and health care access variables by region and gender for NH-AI/AN and NHW people.

Results

Colorectal cancer

Colorectal cancer incidence rates were higher among NH-AI/AN compared to NHW women for most age groups in the United States overall and Northern Plains, Alaska, Southern Plains and Pacific Coast (RRs: 1.22–3.54) (Table 1, Supplemental Table 1). Approximately 56% of colorectal cancers among NH-AI/AN women were diagnosed at regional or distant stages (Table 2) compared to 53% among NHW women. This was consistent across all regions (52.2–59.4%) for NH-AI/AN women, while the range of later-stage cancers among NHW was narrower across regions (49.9–54.8%). Rates of local, regional, and distant colorectal cancer were higher among NH-AI/AN compared to NHW women in every region (RRs: 1.27–3.19) except the East and Southwest (Table 2, Supplemental Table 2). Rates decreased among NH-AI/AN and NHW women (− 17.9% vs − 35.3%, respectively) between 1999–2018 (Fig. 1). Trends in colorectal cancers among NH-AI/AN women did not change during this time but decreased significantly among NHW women (AAPC: − 2.2) (Fig. 1). Regionally, significant decreases were observed in colorectal cancer incidence

among NH-AI/AN women in the Northern Plains (AAPC: − 1.7) and East (AAPC: − 2.5) while increases were observed in the Southwest (AAPC: 3.9) (Supplemental Table 3).

Colorectal cancer incidence rates among NH-AI/AN men were higher than NHW rates across all age groups in the U.S. and in the Northern Plains, Southern Plains, and Alaska regions (RRs ranged from 1.30–2.56) (Table 1, Supplemental Table 1) and in men under 75 years of age in the Southwest (RRs:1.19–1.36). Rates were lower for NH-AI/AN men in the East region for all age groups combined (RR = 0.72). Approximately 56% and 54% of colorectal cancers in the United States were diagnosed at regional or distant stages in NH-AI/AN and NHW men, respectively (Table 2). Regional stage percentages ranged from 51.4% to 64.0% in NH-AI/AN men and 52.0% to 55.2% in NHW men. Rates of later-stage colorectal cancers (regional and distant stage) were higher among NH-AI/AN men compared to NHW men in the Northern Plains, Southern Plains and Alaska (RRs: 1.64–2.91) (Table 2, Supplemental Table 2), but regional stage rates were lower among NH-AI/AN in the East (RR = 0.65). In NH-AI/AN men, rates decreased by 38.7% compared to a 40.8% decrease among NHW men between 1999–2018 (Fig. 1). Significant decreases in incidence rates were observed for both groups (NHW AAPC: − 2.7 vs NH-AI/AN AAPC: − 0.9), but these trend decreases were larger in NHW men. Colorectal cancer incidence rates decreased among NH-AI/AN men in the Pacific Coast (AAPC: − 2.0) and East (AAPC: − 2.4) only, while rates decreased among NHW men across all regions (Supplemental Table 3).

Lung cancer

Lung cancer incidence rates were higher among NH-AI/AN compared to NHW women for all ages combined and among most age groups in the United States overall, Northern Plains, Alaska, Southern Plains and Pacific Coast (RRs: 1.07–2.21) (Table 1, Supplemental Table 1). Nearly two-thirds (65.4% and 63.5%) of all lung cancers in NH-AI/AN and NHW women, respectively, were diagnosed at later stages (Table 2). Regionally, percent later-stage lung cancer ranged from 61.6% to 71.8% among NH-AI/AN women and from 58.6% to 67.3% among NHW women. Rates for distant stage lung cancer were elevated in every region except the East and Southwest (RRs: 1.28–2.15) (Table 2, Supplemental Table 2). In the Southwest, rates were lower than NHW rates across all stages (RRs: 0.18–0.38). While lung cancer rates decreased by 12.7% for NHW women from 1999 to 2018, they increased 1.5% among NH-AI/AN women during the same period (Fig. 1). The trend in the lung cancer incidence rates was stable in NH-AI/AN women but decreased significantly in NHW women (AAPC:− 0.6).

Lung cancer incidence rates among NH-AI/AN men were higher compared to NHW men in the 50–64 and 65–74 age groups in the United States (RR = 1.12 and 1.13, respectively), and for all ages combined (RR = 1.09) (Table 1, Supplemental Table 1). These findings were consistent in the Northern Plains, Alaska, and the Southern Plains, where rates for the 50–64, 65–74, 75 + age groups were all higher among NH-AI/AN men compared to NHW men (RRs: 1.36–2.18). Lung cancer incidence rates were lower among NH-AI/AN compared to NHW men in the older age groups (65 +) in the East and Southwest (RRs ranged from 0.41–0.73) as well as all age groups combined (RR = 0.71 in the East, and 0.41

in the Southwest). Rates of later-stage lung cancers were higher (RRs: 1.10–2.89) among NH-AI/AN men compared to NHW men in most regions, but lower in the Southwest and East. In the United States, approximately 70% of lung cancers among NH-AI/AN men and 68% among NHW men were diagnosed at later-stage (Table 2). Regionally, the percentage of lung cancers diagnosed at later-stage ranged from 65.1% to 77.4% among NH-AI/AN men and from 62.6% to 70.3% among NHW men. Rates decreased by 19.6% among NH-AI/AN men compared to 38.1% in NHW men (Fig. 1). Trends decreased significantly in both NH-AI/AN and NHW men, but the decreases were larger among NHW men (NHW AAPC: − 2.4 vs AI/AN AAPC: − 1.5) (Fig. 1). Lung cancer incidence rates decreased among NH-AI/AN men the Northern Plains (AAPC: − 1.6) only, while rates decreased across all regions for NHW men (Supplemental Table 1).

Breast cancer

Female breast cancer incidence rates were lower among NH-AI/AN compared to NHW women in the United States for all age groups combined (RR = 0.84) and across each age group (RRs: 0.80–0.87) (Table 1, Supplemental Table 1). Rates were also lower across most age groups in the Southwest (RRs: 0.49–0.57) and East (RRs: 0.56–0.68), but higher overall in the Northern Plains (RR = 1.07), Alaska (RR = 1.14) and Southern Plains (RR = 1.24). Breast cancer incidence rates were also higher among NH-AI/AN women for the youngest age group in the Southern Plains (RR = 1.37). Approximately 36% of all breast cancers among NH-AI/AN women were diagnosed at later stages compared to 29.2% in NHW women (Table 2). Rates for regional and distant breast cancer were higher among NH-AI/AN compared to NHW women in the Northern Plains, Southern Plains and Alaska (distant only) (RRs: 1.19–1.84), but lower in the Southwest (RRs: 0.60–0.65) (Table 2, Supplemental Table 2). Between 1999–2018, rates decreased for both NH-AI/AN and NHW women (− 1.6% vs − 9.1%) (Fig. 1). Overall trends have not changed in this time-period among AI/AN women but have decreased among NHW women (AAPC: − 0.5). Trends increased among NH-AI/AN women the Northern Plains (AAPC: 0.9) and East (AAPC: 1.4) while they decreased for NHW women in 5 out of the 6 regions (Supplemental Table 3).

Cervical cancer

Cervical cancer incidence rates were elevated across all ages among NH-AI/AN compared to NHW women the United States (RR = 1.58), as well as ages 20 + (RRs: 1.26–1.84) (Table 1, Supplemental Table 1). Compared to NHW women, incidence was also elevated in the Northern and Southern Plains among NH-AI/AN women aged 20–34 (RR = 2.35 and 2.68, respectively), 35–54 (RR = 1.77 and 1.61, respectively), and 75 + years (Southern Plains only, RR = 3.34), and in Alaska among the 20–34 age group (RR = 3.54). Nearly 49% of all cervical cancers among NH-AI/AN women were diagnosed at later stages (Table 2), and regional rates were elevated in the Northern Plains, Alaska, Southern Plains and Pacific Coast (RRs ranged from 1.73–2.94) (Table 2, Supplemental Table 2). Rates of distant cervical cancer were higher among NH-AI/AN women overall in the United States (RR = 1.83) and in the Southern Plains (RR = 1.85) compared to NHW women. Incidence rates decreased among NH-AI/AN and NHW women between 1999–2018 (− 26.2% vs − 21.7%) (Fig. 1). Trends in cervical cancer incidence rates did not change during this time-period for NH-AI/AN women but decreased significantly for NHW women (APC: − 1.1). Trends

decreased among NH-AI/AN women in the Southwest only (AAPC: − 1.9) (Supplemental Table 3).

Cancer screening prevalence and health care access

Prevalence of up-to-date screening for colorectal, breast, and cervical cancer, as well as access to health care, are shown in Table 3. Screening prevalence varied by geographic region among NH-AI/AN people and between NH-AI/AN and NHW people. Colorectal cancer screening prevalence ranged from 53.9% to 74.1% in NH-AI/AN women. Breast cancer screening prevalence ranged from 64.8% to 79.8%, and the cervical cancer screening ranged from 79.3% to 94.5%. Less geographic variation was observed in screening prevalence for NHW women. Similar geographic variation was observed in colorectal cancer screening prevalence among NH-AI/AN men. Prevalence ranged from 41.6% to 61.9% in NH-AI/AN men and from 61.0% to 72.6% in NHW men.

Overall prevalence of health care access was 78.1% among NH-AI/AN women and 73.1% among NH-AI/AN men. Prevalence in NHW women and men was 86.1% and 84.5%, respectively. Prevalence of health care access ranged from 73.4% to 81.9% in NH-AI/AN women and from 70.0% to 87.2% in NH-AI/AN men (Table 3).

Discussion

This study highlights the substantial disparities in screening-amenable cancers between NH-AI/AN and NHW people. These disparities manifest themselves in elevated incidence rates, later-stage diagnoses, lower prevalence of screening, and growing disparities in incidence rates. AI/AN people in some regions have a lower risk of certain cancers relative to White people, particularly for lung, colorectal, and female breast cancers. Moreover, while incidence rates for colorectal and lung cancers decreased among NH-A/IAN men, these improvements are often smaller than decreases observed among NHW people. Variations in rates of these cancers can be due to differences in the prevalence of individual level risk factors, such as commercial tobacco use [36] and HPV infection [37]. These differences can also reflect variation in social determinants of health, including access to care and preventive services, such as screening.

Our data show that colorectal, lung, breast, and cervical cancers are being diagnosed at later stages in high proportions among AI/AN people in many geographic areas. Availability of timely screening services could play a role in disparities. Based on BRFSS data concordant with the incidence data presented in this study, we found that NH-AI/AN people in most regions had low prevalence of up-to-date screening across these cancers. These findings add to the evidence that individuals who are not up-to-date with cancer screening are disproportionately found among segments of the US population that experience cancer health disparities, including individuals in racial and ethnic minority groups [38].

Improving access to care, community outreach and accessibility of screening services, paired with particular efforts to reach groups that have been economically/socially marginalized could increase screening uptake [39, 40]. Studies have found outreach interventions [41] to be effective in bolstering colorectal cancer screening participation [42–

44]. Other factors associated with lower screening utilization include lack of transportation, rurality and distance from services, lower income, language barriers, and lack of health insurance [5, 6, 13, 45, 46]. Few studies describe lung cancer screening data. Provider knowledge, access to care, and other sociodemographic factors have been shown to influence lung cancer screening utilization [47, 48]. Uptake of lung cancer screening remains low nationwide [49, 50], and false positive rates are relatively high [51]. A recent study conducted in an urban Minnesota community clinic serving tribal populations found similar barriers to lung cancer screening including provider and patient knowledge, trust, fear and resources and capacity as barriers to lung cancer screening [52]. Future efforts to understand the factors driving disparities in guideline-concordant screening could aid in the reduction of region-specific disparities in incidence rates of screening-amenable cancers.

To address some of the challenges in cancer screening among AI/AN people, there are several successful examples of cancer control programs lead by tribal organizations [42, 44, 53]. The Fond du Lac Human Services Division works closely with Minnesota's Sage Screening Programs to provide free and timely access to breast and cervical screenings for state women [54]. The American Indian Cancer Foundation has developed the Blue Beads Campaign to increase education and awareness about colorectal cancer and screening among AI/AN communities and has been successful in reaching over 2000 people in the communities they serve [55]. The Inter-Tribal Council of Michigan aims to address health disparities through their Three Fires Cancer Consortium that provides training and resources to local tribal coordinators and staff to improve cancer screening and early diagnosis for their communities [56]. Nationally, the IHS provides direct clinical and preventive services through its network of IHS funded self-governance tribal health facilities and direct services clinics. These are examples of ongoing efforts and successful programs aimed at improving cancer screening and access to care for AI/AN people lead by tribal organizations. Cancer prevention programs that incorporate tribal culture and traditional practices into community-based and culturally appropriate interventions, such as these, have been shown to be effective [57, 58].

This study has limitations. The methodology used to address racial misclassification does not account for individuals who are not members of federally recognized tribes, are not eligible for IHS services, or have not previously accessed IHS services. Individuals living in non-PRCDA areas are excluded from analyses, and therefore these results may not be generalizable to all AI/AN people in the United States. The exclusion of Hispanic AI/AN people may disproportionally impact some states and regions. Cancer risk factors associated with these cancers were outside the scope of this study [59]. Screening data from the BRFSS may be subject to sampling biases, especially in AI/AN communities where some households may not have a landline or cell phone [60]. It is also only administered in English and Spanish, which may not represent the languages spoken at home by AI/AN people. Data from BRFSS are self-reported and therefore may be subject to misclassification. BRFSS data presented here are at a national/regional level and are descriptive in nature. Screening data sourced from BRFSS cannot be analyzed according to PRCDA county as the data are available and weighted at the state, not county level. Because the BRFSS data cannot be limited to PRCDA counties, the incidence data and screening data are not necessarily representative of the same underlying populations. Screening impacts

mortality related to these cancers. Updated mortality data for AI/AN people, that has been corrected for racial misclassification, is not available for the timeframe of this study. There are limited data on known social determinants of health care access, which might otherwise allow for greater insights into observed variations in incidence of screening-amenable cancers by stage at diagnosis and receipt of screening services.

This study reveals geographic differences in the incidence of screening-amenable cancers among NH-AI/AN people in the United States. Opportunities to reduce cancer disparities include efforts to improve screening uptake and reduce inequities in the underlying social determinants of health that drive cancer risk, including access to care as well as the economic and physical environments [61]. Additionally, the further development of ongoing efforts towards culturally informed, community-based interventions led by, or in conjunction with, tribal communities should be continued. Ongoing improvement of data quality and completeness for AI/AN people will aid in the more comprehensive description of cancer prevention and control efforts for this population. Combined, these efforts will help to promote recommended screening for cancer and increased access to preventive health services that could help reduce persistent disparities in late-stage cancer incidence and reduce cancer deaths among AI/AN people.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Funding

The work was supported by the Centers for Disease Control and Preventions. Authors participated as a part of their official duties.

Data availability

The present dataset was derived from a publicly available database.

References

1. Haghighat S, Sussman DA, Deshpande A (2021) US preventive services task force recommendation statement on screening for colorectal cancer. JAMA 326:1328
2. Force USPST, Krist AH, Davidson KW et al. (2021) Screening for lung cancer: US preventive services task force recommendation statement. JAMA 325:962–970 [PubMed: 33687470]
3. Force USPST, Curry SJ, Krist AH et al. (2018) Screening for cervical cancer: US preventive services task force recommendation statement. JAMA 320:674–686 [PubMed: 30140884]
4. Siu AL, US Preventive Services Task Force (2016) Screening for breast cancer: US preventive services task force recommendation statement. Ann Intern Med 164(4):279–296. 10.7326/M15-2886 [PubMed: 26757170]
5. Ioannou GN, Chapko MK, Dominitz JA (2003) Predictors of colorectal cancer screening participation in the United States. Am J Gastroenterol 98:2082–2091 [PubMed: 14499792]
6. Carter-Harris L, Slaven JE, Monahan PO, Shedd-Steele R, Hanna N, Rawl SM (2018) Understanding lung cancer screening behavior: racial, gender, and geographic differences among Indiana long-term smokers. Prev Med Rep 10:49–54 [PubMed: 29552458]
7. Ooi SL, Martinez ME, Li CI (2011) Disparities in breast cancer characteristics and outcomes by race/ethnicity. Breast Cancer Res Treat 127:729–738 [PubMed: 21076864]

8. Harper S, Lynch J, Meersman SC, Breen N, Davis WW, Reichman MC (2009) Trends in area-socioeconomic and race-ethnic disparities in breast cancer incidence, stage at diagnosis, screening, mortality, and survival among women ages 50 years and over (1987–2005). Cancer Epidemiol Biomark Prev 18:121–131

9. Benavidez GA, Zgodic A, Zahnd WE, Eberth JM (2021) Disparities in meeting USPSTF breast, cervical, and colorectal cancer screening guidelines among women in the United States. Prev Chronic Dis 18:E37 [PubMed: 33856975]

10. Towne SD, Smith ML, Ory MG (2014) Geographic variations in access and utilization of cancer screening services: examining disparities among American Indian and Alaska native elders. Int J Health Geogr 13:18 [PubMed: 24913150]

11. Kurani SS, McCoy RG, Lampman MA et al. (2020) Association of neighborhood measures of social determinants of health with breast, cervical, and colorectal cancer screening rates in the US midwest. JAMA Netw Open 3:e200618 [PubMed: 32150271]

12. Cancer Facts & Figures 2022-Special Section: cancer in American Indian and Alaska native population. Available at https://www.cancer.org/content/dam/cancer-org/research/cancer-facts-and-statistics/annual-cancer-facts-and-figures/2022/2022-special-section-aian.pdf. Accessed 13 Feb 2022

13. Nuño T, Gerald JK, Harris R, Martinez ME, Estrada A, García F (2012) Comparison of breast and cervical cancer screening utilization among rural and urban Hispanic and American Indian women in the Southwestern United States. Cancer Causes Control 23:1333–1341 [PubMed: 22710745]

14. Jerome-D'Emilia B, Gachupin FC, Suplee PD (2019) A systematic review of barriers and facilitators to mammography in American Indian/Alaska native women. J Transcult Nurs 30:173–186 [PubMed: 30122121]

15. Daley CM, James AS, Filippi M et al. (2012) American Indian community leader and provider views of needs and barriers to colorectal cancer screening. J Health Dispar Res Pract 37:307–315

16. Centers for disease control and prevention. US cancer statistics. https://www.cdc.gov/uscs Accessed 11 Feb 2022

17. Centers for disease control and prevention. National program of cancer registries. https://www.cdc.gov/cancer/npcr/about.htm Accessed 12 Feb 2020

18. National institutes of health. Surveillance, epidemiology and end results program. https://seer.cancer.gov/ Accessed 11 Feb 2022

19. US preventive services task force cancer recommendations. Retrieved from https://www.uspreventiveservicestaskforce.org/uspstf/recommendation-topics/uspstf-and-b-recommendations. Accessed Oct 2021

20. Jim MA, Arias E, Seneca DS et al. (2014) Racial misclassification of American Indians and Alaska natives by Indian health service contract health service delivery area. Am J Public Health 104(Suppl 3):S295–302 [PubMed: 24754617]

21. Espey DK, Wiggins CL, Jim MA, Miller BA, Johnson CJ, Becker TM (2008) Methods for improving cancer surveillance data in American Indian and Alaska native populations. Cancer 113:1120–1130 [PubMed: 18720372]

22. Centers for disease control and prevention. United States cancer statistics (USCS). Data visualizations tool technical notes. Interpreting race and ethnicity in cancer data. Available at https://www.cdc.gov/cancer/uscs/technical_notes/interpreting/race.htm. Accessed Nov 2022

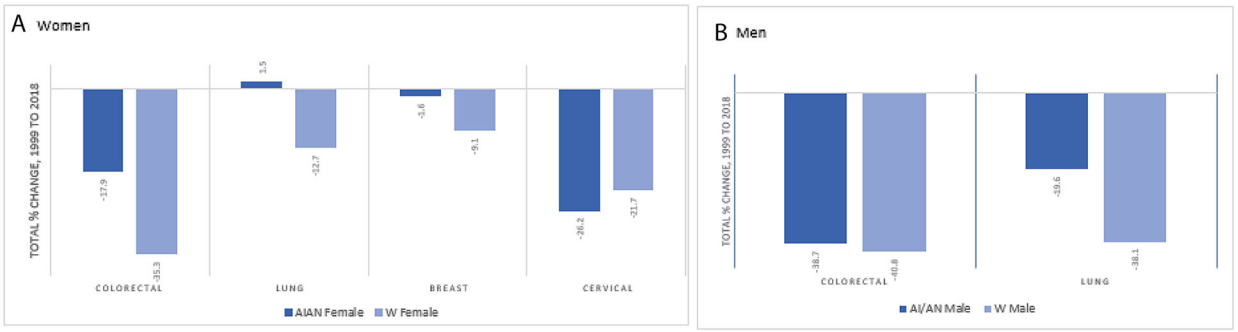
23. US cancer statistics; data visualizations tool. Technical notes. Diagnosis years 1999–2016. Atlanta, GA: US department of health and human services, centers for disease control and prevention and national cancer institute. November 2018 submission. Retrieved from https://www.cdc.gov/cancer/uscs/technical_notes/index.htm. Accessed 1 Jan 2020

24. Arias E, Heron M, National Center for Health S, Hakes J, Bureau USC (2016) The validity of race and Hispanic-origin reporting on death certificates in the United States: an update. Vital Health Stat 2:1–21

25. US cancer statistics working group. US cancer statistics data visualizations tool, based on 2021 submission data (1999–2019): US department of health and human services, centers for disease control and prevention and national cancer institute; www.cdc.gov/cancer/dataviz, released in June 2022

26. Centers for disease control and prevention. Behavioral risk factor surveillance system statistical briefs. BRFSS statistical brief on colorectal cancer screening questions. Retrived from https://www.cdc.gov/brfss/data_documentation/pdf/brfss-statistical-brief-colorectal-cancer-screening-questions-508.pdf. Accessed Oct 2021
27. Centers for disease control and prevention. Behavioral risk factor surveillance system statistical briefs. BRFSS statistical brief on breast cancer screening questions. Retrieved from https://www.cdc.gov/brfss/data_documentation/pdf/brfss-statistical-brief-breast-cancer-screening-questions-508.pdf. Accessed Oct 2021
28. Centers for disease control and prevention. Behavioral risk factor surveillance system statistical briefs. BRFSS statistical brief on cervical cancer screening questions. Retrieved from https://www.cdc.gov/brfss/data_documentation/pdf/brfss-statistical-brief-cervical-cancer-screening-questions-508.pdf. Accessed Oct 2021
29. US preventive services task force cancer reccomendation topics: archived colorectal cancer: screening final reccomendation statement June 15. 2016. Retrieved from https://uspreventiveservicestaskforce.org/uspstf/recommendation/colorectal-cancer-screening-june-2016. Accessed Jan 2022
30. Centers for disease control and prevention. Behavioral risk factor surveillance system statistical briefs. BRFSS statistical brief on the health care access module, 2013 and 2014. Retrieved from https://www.cdc.gov/brfss/data_documentation/pdf/2013-2014_HCS.pdf. Accessed Oct 2021
31. Centers for disease control and prevention. Behavioral risk factor surveillance system survey data. Atlanta, Georgia: US department of health and human services, centers for disease control and prevention, 1999–2009. Retrieved from https://www.cdc.gov/brfss/annual_data/)
32. Centers for disease control and prevention (CDC) behavioral risk factor surveillance system survey data. Retrieved from https://www.cdc.gov/brfss/. Accessed Oct 2021
33. Surveillance research program, national cancer institute. SEER*Stat software, latest release: 8.3.2. 2016. Retrieved from http://seer.cancer.gov/seerstat. Accessed Jan 2020
34. Tiwari RC, Clegg LX, Zou Z (2006) Efficient interval estimation for age-adjusted cancer rates. Stat Methods Med Res 15:547–569 [PubMed: 17260923]
35. Young Jl Jr, RSDRLAG et al. (2001) SEER summary staging manual-2000: codes and coding instructions. NIH Pub, Bethesda, MD
36. Azagba S, Shan L, Latham K, Qeadan F (2020) Trends in cigarette smoking among American Indians and Alaska Natives in the USA: 1992–2015. Cancer Causes Control 31:73–82 [PubMed: 31734765]
37. Saraiya M, Unger ER, Thompson TD et al. (2015) US assessment of HPV types in cancers: implications for current and 9-valent HPV vaccines. J Natl Cancer Inst 107:djv086 [PubMed: 25925419]
38. White A, Thompson TD, White MC et al. (2017) Cancer screening test use—United States, 2015. MMWR Morb Mortal Wkly Rep 66:201–206. 10.15585/mmwr.mm6608a1 [PubMed: 28253225]
39. Centers for disease control and prevention. National breast and cervical cancer early detection program (NBCCEDP). Increasing outreach to underserved groups. Retrieved from https://www.cdc.gov/cancer/nbccedp/success/underserved-groups.htm. Accessed Oct 2021
40. Sengupta R, Honey K (2020) AACR cancer disparities progress report 2020: achieving the bold vision of health equity for racial and ethnic minorities and other underserved populations. Cancer Epidemiol Biomark Prev 29:1843
41. Green BB, Wang CY, Anderson ML et al. (2013) An automated intervention with stepped increases in support to increase uptake of colorectal cancer screening: a randomized trial. Ann Intern Med 158:301–311 [PubMed: 23460053]
42. Redwood D, Provost E, Perdue D, Haverkamp D, Espey D (2012) The last frontier: innovative efforts to reduce colorectal cancer disparities among the remote Alaska native population. Gastrointest Endosc 75:474–480 [PubMed: 22341095]
43. Muller CJ, Robinson RF, Smith JJ et al. (2017) Text message reminders increased colorectal cancer screening in a randomized trial with Alaska Native and American Indian people. Cancer 123:1382–1389 [PubMed: 28001304]

44. Haverkamp D, English K, Jacobs-Wingo J, Tjemsland A, Espey D (2020) Effectiveness of interventions to increase colorectal cancer screening among American Indians and Alaska natives. Prev Chronic Dis 17:E62 [PubMed: 32678062]
45. Nuche-Berenguer B, Sakellariou D (2019) Socioeconomic determinants of cancer screening utilisation in Latin America: a systematic review. PLoS ONE 14:e0225667 [PubMed: 31765426]
46. Eberth JM, Huber JC Jr, Rene A (2010) Breast cancer screening practices and correlates among American Indian and Alaska native women in California, 2003. Womens Health Issues 20:139–145 [PubMed: 20211430]
47. Rivera MP, Katki HA, Tanner NT et al. (2020) Addressing disparities in lung cancer screening eligibility and healthcare access. An official American thoracic society statement. Am J Respir Crit Care Med 202:e95–e112 [PubMed: 33000953]
48. Lewis JA, Chen H, Weaver KE et al. (2019) Low provider knowledge is associated with less evidence-based lung cancer screening. J Natl Compr Canc Netw 17:339–346 [PubMed: 30959463]
49. Fedewa SA, Kazerooni EA, Studts JL et al. (2021) State variation in low-dose computed tomography scanning for lung cancer screening in the United States. J Natl Cancer Inst 113:1044–1052 [PubMed: 33176362]
50. Richards TB, Doria-Rose VP, Soman A et al. (2019) Lung cancer screening inconsistent with US preventive services task force recommendations. Am J Prev Med 56:66–73 [PubMed: 30467092]
51. Pinsky PF, Bellinger CR, Miller DP (2018) False-positive screens and lung cancer risk in the National lung screening trial: implications for shared decision-making. J Med Screen 25:110–112 [PubMed: 28929865]
52. Anderson MD, Pickner WJ, Begnaud A (2023) Determinants of lung cancer screening in a minnesota urban indigenous community-a community based, participatory, action-oriented study. Cancer Prev Res (Phila) 16:239–245 [PubMed: 36630997]
53. Nadeau M, Walaszek A, Perdue DG, Rhodes KL, Haverkamp D, Forster J (2016) Influences and practices in colorectal cancer screening among health care providers serving northern plains American Indians, 2011–2012. Prev Chronic Dis 13:E167 [PubMed: 27978410]
54. Centers for disease control and prevention. National comprehensive cancer control program (NCCCP). Fond du Lac keeps mammograms a priority during pandemic. Available at https://www.cdc.gov/cancer/ncccp/success-stories/fond-du-lac-mammograms.htm/ Accessed Dec 2022
55. Centers for disease control and prevention. National comprehensive cancer control program (NCCCP). Blue beads campaign creates colorectal cancer awareness among American Indian and Alaska native people. Available at https://www.cdc.gov/cancer/ncccp/success-stories/blue-beads-campaign.htm. Accessed Dec 2022
56. Centers for disease control and prevention. National comprehensive cancer control program (NCCCP). Increasing colorectal cancer screening among tribal members during the COVID-19 pandemic. Available at https://www.cdc.gov/cancer/ncccp/success-stories/tribal-member-colorectal-screening-COVID19.htm. Accessed Dec 2022
57. Subrahmanian K, Petereit DG, Kanekar S et al. (2011) Community-based participatory development, implementation, and evaluation of a cancer screening educational intervention among American Indians in the Northern Plains. J Cancer Educ 26:530–539 [PubMed: 21431984]
58. Bryant J, Patterson K, Vaska M et al. (2021) Cancer screening interventions in indigenous populations: a rapid review. Curr Oncol 28:1728–1743 [PubMed: 34066460]
59. Melkonian SC, Jim MA, Haverkamp D et al. (2019) Disparities in cancer incidence and trends among American Indians and Alaska natives in the United States, 2010–2015. Cancer Epidemiol Biomarkers Prev 28:1604–1611 [PubMed: 31575554]
60. Office of the assistant secretary for planning and evaluation. AI/AN data capacity, improving data capacity for American Indian/Alaska native (AI/AN) populations in federal health surveys. Available at https://aspe.hhs.gov/sites/default/files/migrated_legacy_files//197431/improving-data-capacity-aian.pdf. Accessed Mar 2022
61. Alcaraz KI, Wiedt TL, Daniels EC, Yabroff KR, Guerra CE, Wender RC (2020) Understanding and addressing social determinants to advance cancer health equity in the United States: a blueprint for practice, research, and policy. CA Cancer J Clin 70:31–46 [PubMed: 31661164]



	AI/AN Female				W Female				AI/AN Male				W Male			
	1999 rate	2018 rate	% change[c]	AAPC[d]	1999 rate	2018 rate	% change[c]	AAPC[d]	1999 rate	2018 rate	% change[c]	AAPC[d]	1999 rate	2018 rate	% change[c]	AAPC[d]
Colorectal	49.2	40.4	-17.9	-0.5	46.7	30.2	-35.3	-2.2*	79.1	48.5	-38.7	-0.9*	65.5	38.8	-40.8	-2.7*
Lung	52	52.8	1.5	0.2	58.2	50.8	-12.7	-0.6*	73.5	59.1	-19.6	-1.5*	91.7	56.8	-38.1	-2.4*
Female breast	102.6	101	-1.6	0.2	144.9	131.7	-9.1	-0.5*	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cervical	13	9.6	-26.2	-0.4	8.3	6.5	-21.7	-1.1*	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Fig. 1.

Total percent change and average annual percent change for screening-amenable cancer rates[a] among non-Hispanic AI/AN[b] and non-Hispanic White women and men, 1999 to 2018, PRCDA Counties, United States.

PRCDA indicates Purchased/Referred Care Delivery Area; AI/AN: non-Hispanic American Indian/Alaska Native; NHW: non-Hispanic White RR, Rate Ratio

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—1998–2018. United States Department of Health and Human Services, Centers for Disease Control and Prevention. Released June 2021, based on the 2020 submission.

States that have at least one PRCDA-designated county, grouped by Indian Health Service (IHS) region are: Alaska (Alaska), Pacific Coast (California, Idaho, Oregon, and Washington), Southwest (Arizona, Colorado, Nevada, New Mexico, and Utah), Northern Plains (Indiana, Iowa, Michigan, Minnesota, Montana, Nebraska, North Dakota, South Dakota, Wisconsin, and Wyoming), Southern Plains (Kansas, Oklahoma, and Texas), and East (Alabama, Connecticut, Florida, Louisiana, Massachusetts, Maine, Mississippi, New York, North Carolina, Pennsylvania, Rhode Island, South Carolina, and Virginia). The percentage of the American Indian/Alaska Native population living in a PRCDA-designated county from 2014–2018 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%.

[a]Rates are per 100,000 people and are ageadjusted to the 2000 U.S. standard population (19 age groups - Census P251130).

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

[c]The change in rates was calculated as the total percentage change from the rate in 1999 to the rate in 2018.

[d]AAPC represents average annual percent change in rates between 1999 and 2018, calculated using joinpoint regression. *Indicates AAPC is statistically significantly different from zero (2-sided $p<0.05$)

Table 1

Incidence rates for screening-amenable cancers in non-Hispanic AI/ANa and non-Hispanic White women and men, 2014–2018 by region and age groups, PRCDA Counties, United States

	Total United States			Northern plains		Alaska		Southern plains		Pacific coast		East		Southwest	
	AI/AN count	AI/AN (W) rate[b]	RR[c]	AI/AN (W) rate[b]	RR[c]	AI/AN (W) rate[b]	RR[c]	AI/AN (W) rate[b]	RR[c]	AI/AN (W) rate[b]	RR[c]	AI/AN (W) rate[b]	RR[c]	AI/AN (W) rate[b]	RR[c]
Women															
Cancer type															
Colorectal															
<50	259	10.5 (7.9)	1.34*	12.5 (7.9)	1.59*	22.9 (8.0)	2.87*	14.0 (8.2)	1.71*	8.8 (7.7)	1.15	7.0 (8.2)	0.85	6.6 (7.1)	0.93
50–64	681	90.6 (54.0)	1.68*	101.5 (51.6)	1.97*	175.1 (49.5)	3.54*	104.7 (60.2)	1.74*	85.6 (54.1)	1.58*	79.1 (54.8)	1.44*	63.9 (51.6)	1.24*
65–74	416	151.9 (99.3)	1.53*	176.5 (104.0)	1.70*	260.2 (113.2)	2.30*	201.7 (125.9)	1.60*	158.3 (94.8)	1.67*	91.9 (102.2)	0.90	92.6 (85.0)	1.09
75 +	396	231.7 (190.1)	1.22*	236.7 (207.6)	1.14	534.8 (185.0)	2.89*	300.1 (177.8)	1.69*	233.7 (191.0)	1.22	129.3 (193.9)	0.67	150.0 (161.4)	0.93
Overall	1752	45.2 (31.8)	1.42*	50.2 (32.8)	1.53*	92.3 (31.8)	2.90*	57.3 (34.0)	1.68*	43.8 (31.5)	1.39*	30.8 (32.6)	0.94	29.5 (28.2)	1.05
Lung															
<50	85	3.5 (3.3)	1.07	5.7 (3.7)	1.53	~	~	6.2 (3.8)	1.64*	4.2 (2.5)	1.71*	~	~	~	~
50–64	749	96.3 (86.8)	1.11*	177.2 (93.4)	1.90*	144.3 (71.5)	2.02*	141.3 (105.8)	1.33*	92.3 (71.8)	1.29*	97.8 (101.9)	0.96	17.4 (65.5)	0.27*
65–74	782	284.5 (259.6)	1.10*	571.0 (266.8)	2.14*	399.2 (215.4)	1.85*	383.2 (289.9)	1.32*	286.1 (237.9)	1.20*	275.2 (294.0)	0.94	62.8 (204.5)	0.31*
75 +	610	355.5 (346.3)	1.03	720.8 (325.6)	2.21*	516.7 (307.4)	1.68*	461.8 (322.8)	1.43*	436.2 (355.7)	1.23*	271.4 (372.8)	0.73*	90.8 (287.6)	0.32*
Overall	2226	57.2 (53.4)	1.07*	111.9 (54.0)	2.07*	81.1 (45.3)	1.79*	78.8 (57.2)	1.38*	62.1 (49.7)	1.25*	51.0 (60.1)	0.85*	12.7 (42.4)	0.30*
Breast															
<50	956	39.9 (46.1)	0.87*	46.8 (44.6)	1.05	56.1 (46.9)	1.20	54.3 (39.7)	1.37*	42.3 (44.5)	0.95	40.2 (50.3)	0.80	21.9 (43.0)	0.51*
50–64	1824	241.7 (278.2)	0.87*	311.0(266.4)	1.17*	316.9 (244.6)	1.30*	331.9 (264.9)	1.25*	245.5 (280.5)	0.88*	162.2 (291.0)	0.56*	146.1 (257.7)	0.57*
65–74	1092	389.6 (469.5)	0.83*	473.7 (460.6)	1.03	451.7 (459.7)	0.98	531.5 (452.2)	1.18	433.9 (481.7)	0.90	321.8 (478.3)	0.67*	214.5 (435.7)	0.49*
75 +	588	342.9 (431.2)	0.80*	417.0 (423.0)	0.99	396.9 (380.9)	1.04	464.9 (408.6)	1.14	382.1 (445.8)	0.86	299.5 (439.2)	0.68*	208.9 (396.9)	0.53*

	Total United States			Northern plains		Alaska		Southern plains		Pacific coast		East		Southwest	
	AI/AN count	AI/AN (W) rate[b]	RR[c]	AI/AN (W) rate[b]	RR[c]	AI/AN (W) rate[b]	RR[c]	AI/AN (W) rate[b]	RR[c]	AI/AN (W) rate[b]	RR[c]	AI/AN (W) rate[b]	RR[c]	AI/AN (W) rate[b]	RR[c]
Overall	4460	111.6 (132.1)	0.84*	137 (128.2)	1.07*	141.9 (124.0)	1.14*	152.2 (123.0)	1.24*	119.1 (133.0)	0.90*	92.7 (138.1)	0.67*	64.5 (122.5)	0.53*
Cervical															
<20	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~
20–34	95	10.7 (5.8)	1.84*	12.9 (5.5)	2.35*	15.4 (4.3)	3.54*	20.6 (7.7)	2.68*	9.7 (6.1)	1.58	8.7 (5.6)	1.56	2.7 (4.9)	0.55
35–54	206	20.4 (12.8)	1.59*	22.6 (12.8)	1.77*	20.2 (14.0)	1.44	26.8 (16.6)	1.61*	26.4 (13.7)	3.54	7.3 (11.9)	0.62	14.4 (11.0)	1.31
55–74	86	11.3 (8.9)	1.26*	15.1 (8.4)	1.81	14.9 (10.1)	1.48	14.2 (12.1)	1.17	8.9 (9.2)	0.97	8.7 (8.8)	0.99	8.9 (7.5)	1.19
75 +	20	11.8 (6.7)	1.77*	~	~	~	~	21.3 (6.4)	3.34*	~	~	~	~	~	~
Overall	407	10.7 (6.8)	1.58*	12.3 (6.6)	1.87*	13.2 (7.0)	1.88*	15.6 (8.7)	1.79*	11.7 (7.1)	1.64*	5.7 (6.5)	0.88	6.5 (5.7)	1.14*
Men															
Cancer type															
Colorectal															
<50	303	12.9 (8.9)	1.46*	17.7 (8.8)	2.00*	17.8 (8.2)	2.17*	15.5 (10.0)	1.55*	10.6 (8.5)	1.25	6.3 (9.4)	0.67	10.9 (8.0)	1.36*
50–64	760	115.6 (76.9)	1.50*	154.1 (75.5)	2.04*	177.4 (78.4)	2.26*	156.0 (85.7)	1.82*	82.7 (76.4)	1.08	72.8 (77.8)	0.94	87.1 (73.3)	1.19*
65–74	442	190.7 (135.9)	1.40*	204.5 (141.1)	1.45*	358.0 (140.1)	2.56*	243.4 (172.7)	1.41*	167.5 (127.1)	1.32*	88.8 (142.6)	0.62*	153.1 (118.8)	1.29*
75 +	338	291.9 (225.0)	1.30*	427.2 (244.7)	1.75*	482.3 (214.1)	2.25*	423.4 (236.3)	1.79*	248.4 (220.6)	1.13	143.7 (232.9)	0.62	179.8 (189.8)	0.95
Overall	1843	56.9 (40.5)	1.40*	75.2 (41.8)	1.80*	92.2 (39.9)	2.31*	76.2 (45.8)	1.67*	46.1 (39.3)	1.17*	30.0 (41.9)	0.72*	41.9 (36.1)	1.16*
Lung															
<50	69	3.0 (2.8)	1.06	4.9 (3.0)	1.62	~	~	5.8 (3.1)	1.86*	2.1 (2.3)	0.9	~	~	0.9 (1.9)	0.49
50–64	695	102.8 (92.0)	1.12*	163.4 (103.3)	1.58*	148.5 (78.3)	2.00*	166.1 (122.2)	1.36*	101.6 (73.9)	1.37*	87.1 (106.5)	0.82	15.6 (68.6)	0.23*
65–74	771	338.5 (298.3)	1.13*	518.9 (324.1)	1.60*	533.6 (244.4)	2.18*	557.3 (398.3)	1.40*	298.9 (257.5)	1.16	195.6 (334.5)	0.58*	98.5 (237.3)	0.41*
75 +	568	475.3 (450.7)	1.05	693.1 (460.1)	1.51*	756.9 (485.6)	1.56*	756.5 (508.4)	1.49*	431.6 (426.1)	1.01	362.4 (496.0)	0.73*	178.5 (360.1)	0.50*
Overall	2103	68.6 (62.7)	1.09*	104.2 (66.9)	1.56*	104.1 (58.3)	1.79*	111.6 (77.6)	1.44*	62.5 (55.5)	1.13*	50.2 (70.5)	0.71*	20.3 (49.0)	0.41*

Source: National Program of Cancer Registries and Surveillance, Epidemiology, and End Results SEER*Stat Database: US Cancer Statistics American Indian and Alaska Native Incidence Analytic Database-1998–2018. United States Department of Health and Human Services, Centers for Disease Control and Prevention. Released June 2021, based on the 2020 submission

States that have at least one PRCDA-designated county, grouped by Indian Health Service (IHS) region are: Alaska (Alaska), Pacific Coast (California, Idaho, Oregon, and Washington), Southwest (Arizona, Colorado, Nevada, New Mexico, and Utah), Northern Plains (Indiana, Iowa, Michigan, Minnesota, Montana, Nebraska, North Dakota, South Dakota, Wisconsin, and Wyoming), Southern Plains (Kansas, Oklahoma, and Texas), and East (Alabama, Connecticut, Florida, Louisiana, Massachusetts, Maine, Mississippi, New York, North Carolina, Pennsylvania, Rhode Island, South Carolina, and Virginia). The percentage of the American Indian/Alaska Native population living in a PRCDA-designated county from 2014–2018 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%

PRCDA indicates Purchased/Referred Care Delivery Area, *AI/AN* non-Hispanic American Indian/Alaska Native, *W* non-Hispanic White, *RR* Rate Ratio

[a] AI/AN race is reported by NPCR and SEER registries or through linkage with the IHS patient registration database. Includes only AI/AN of non-Hispanic origin[a]

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

[c] RR are AI/AN versus White and are calculated in SEER*Stat prior to rounding of rates and may not equal RR calculated from rates presented in table

[*] Indicates RR is statistically significantly different from zero (2-sided $p < 0.05$)

[~] statistics with counts fewer than 6 are suppressed

Table 2

Incidence rates (per 100,000) for screening-amenable cancers in non-Hispanic AI/ANa and non-Hispanic White women and men, 2014–2018 by region and stage, PRCDA counties, United States

	Localized[d]			Regional[e]			Distant[f]			Unstaged[g]		
	% AI/AN (W)	Rate AI/AN (W)[b]	RR[c] (AI/AN:W)	% AI/AN (W)	Rate AI/AN (W)[b]	RR[c] (AI/AN:W)	% AI/AN (W)	Rate AI/AN (W)[b]	RR[c] (AI/AN:W)	% AI/AN (W)	Rate AI/AN (W)[b]	RR[c] (AI/AN:W)
Women												
Colorectal												
Northern plains	34.4 (35.1)	16.2 (11.8)	1.38*	36.4 (34.4)	20.2 (12.3)	1.65*	23 (19.8)	11.5 (6.6)	1.72*	6.0 (10.5)	2.3 (2.2)	1.04
Alaska	38.5 (32.3)	32.9 (10.3)	3.19*	33.0 (33.9)	38.1 (12.5)	3.05*	19.2 (20.9)	18.1 (6.5)	2.77*	9.1 (12.7)	3.2 (2.5)	1.27
Southern plains	30.4 (36.7)	17.3 (12.5)	1.38*	33.4 (29.5)	20.2 (11)	1.83*	21.2 (20.4)	12.2 (7.1)	1.71*	14.8 (13.2)	7.5 (3.4)	2.24*
Pacific coast	32.5 (35.7)	14.4 (11.4)	1.27*	39.7 (33.6)	18.2 (11.5)	1.58*	19.3 (20.1)	8.4 (6.4)	1.31*	8.3 (10.3)	2.7 (2.1)	1.28
East	36.6 (37.2)	10.9 (12.3)	0.89	38.6 (32.8)	13.4 (11.5)	1.17	19.8 (20)	5.9 (6.7)	0.88	4.9 (9.9)	0.6 (2.1)	0.27
Southwest	30.6 (36.0)	8.7 (10.1)	0.86	34.1 (31.8)	10.7 (9.9)	1.10	21.9 (18.6)	6.7 (5.4)	1.25	13.2 (13.4)	3.4 (2.8)	1.20
Total United States	32.8 (36.2)	14.4 (11.7)	1.23*	35.5 (33.0)	17.4 (11.4)	1.53*	20.9 (19.9)	9.6 (6.5)	1.48*	10.7 (10.7)	3.8 (2.3)	1.67*
Lung												
Northern plains	28.0 (25.9)	31.6 (14.0)	2.25*	20.6 (21.5)	22.9 (12.2)	1.88*	41.0 (44.7)	44.6 (24.2)	1.84*	10.2 (7.7)	12.8 (3.5)	3.63*
Alaska	23.4 (23.5)	18.8 (10.2)	1.85*	18.3 (23.7)	15.6 (11.1)	1.40	53.5 (43.6)	43.1 (20.1)	2.15*	4.5 (9.0)	3.5 (3.9)	0.91
Southern plains	21.4 (22.5)	16.8 (12.9)	1.30*	22.2 (20.4)	18.3 (12.2)	1.50*	42.5 (44.3)	32.8 (25.6)	1.28*	13.7 (12.6)	10.9 (6.5)	1.67*
Pacific coast	24.5 (26.9)	15.5 (13.5)	1.15	20.1 (20.1)	12.7 (10.6)	1.21	46.7 (43.8)	28.6 (21.9)	1.31*	8.5 (9.1)	5.3 (3.9)	1.38
East	26.0 (29.3)	14.0 (17.7)	0.79	24.8 (21.1)	12.5 (13.4)	0.93	40.8 (41.9)	20.3 (25.3)	0.80	8.2 (7.4)	4.2 (3.7)	1.15
Southwest	17.0 (26.6)	2.1 (11.2)	0.18*	25.5 (18.5)	3.1 (8.2)	0.38*	43.9 (40.1)	5.7 (17.2)	0.33*	13.4 (14.6)	1.8 (5.9)	0.32*
Total United States	23.9 (27.4)	13.7 (14.7)	0.94	21.4 (20.6)	12.5 (11.6)	1.08	44 (42.9)	24.8 (23.0)	1.08*	10.5 (9.0)	6.2 (4.1)	1.50*
Breast												
Northern plains	57.5 (67.6)	77.5 (84.9)	0.91	32.2 (24.9)	44.5 (34.5)	1.29*	6.8 (5.0)	9.8 (6.3)	1.56*	3.2 (2.4)	5.1 (2.5)	2.03*
Alaska	62.5 (64.3)	88.0 (79.2)	1.11	27.5 (25.8)	39.8 (33.2)	1.20	9.1 (5.9)	13.5 (7.3)	1.84*	0.8 (3.9)	0.6 (4.2)	0.14*
Southern plains	61.2 (62.1)	93.6 (75.1)	1.25*	27.3 (26.1)	40.6 (34.2)	1.19*	6.6 (6.5)	10.7 (8.2)	1.31*	4.7 (5.0)	7.4 (5.6)	1.33

	Localized[d]			Regional[e]			Distant[f]			Unstaged[g]		
	% AI/AN (W)	Rate AI/AN (W)[b]	RR[c] (AI/AN:W)	% AI/AN (W)	Rate AI/AN (W)[b]	RR[c] (AI/AN:W)	% AI/AN (W)	Rate AI/AN (W)[b]	RR[c] (AI/AN:W)	% AI/AN (W)	Rate AI/AN (W)[b]	RR[c] (AI/AN:W)
Pacific coast	58.2 (66.9)	67.9 (87.0)	0.78*	30.7 (24.9)	37.9 (35.8)	1.06	5.7 (5.0)	7.2 (6.8)	1.07	5.2 (3.0)	6.2 (3.4)	1.80*
East	54.5 (69.5)	51.2 (94.5)	0.54*	35.3 (22.7)	32.4 (34.0)	0.95	7.6 (5.1)	7.0 (6.8)	1.02	2.4 (2.5)	2.2 (2.8)	0.76
Southwest	57.9 (66.0)	37.0 (78.7)	0.47*	30.0 (24.1)	19.3 (32.4)	0.60*	5.9 (4.9)	4.0 (6.2)	0.65*	5.9 (4.8)	4.1 (5.2)	0.12
Total US	59.1 (67.5)	65.5 (87.5)	0.75*	29.8 (24.1)	33.3 (34.4)	0.97	6.6 (5.1)	7.8 (6.7)	1.15*	4.3 (3.0)	5.0 (3.4)	1.47*
Cervical												
Northern plains	37.0 (48.7)	4.4 (3.5)	1.27	40.3 (28.3)	5.1 (1.9)	2.62*	14.5 (16.4)	1.5 (0.9)	1.66	8 (6.4)	1.3 (0.2)	5.75*
Alaska	45.4 (59.0)	5.7 (4.2)	1.36	30.3 (20.4)	4.8 (1.6)	2.94*	21.2 (15.6)	2.7 (1.0)	2.68	-	-	-
Southern plains	38.8 (37.3)	6.0 (3.4)	1.76*	30.5 (29.1)	4.9 (2.8)	1.73*	16.4 (17.3)	2.6 (1.4)	1.85*	14.1 (16.1)	2.0 (1.0)	1.93
Pacific coast	45.8 (47.6)	5.3 (3.7)	1.45*	36.4 (28.2)	4.5 (2.2)	2.10*	11.7 (14.4)	1.4 (0.9)	1.59	5.8 (9.6)	0.4 (0.4)	1.11
East	58.8 (44.7)	3.5 (3.2)	1.09	23.5 (30.0)	1.2 (2.0)	0.60	11.7 (15.2)	0.7(0.8)	0.82	5.8 (9.9)	0.3 (0.4)	0.76
Southwest	34.2 (46.0)	2.1 (2.9)	0.73	34.2 (27.4)	2.5 (1.6)	1.52	15.7 (14.1)	1.1 (0.7)	1.60	15.7 (12.3)	0.8 (0.5)	1.73
Total United States	40.5 (45.9)	4.3 (3.4)	1.25*	33.6 (28.7)	3.8 (2.0)	1.87*	15.2 (15.2)	1.6 (0.9)	1.83*	10.5 (10.0)	1.0 (0.4)	2.27*
Men												
Colorectal												
Northern plains	32.6 (35.1)	22.5 (14.5)	1.56*	38.2 (34.3)	31.4 (15.7)	2.00*	22.2 (20.9)	17.1 (8.8)	1.95*	6.8 (9.6)	4.2 (2.8)	1.49
Alaska	33.0 (35.0)	29.7 (13.3)	2.23*	35.0 (31.3)	34.2 (13.8)	2.48*	29.0 (22.7)	27.4 (9.4)	2.91*	3.0 (10.8)	1.0 (3.4)	0.29
Southern plains	28.0 (33.9)	22.5 (15.5)	1.45*	33.0 (31.5)	25.7 (15.5)	1.66*	22.7 (20.9)	15.6 (9.6)	1.64*	16.1 (13.5)	12.4 (5.2)	2.38*
Pacific coast	34.0 (35.1)	15.9 (13.6)	1.17	33.4 (33.9)	16.3 (14.6)	1.12	20.3 (21.0)	8.6 (8.3)	1.03	12.1 (9.8)	5.3 (2.7)	1.96*
East	27.0 (37.5)	7.5 (15.6)	0.48*	31.7 (32.8)	9.6 (14.8)	0.65*	27.0 (20.9)	8.7 (8.8)	0.98	14.1 (8.6)	4.1 (2.7)	1.52
Southwest	36.3 (34.7)	14.8 (12.4)	1.20	30.6 (31.0)	13.3 (12.1)	1.10	20.8 (21.0)	8.7 (7.8)	1.12	12.1 (13.2)	5.0 (3.8)	1.32
Total United States	32.0 (35.8)	18.1 (14.4)	1.26*	33.6 (33.1)	19.0 (13.5)	1.37*	22.7 (20.9)	12.5 (8.6)	1.46*	11.5 (10.0)	7.4 (4.1)	2.10*
Lung												
Northern plains	16.7 (20.8)	19.4 (14.0)	1.38*	25.1 (21.9)	25.5 (15.2)	1.67*	48.6 (48.4)	49.9 (32.3)	1.55*	9.4 (8.7)	9.4 (5.3)	1.77*
Alaska	16.5 (20.2)	16.6 (12.5)	1.33	28.2 (18.1)	30.8 (10.7)	2.89*	49.2 (50.6)	51.2 (28.5)	1.79*	5.8 (10.8)	5.4 (6.6)	0.82
Southern plains	18.1 (20.3)	20.5 (16.0)	1.28*	19.0 (19.4)	21.9 (15.6)	1.41*	46.7 (45.3)	50.1 (34.9)	1.44*	16.0 (14.7)	19.0 (11.1)	1.71*

	Localized[d]			Regional[e]			Distant[f]			Unstaged[g]		
	% AI/AN (W)	Rate AI/AN (W)[b]	RR[c] (AI/AN:W)	% AI/AN (W)	Rate AI/AN (W)[b]	RR[c] (AI/AN:W)	% AI/AN (W)	Rate AI/AN (W)[b]	RR[c] (AI/AN:W)	% AI/AN (W)	Rate AI/AN (W)[b]	RR[c] (AI/AN:W)
Pacific coast	17.5 (22.1)	11.3 (12.4)	0.91	24.7 (20.3)	14.5 (11.7)	1.24*	48.5 (48.0)	30.7 (26.5)	1.16	9.1 (9.5)	6.0 (4.9)	1.22
East	25.8 (24.2)	12.2 (17.1)	0.71	26.6 (22.1)	13.6 (16)	0.85	38.8 (46.0)	20.0 (32.5)	0.61*	8.6 (7.5)	4.5 (4.9)	0.91
Southwest	11.7 (21.9)	2.4 (10.7)	0.22*	23.5 (19.6)	4.9 (9.9)	0.49*	48.3 (43.0)	10.0 (21.2)	0.47*	16.3 (15.2)	3.0 (7.2)	0.41*
Total United States	17.6 (22.5)	12.3 (14.2)	0.87*	23.1 (21.1)	15.4 (13.1)	1.16*	47.3 (46.6)	32.1 (29.2)	1.10*	11.9 (9.6)	8.8 (6.2)	1.48*

Source: National Program of Cancer Registries and Surveillance, Epidemiology, and End Results SEER*Stat Database: US Cancer Statistics American Indian and Alaska Native Incidence Analytic Database-1998–2018. United States Department of Health and Human Services, Centers for Disease Control and Prevention. Released June 2021, based on the 2020 submission

States that have at least one PRCDA-designated county, grouped by Indian Health Service (IHS) region are: Alaska (Alaska), Pacific Coast (California, Idaho, Oregon, and Washington), Southwest (Arizona, Colorado, Nevada, New Mexico, and Utah), Northern Plains (Indiana, Iowa, Michigan, Minnesota, Montana, Nebraska, North Dakota, South Dakota, Wisconsin, and Wyoming), Southern Plains (Kansas, Oklahoma, and Texas), and East (Alabama, Connecticut, Florida, Louisiana, Massachusetts, Maine, Mississippi, New York, North Carolina, Pennsylvania, Rhode Island, South Carolina, and Virginia). The percentage of the American Indian/Alaska Native population living in a PRCDA-designated county from 2014–2018 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%

PRCDA indicates Purchased/Referred Care Delivery Area, *AI/AN* non-Hispanic American Indian/Alaska Native, *W* non-Hispanic White, *RR* Rate Ratio

[a] AI/AN race is reported by NPCR and SEER registries or through linkage with the IHS patient registration database. Includes only AI/AN of non-Hispanic origin

[b] Rates are per 100,000 people and are age-adjusted to the 2000 US standard population (19 age groups-Census P25–1130)

[c] RR are AI/AN versus White and are calculated in SEER*Stat prior to rounding of rates and may not equal RR calculated from rates presented in table

[d] Localized cancer refers to a malignancy limited to the organ of origin; no spread beyond organ of origin; infiltration past basement membrane of epithelium into stroma of organ

[e] Regionalized cancer refers to tumor extension beyond limits of organ of origin by direct extension, lymph nodes, both, or not otherwise specified

[f] Distant cancer refers to a tumor which has spread to areas of the body distant or remote from the primary tumor

[g] Unstaged cancer includes cases for which sufficient evidence is not available to adequately assign stage

* Indicates RR is statistically significantly different from zero (2-sided $p < 0.05$)*

~ statistics with counts fewer than 6 are suppressed

Table 3

Prevalence of up-to-date screening[a] and health care access[b] in non-Hispanic American Indians/Alaska Native[c] and non-Hispanic White People eligible for screening[d] (BRFSS 2014, 2016, 2018) by IHS region

Gender	Region	% up-to-date on recommended screening						% responding "yes" to access to care[e]	
		Colorectal		Breast		Cervical			
		AI/AN	White	AI/AN	White	AI/AN	White	AI/AN	White
Women									
	Northern plains	58.6	69.8	77.5	78.7	89.4	90.2	81.9	88.4
	Alaska	65.1	64.3	79.8	69.1	94.5	87.3	78.8	80.3
	Southern plains	67.5	67.2	75.8	73.9	79.9	87.0	NA	NA
	Southwest	53.9	68.3	64.8	72.7	79.3	87.3	78.6	84.5
	Pacific coast	74.1	74.4	76.9	79.1	93.0	88.7	73.4	83.8
	East	60.7	70.2	76.1	78.8	85.0	89.9	77.3	85.7
	Total United States	62.4	70.3	74.8	78.0	84.8	89.4	78.1	86.1
Men									
	Northern plains	58.8	67.6	NA	NA	NA	NA	71.7	86.0
	Alaska	61.9	61.0	NA	NA	NA	NA	71.9	76.3
	Southern plains	53.3	65.3	NA	NA	NA	NA		
	Southwest	41.6	67.9	NA	NA	NA	NA	70.0	83.5
	Pacific coast	46.6	72.6	NA	NA	NA	NA	87.2	81.9
	East	59.3	68.5	NA	NA	NA	NA	73.0	84.3
	Total United States	54.6	68.5	NA	NA	NA	NA	73.1	84.5

BRFSS Behavior Risk Factor Surveillance System, *IHS* Indian Health Service

[*] Pearson Correlation Coefficient represents correlation between population level risk factor prevalence data and liver cancer incidence rates

[a] Screening recommendations that align with Healthy People 2020 and according to BRFSS statistical briefs found here: https://www.cdc.gov/brfss/data_documentation/statistic_brief.htm

[b] 2 category health care access question "Continuously insured for the past 12 months" or "Uninsured for part or all of past 12 months" https://www.cdc.gov/brfss/data_documentation/pdf/2013-2014_HCS.pdf

[c] Race is self-reported from Behavioral Risk Factor Surveillance System

[d] Prevalence limited to BRFSS data from individuals within the age ranges eligible for screening. Cervical cancer 21–65, Breast and Colorectal 50–75

[e] Ages 21–75 included in access to care analysis. Access to Care variables are an optional module and not included in data from any state in the Southern Plains