



CANCER
AMONG THE
NAVAJO

2005 - 2013

EXECUTIVE SUMMARY

FOREWORD

In response to professional and community concerns that cancer is a major health issue among Navajo residents of the Navajo Nation, the Navajo Cancer Workgroup presents *Cancer Among the Navajo, 2005-2013*. This report was produced to update the findings of a previous report, 'Cancer Among the Navajo, 1995-2004,' and help broaden our current understanding of cancer in this community. Patients, family members, medical and public health professionals, educators, community members, legislation and policy makers, and program administrators and staff are encouraged to use this report to broaden our current understanding of cancer among the Navajo people and strategize to improve cancer prevention, education, and treatment.

ACKNOWLEDGMENTS

The report was prepared by the Navajo Cancer Workgroup to support the efforts of Navajo Nation to improve cancer prevention and care by utilizing and improving cancer data. The workgroup consists of representatives from the Navajo Epidemiology Center, Navajo Department of Health Programs, New Mexico Tumor Registry, Arizona Cancer Registry, Navajo Area Indian Health Service, Non-Profit Organizations, Universities, and Centers for Disease Control and Prevention (CDC).

DEDICATION

Cancer has greatly impacted the lives of the Navajo people over the years. Therefore, we would like to dedicate this report to cancer survivors, those who have lost their lives to cancer, and their loved ones who cared for them. The amount of courage, determination and resilience of cancer survivors is immeasurable, and we send them continuous strength and support. May they be a symbol of hope for all who have been affected by cancer. As for those who have lost their battle to cancer, their families and friends are in our prayers. We hope this report will provide the Navajo people with the information, awareness and resources needed to decrease the burden of cancer.

METHODOLOGY

In this report, Navajo Cancer Workgroup obtained high-quality, population-based cancer surveillance cancer incidence, stage at diagnosis, and mortality data reported to the Arizona Cancer Registry, New Mexico Tumor Registry and Utah Cancer Registry. The Navajo cancer incidence and mortality rates were based on data from American Indians and Alaska Natives (AI/AN) who resided in a six-county (Coconino, Navajo and Apache counties in Arizona; San Juan and McKinley counties in New Mexico; and San Juan county in Utah) region that comprise the Navajo Nation. In these six counties Navajos represent about eighty percent of the total AI/AN population; therefore, cancer data for AI/AN serves as proxy for Navajo. For the screening behaviors, data were used from the Navajo Nation Health Survey (Chinle and Northern Agencies), Indian Health Service (IHS), federal and tribal clinical outcome measures reported as part of the Government Performance and Results Act (GPRA), as well as the Behavioral Risk Factor Surveillance Survey (BRFSS) – a well-established national, telephone-based health survey supported by CDC.

FINDINGS

Findings show that from 2005-2013, the ten most commonly diagnosed cancers (by counts) among the Navajos were female breast, colorectal, prostate, kidney, uterine, stomach, non-Hodgkin lymphoma, pancreas, thyroid, liver, and lung. Prostate cancer was the most commonly diagnosed cancer among Navajo males (85.0 per 100,000 males, 226 total number of cases), followed by colorectal cancer and kidney cancer. Among Navajo females, breast cancer was the most commonly diagnosed cancer (282 new cases, 64.4 per 100,000 females), followed by colorectal cancer and uterine cancer. Compared to the non-Hispanic white (NHW) population in Arizona and New Mexico, Navajo had a lower incidence of prostate, female breast, non-Hodgkin lymphoma, thyroid, and lung cancers, but higher incidence and mortality of liver, kidney, stomach, and gallbladder cancers.

Navajos are diagnosed in later stages compared to NHW, with 8-9 percent fewer breast and colorectal cancer patients being diagnosed in the localized stages.

Cancer screening among the Navajos is low, particularly for colorectal cancer. However, there are substantial differences in breast cancer screening based on the data sources, with Navajo area-wide GPRA (clinic-reported) suggesting much lower rates than the self-reported Navajo Nation Health Survey and BRFSS data. The BRFSS data suggests that NHW females receive mammography and pap test screenings at almost the same rates as AI/AN females in the six-counties included, but colorectal cancerscreening rates are much lower (57.4 percent NHW vs. 32.4 percent AI/AN). Within the Navajo Nation Health Survey, screening rates for mammography, pap test, and colorectal cancer screening were 12-25 percent lower in the Chinle Agency compared to the Northern Agency.

The most common causes of cancer mortality among Navajo males were prostate (23.3 deaths per 100,000 males), colorectal, and stomach cancers, and among Navajo females breast (13.1 deaths per 100,000 female), colorectal and ovarian cancers. This is a stark difference from NHW, for whom the leading cause of cancer death was lung cancer, at rates 6.6 times higher than the Navajo.

CONCLUSIONS AND RECOMMENDATIONS

Cancer among the Navajo remains a substantial public health challenge on the Navajo Nation. The most common cancers remain prostate, breast, and colorectal cancers, with higher incidence rates in 2005-2013 compared to 1995-2004. Although the incidence and mortality of the most common cancers (prostate, breast, colorectal) remain lower than NHW population, the Navajos suffer from comparatively high rates of kidney, liver, stomach and gallbladder cancers.

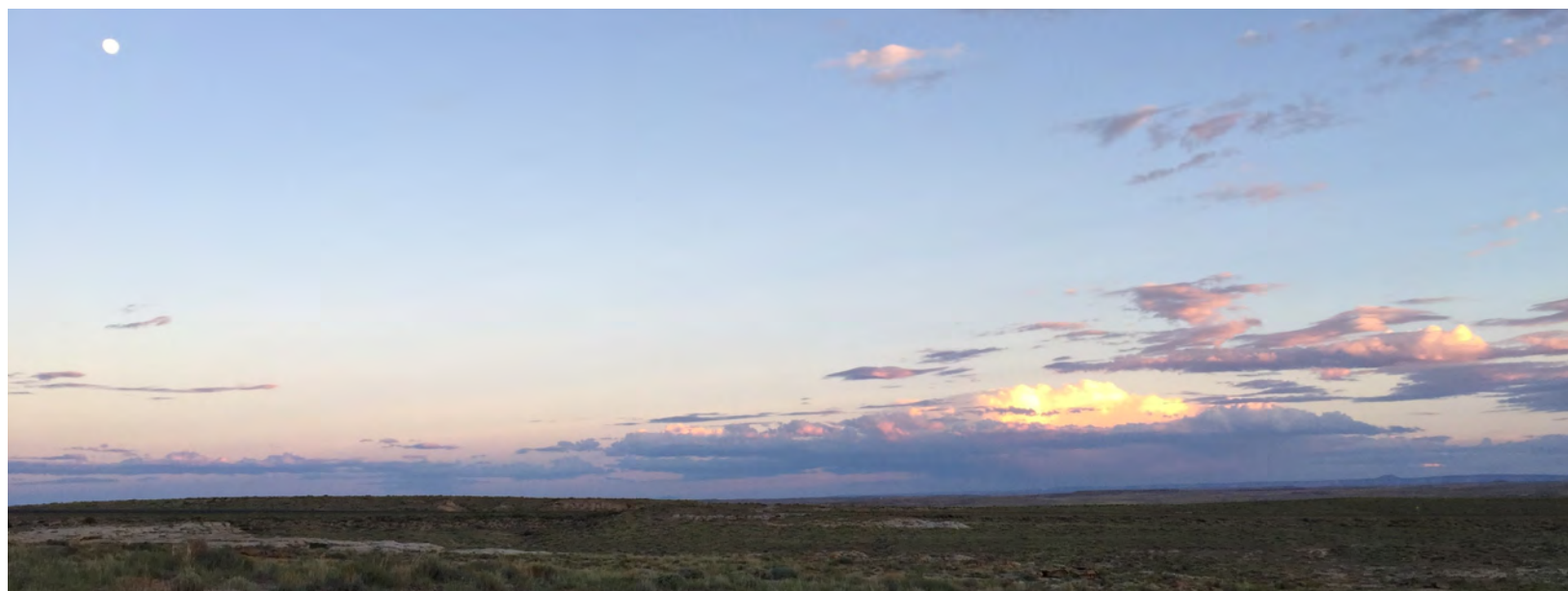
Navajos continue to be diagnosed at relatively advanced disease stages, although improvement (7 percent increase) is noted in patients being diagnosed in the localized stage of colorectal cancer (males and females combined) compared to 1995-2004. Cancer screening (particularly for breast cancer) was higher than in the report from 1995-2004, but rates remain low for colorectal cancer, with substantial variability between the Chinle and Northern Agencies.

The workgroup recommends continuing the partnership with state cancer registries and cancer control planners to maintain and improve on-going surveillance of cancer among the Navajos, and to promote research that examines risk factors and causes, as well as appropriate approaches to promote screening, early detection, and treatment. In addition, the workgroup recommends increasing education and training for health care providers regarding current cancer screening practices and guidelines, and expanding collaboration among Navajo tribal health programs, Navajo Senior Centers, Indian Health Service, and tribally operated facilities and local communities in order to translate these data into targeted and culturally appropriate cancer prevention and intervention programs.

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Health Care on the Navajo Nation



Until the advent of population-based cancer surveillance in the 1970's, reports of cancer among the Navajo were mostly based on case-series that were derived from the experiences of individual physicians or organizations that served American Indians and Alaska Natives (AI/AN) communities, and on data using vital records. Reports of cancer among the Navajo people were published in the medical literature as early as the 1930s.¹⁻³ A common finding in these reports was the relative low number of cancers observed among the Navajo. For example, C.G. Salsbury, M.D., a physician who worked among the Navajo in Ganado, Arizona, wrote in the *Arizona Medicine* that cancer rates were lower among the Navajo compared to whites and questioned whether the Navajos were protected from diabetes and cancer by their diet and nutrition.⁴

Following World War II, uranium mining swept onto the Navajo Nation and settled within uranium-rich regions including Arizona communities of Cove and Monument Valley, and New Mexico communities of Sanostee

and Church Rock. Tailing from the milling process were left abandoned in Shiprock, New Mexico, Tuba City, Arizona, and Kayenta, Arizona.⁵ Decades later, increasing rates of lung cancer in this generally non-smoking population was attributed to occupational exposure while working in the uranium mines.⁵⁻⁷ A report covering years 1989-1993 revealed that the mortality for all cancers among AI/AN remained lower compared to whites.⁸ Yet, mortality rates, a population comparative measure, for cancers of the liver, stomach, kidney, and gallbladder were much higher than whites. AI/AN women also had significantly higher mortality rates from cancer of the cervix than white women. In a report covering years 1999-2004, incidence rates for all cancers among AI/AN, including the Navajo in the southwest were lower than whites, while cancers of the stomach, liver, kidney, gallbladder, and cervix for females were much higher.⁹

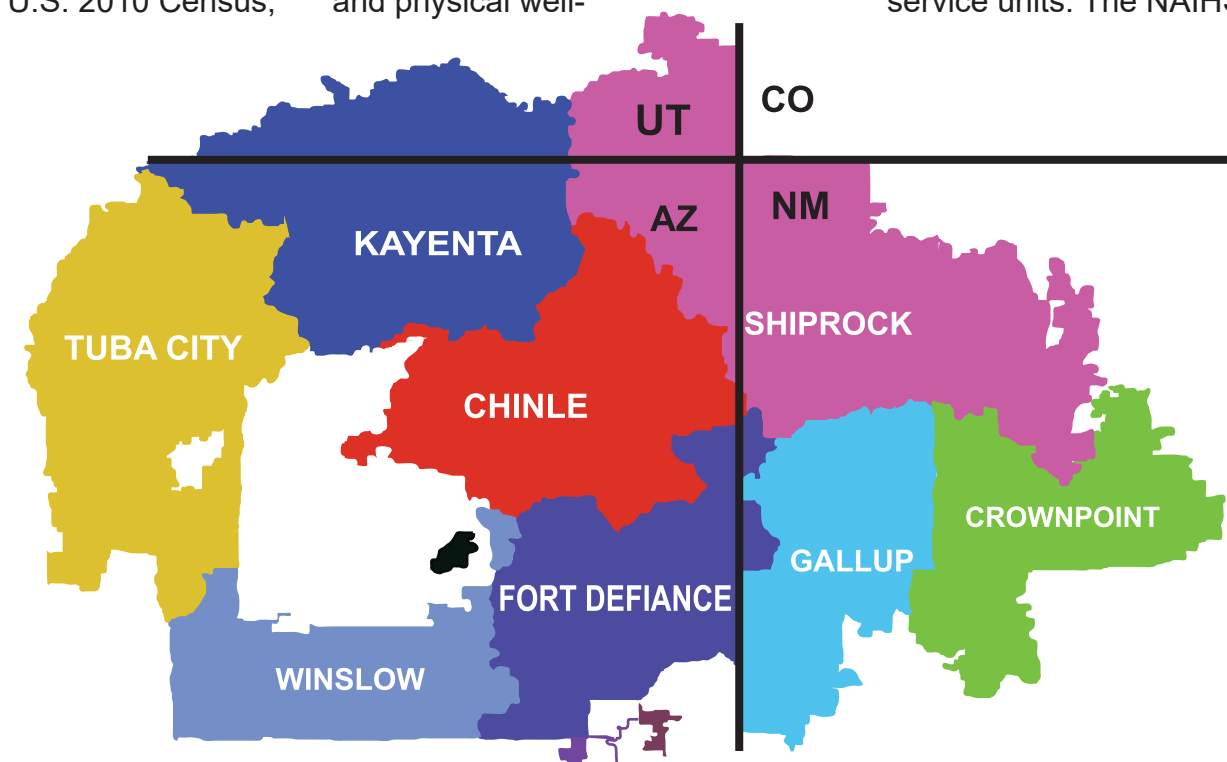
Today, cancer has become one of the leading cause of disease and death for the Navajo people.

The Indian Health Service estimated that 7.3 percent of all deaths in the Navajo Area Indian Health Service region were due to cancer from 1999 to 2001.¹⁰ Clearly, the reality observed from the 1930s to 1950s is much different than today. In this report, data from the Arizona Cancer Registry, New Mexico Tumor Registry and Utah Cancer Registry were used to provide Navajo proxy cancer incidence and stage of diagnosis. The cancer mortality data were provided by National Center for Health Statistics. These data focus on contiguous Navajo Nation but excludes the three satellite communities of Ramah, Alamo, and Tohajiilee in New Mexico (see map on next page).¹⁰ These satellite communities are served by the Albuquerque Area Indian Health Service in New Mexico and were excluded because the Navajo Cancer Workgroup did not have access to Albuquerque Area Indian Health Service Resource Patient Management System (RPMS), a health care information system, for population estimate data.

The Navajo Nation is a large tribe in the United States (U.S.), both geographically and by population. It spans into three states and with more than 300,000 enrolled individuals. The Navajo Nation spans over 27,000 square miles, bordering Arizona, Colorado, New Mexico, and Utah. Based on the U.S. 2010 Census,

These teachings tell how to live in balance with nature and all of Mother Earth's inhabitants; this balance is known as K'e. When out of balance, some people who follow the Navajo tradition seek traditional healing from native healers or traditional practitioners for mental, spiritual, and physical well-

IHS there are five hospitals, seven health centers, fifteen health stations and twenty-two dental clinics, including five contract (or "638") facilities that are administered by Navajo organizations. These facilities are geographically divided into eight NAIHS service areas called service units. The NAIHS pri-



332,129 individuals living in the U.S. claimed to have Navajo ancestry with approximately one-half living on the Navajo Nation and the other half in border towns or metropolitan areas. The Navajo population comprises approximately 48 percent male and 52 percent female, and a median age of 25 years old, which is much younger when compared to the U.S. general population of 35 years old.^{11,12}

The Navajo people believe that the Holy People bestowed special teachings upon them.

being. The practitioners specialize in specific areas for diagnosis and care that ranges from diagnosticians such as hand tremblers and crystal gazers and individuals who perform healing ceremonies involving herbs, balms and purgatives.^{11,13,14} Parallel to native healing is the western medicine system. The IHS, an agency within the U.S. Department of Health and Human Services, is responsible for providing health care services to American Indians and Alaska Natives. Within the Navajo Area

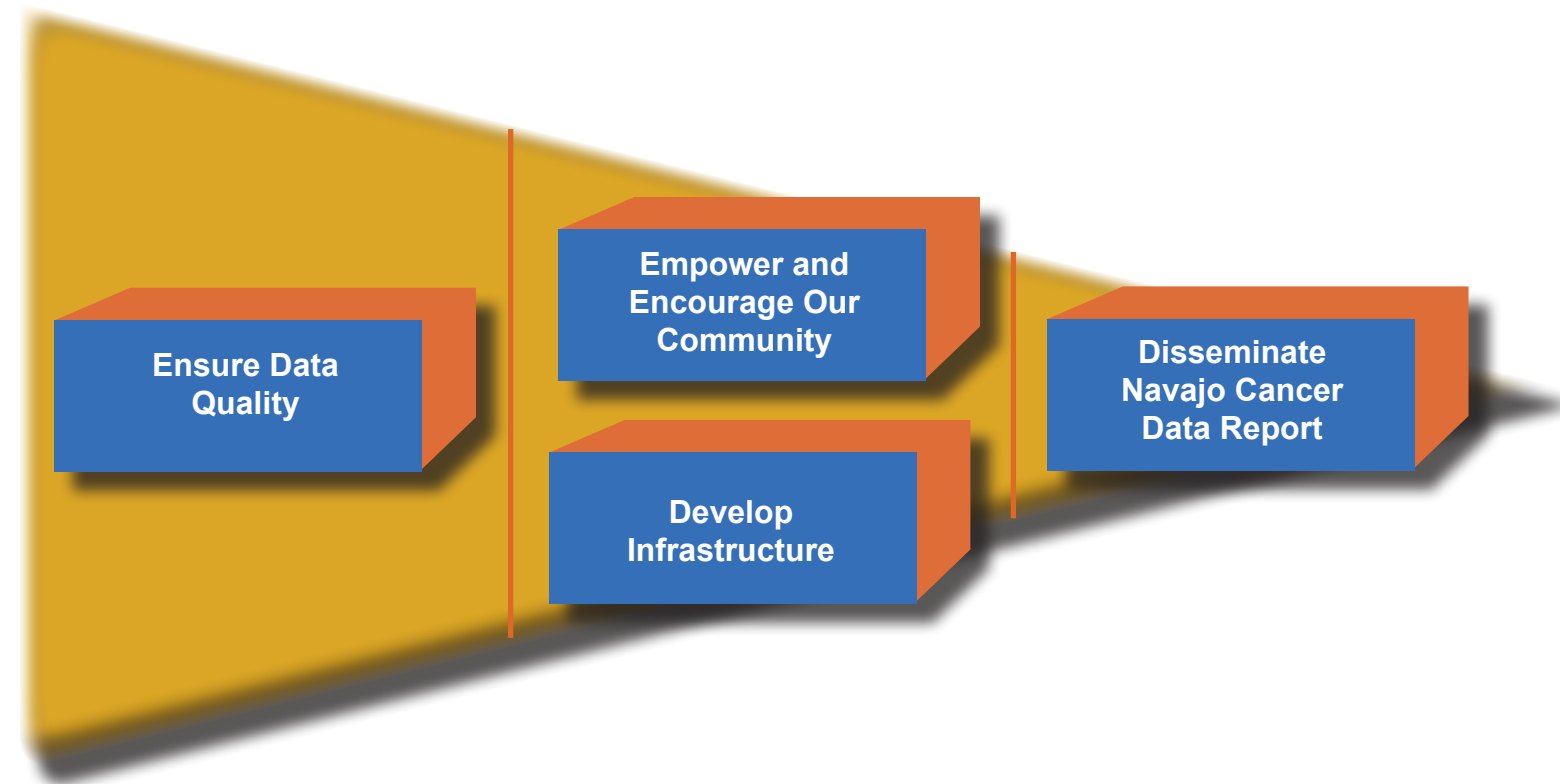
marily serves people from the Navajo Nation, the Southern Band of San Juan Paiute, Hopi, and Zuni. Their services include inpatient care, ambulatory care, contract health, and public health programs.¹⁵

Navajo Cancer Workgroup

A key provider of health, education, and prevention services is the Navajo Department of Health (NDOH). In 1977, the NDOH was established within the Navajo government system to promote and protect the overall health of the Navajo people by developing tribal health programs that focus on health promotion and disease prevention.

Breast and Cervical Cancer Prevention
 Community Health Representatives
 Public Health Nursing
 Public Health Emergency Preparedness
 Planning, Research and Evaluation
 Aging
 Diabetes

Behavioral Health
 Food Distribution
 Women, Infants and Children
 Office of Navajo Uranium Workers
 Environmental Health
 New Dawn Program (horticulture)
 Health Education
 Food Access Navigation
 Epidemiology Center



The Navajo Cancer Workgroup was formed in 1999 to support the efforts of Navajo Nation leaders to improve cancer prevention and care by utilizing and improving cancer data. The workgroup aims to:

- 1) Evaluate and improve cancer data quality and monitoring;
- 2) Empower and engage communities around cancer prevention;
- 3) Support and improve Navajo Area health programs;
- 4) Produce Navajo-specific cancer report to inform and educate public health professionals, medical providers, Navajo Nation health programs and local, state and federal agencies;
- 5) Produce Navajo-specific cancer report to inform tribal leaders and laypersons.

Representatives (listed below) from these organizations make up the Navajo Cancer Workgroup and are recognized and commended for their contribution to this report:

Christine J. Benally	Navajo Area Indian Health Service
Austin Dungan	Utah Department of Health
Carol Goldtooth	Partnership for Native American Cancer Prevention
Timothy Flood	Arizona Cancer Registry
Melissa Jim	Centers for Disease Control and Prevention
Linda Knedler	Northern Navajo Medical Center
Angela Meisner	New Mexico Tumor Registry
Chris Newton	Arizona Cancer Registry
Dornell Pete	Albuquerque Area Southwest Tribal Epidemiology Center
Priscilla Sanderson	Northern Arizona University
Hannah Sehn	Community Outreach and Patient Empowerment Project
Samuel Swift	New Mexico Department of Health
Charles Wiggins	New Mexico Tumor Registry
Del Yazzie	Navajo Epidemiology Center
Hendrik Deheer	Northern Arizona University
Sara Selig	Brigham and Women's Hospital, Community Outreach and Patient Empowerment Project

We extend further appreciation to the following organizations for their contributions and support:

Arizona Department of Health Services	New Mexico Department of Health
Diné College	Northern Arizona University
Navajo Area Indian Health Service	University of New Mexico
Navajo Nation Department of Health	University of Arizona
Navajo Nation Human Research Review Board	Utah Department of Health



Population-based cancer incidence data were collected from New Mexico Tumor Registry, Arizona Cancer Registry and Utah Cancer Registry that jointly cover the geographic area of the Navajo Nation. The New Mexico Tumor Registry and Utah Cancer Registry are members of the National Cancer Institute's Surveillance, Epidemiology, and End Results (SEER) Program. The Arizona Cancer Registry participates in the Center for Disease Control and Prevention's National Program of Cancer Registries (NPCR). Data from these registries are routinely linked with the Indian Health Service (IHS) patient records to identify cases as Navajo. These data are used as numerators for the cancer incidence rate calculations. Cancers were coded and classified according to prevailing standards as summarized in the International Classification of Diseases – Oncology (ICD-10).¹⁶

The comparison group used in this report were non-Hispanic whites (NHW) of Arizona and New Mexico. We used county-level population estimates produced by the US Census Bureau as denominators in the rate calculations.

DATA SUMMARY

- From 2005-2013, the cancers with the ten highest incidence counts among the Navajo were female breast, colorectal, stomach, prostate, kidney, uterine, stomach, non-Hodgkin lymphoma, pancreas, liver, and lung.
- In comparing the incidence rates of cancers by gender, Navajo men were more likely to be diagnosed with cancer. Prostate cancer was the most commonly diagnosed cancer among Navajo men, followed by colorectal cancer, kidney cancer, and stomach cancer. Among Navajo women, breast cancer was the most commonly diagnosed cancer, followed by colorectal cancer and uterine cancer, and kidney cancer.

Cancer incidence and cancer incidence rate are two measurements that inform us about the burden of cancer within a population.

The terms cancer incidence and cancer incidence rate are often used interchangeably, however there is a difference in definition. Cancer incidence (synonymous with incident number) is defined as the number of new cancers of a specific site or type diagnosed in a specified period of time.

Cancer incidence rate is the number of new cancers of a specific site or type diagnosed in a specified period of time among a defined population. In other words, it is the

cancer incidence count divided by the number of people in the entire population at risk.

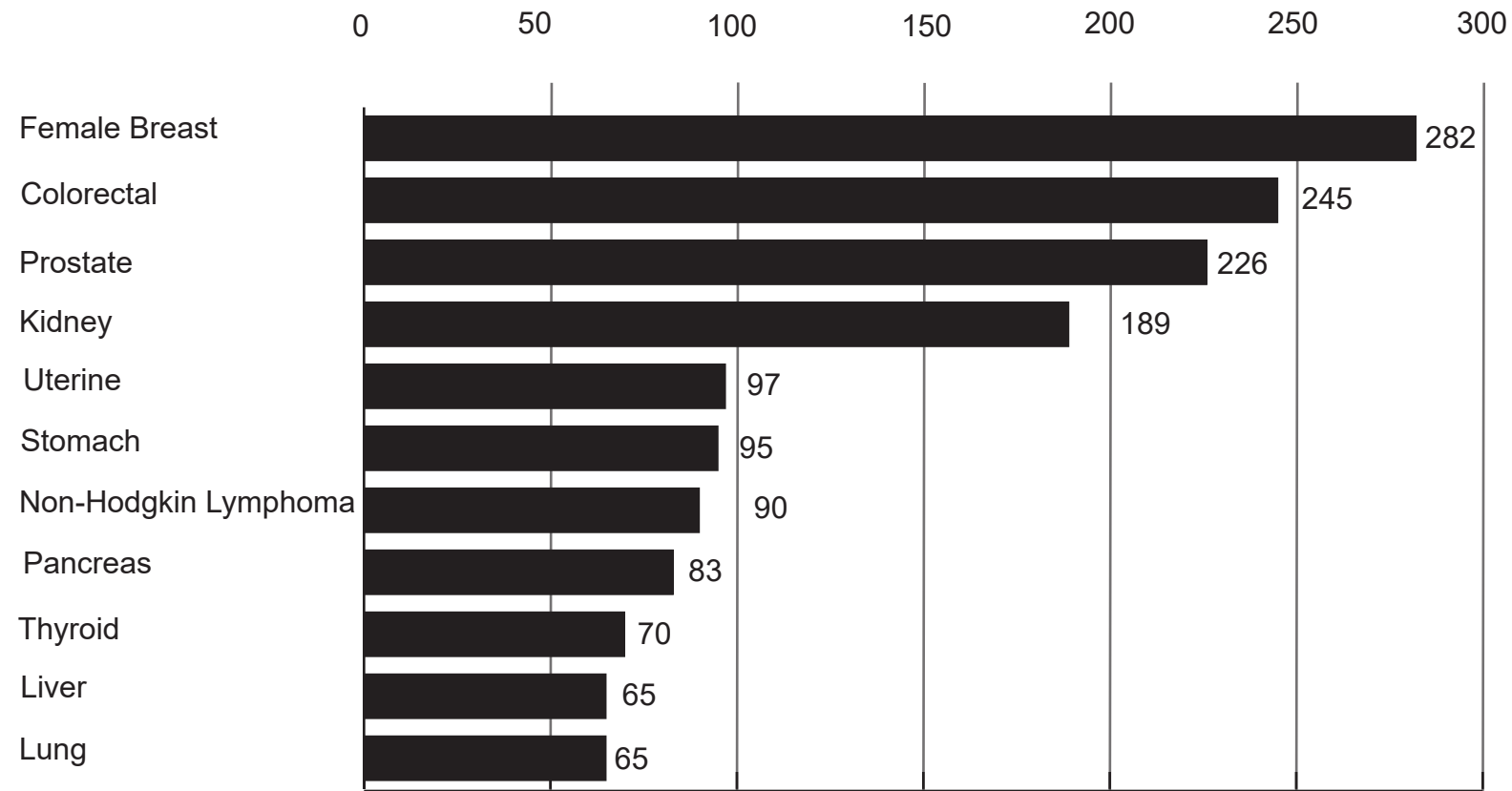
The numerator of the incidence rate is the number of new cancers; the denominator is the population size.

In the following tables, the incidence rates were age-adjusted. It is known that older people are more likely to have cancer than younger people and the age-distribution of different populations often differ. For example, group A may tend to be older on average than group B because they are at higher risk simply because they represent an older population. Therefore, to

accurately compare rates of two populations with differing age distributions, the age groups of one population needs to be weighted to the age distribution of the comparison population. This technique is called age standardization. Age standardization results in a weighted average of the age-specific rates. The standardization produces the rate expected if the populations being compared had identical age distributions. In this report, the rates were age standardized to the 2000 U.S. standard population.

$$\text{Incidence rate} = \frac{\text{Number of Cancer deaths}}{\text{Population at risk} \times 100,000}$$

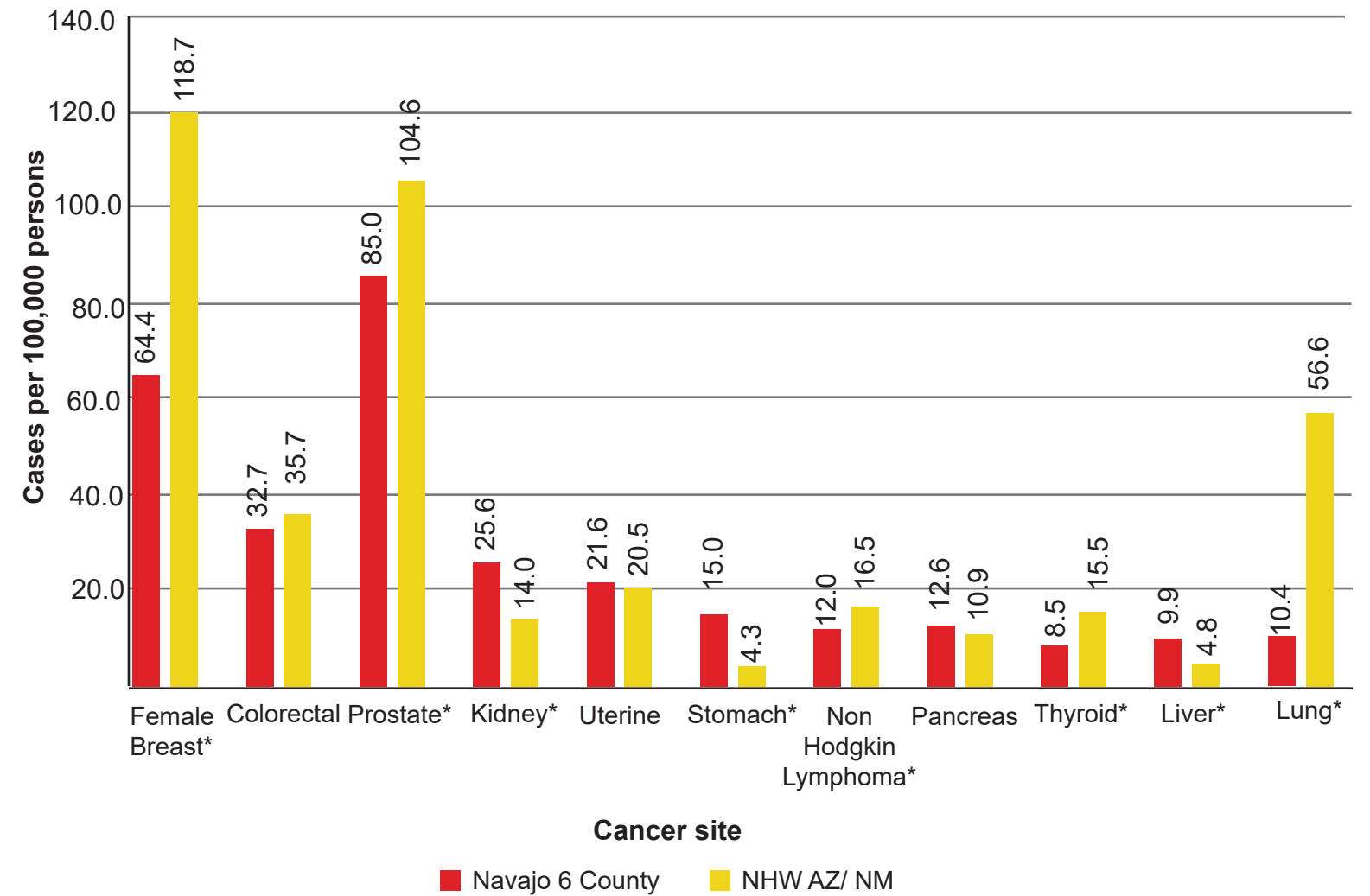
Figure 1. The most commonly diagnosed cancers among the Navajo^{1,a}, counts of cancer cases, 2005-2013, males and females combined, all ages



Source: ¹ Arizona Cancer Registry, New Mexico Tumor Registry and Utah Cancer Registry.
^aAmerican Indian/ Alaskan Native cancer incidence data in the six counties that comprise of most of Navajo Nation were used as a proxy for navajo cancer incidence rates; the six counties include: Apache County (AZ), Coconino County (AZ), Navajo County (AZ), McKinley County (NM), San Juan County (NM).

From 2005-2013, the cancers with the highest incidence counts among the Navajo were female breast, colon and rectum (colorectal), prostate, kidney and renal pelvis (kidney), corpus and uterus, NOS (uterine), stomach, non-Hodgkin lymphoma, pancreas, thyroid, liver and intrahepatic bile duct (liver), and lung and bronchus (lung).

Figure 2. The most commonly diagnosed cancers among the Navajo^{1,a}, non-Hispanic whites, average age adjusted cancer incidence rates^b, 2005-2013, males and females combined, all ages



Source: ¹ Arizona Cancer Registry, New Mexico Tumor Registry and Utah Cancer Registry.

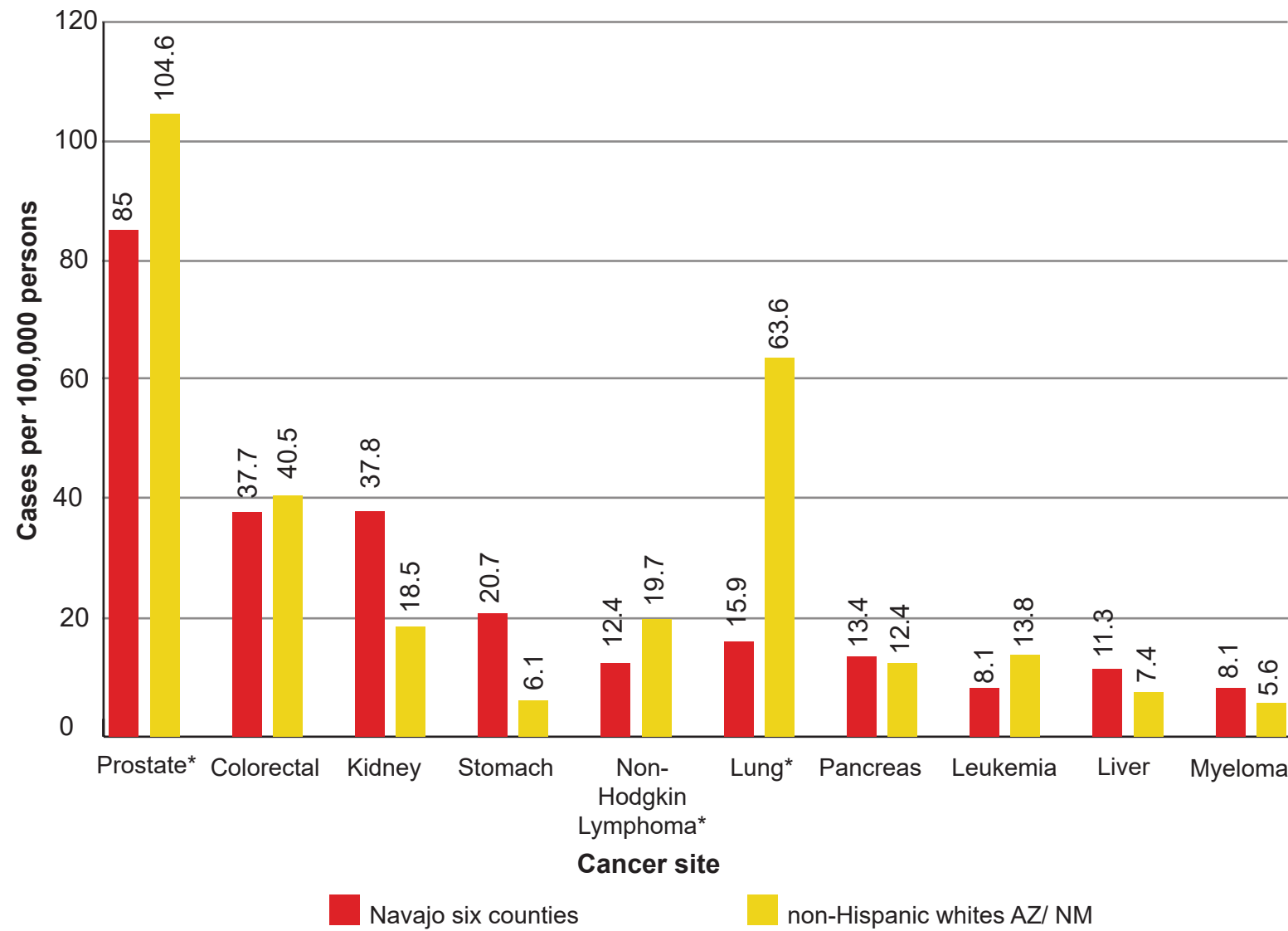
^aAmerican Indian/ Alaskan Native cancer incidence data in the six counties that comprise of most of Navajo Nation were used as a proxy for navajo cancer incidence rates; the six counties include: Apache County (AZ), Coconino County (AZ), Navajo County (AZ), McKinley County (NM), San Juan County (NM).

^bRates per person 100,000 persons and are age-adjusted to the 2000 U.S. standard population.

*p<0.05

The leading cancer incidence for Navajo compared to NHW of Arizona and New Mexico, among males and females combined are shown above. Significantly lower incidence of female breast (RR=0.54), prostate (RR=0.81), non-Hodgkin lymphoma (RR=0.73), thyroid (RR=0.55), and lung cancers (RR=0.18) were observed among the Navajo than the NHW comparison group. Significantly higher incidence of kidney (RR=1.84), stomach (RR=3.52), and liver (RR=2.05) cancers were observed for the Navajo compared to NHW. The incidence of colorectal, uterine, and pancreatic cancers were similar for both Navajos and NHWs.

Figure 3. The most commonly diagnosed cancers among the Navajo^{1,a}, compared to non-Hispanic Whites average age-adjusted cancer incidence rates^b, 2005-2013, males only all ages



Source: ¹ Arizona Cancer Registry, New Mexico Tumor Registry and Utah Cancer Registry.

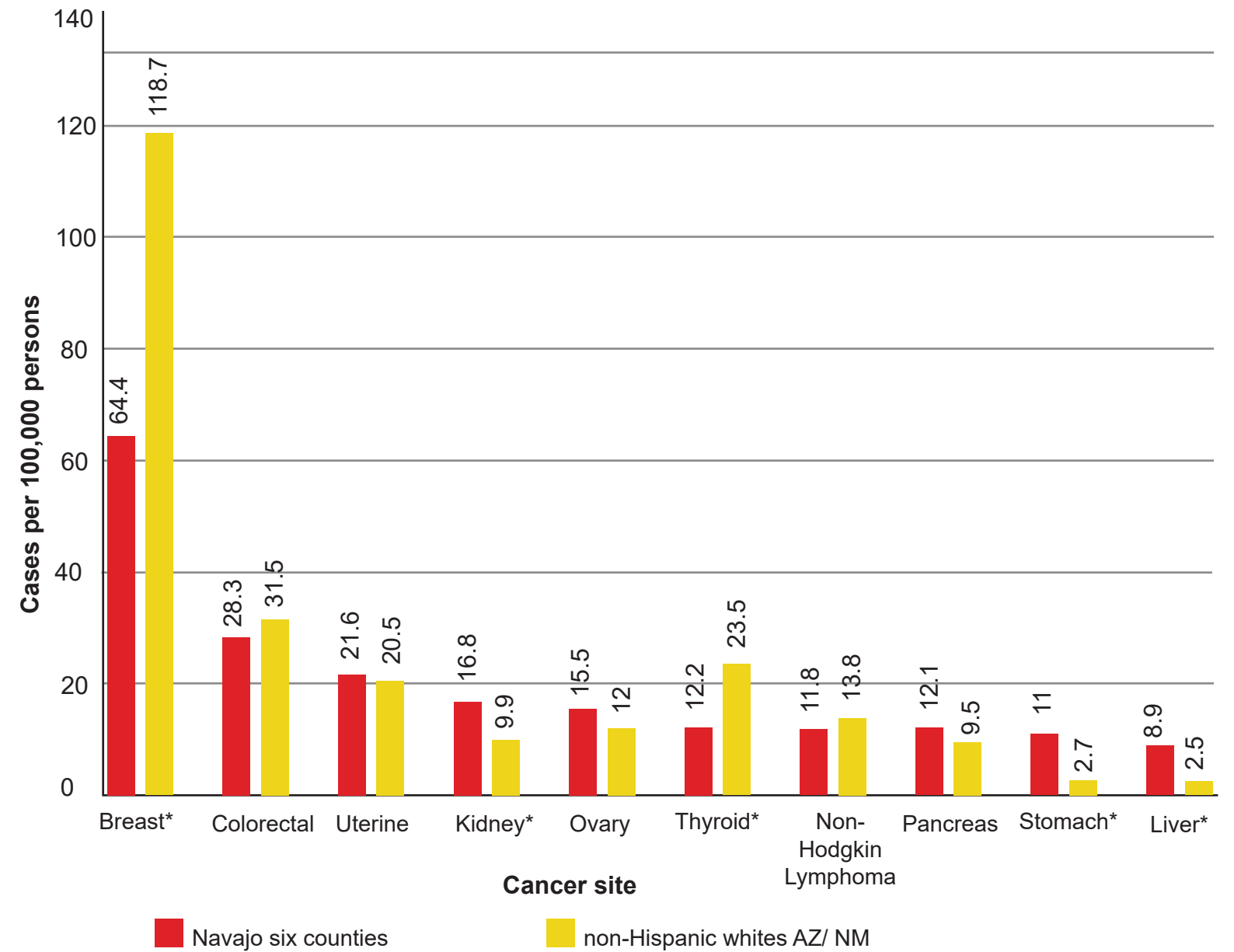
^aAmerican Indian/ Alaskan Native cancer incidence data in the six counties that comprise of most of Navajo Nation were used as a proxy for navajo cancer incidence rates; the six counties include: Apache County (AZ), Coconino County (AZ), Navajo County (AZ), McKinley County (NM), San Juan County (NM).

^bRates are per 100,000 persons and are age-adjusted to the 2000 U.S. standard population.

*p < 0.05

The leading cancer incidence for Navajo males and how they compare to NHW males of Arizona and New Mexico are shown above. Prostate cancer is the most commonly diagnosed cancer among Navajo males. Compared to NHW males, Navajo males had significantly higher incidence for kidney (RR=2.04), stomach (RR=3.38) and liver (RR=1.52) cancers. Navajo males had significantly lower incidence for prostate (RR=0.81), non-Hodgkin lymphoma (RR=0.63), lung (RR=0.25) and leukemia (RR=0.59) compared to NHW males. The incidence of colorectal, pancreas, and myeloma cancers were similar for both Navajo and NHW males.

Figure 4. The most commonly diagnosed cancers among the Navajo^{1,a}, compared to non-Hispanic Whites average age-adjusted cancer incidence rates^b, 2005-2013, females only all ages



Source: ¹ Arizona Cancer Registry, New Mexico Tumor Registry and Utah Cancer Registry.

^aAmerican Indian/ Alaskan Native cancer incidence data in the six counties that comprise of most of Navajo Nation were used as a proxy for navajo cancer incidence rates; the six counties include: Apache County (AZ), Coconino County (AZ), Navajo County (AZ), McKinley County (NM), San Juan County (NM).

^bRates are per 100,000 persons and are age-adjusted to the 2000 U.S. standard population.

*p < 0.05

The leading cancer incidence for Navajo women compared to NHW women of Arizona and New Mexico. Among Navajo women incidence of kidney, stomach, and liver cancers were higher than NHW women. For breast, colorectal, and thyroid cancers the incidence were lower compared to NHW women. The incidence for ovary, uterine, non-Hodgkin lymphoma, and pancreatic cancers were similar for both Navajo and NHW women.



METHODOLOGY

We examined derived summary stage 2000 cancer staging data obtained from the New Mexico Tumor Registry (SEER), Arizona Cancer Registry (NPCR) and Utah Cancer Registry (SEER) for cases that were diagnosed during the period 2005-2013.¹⁸

Data for NHW in Arizona and New Mexico are presented in this report for comparison. Cancer staging data are presented in proportions – the number of cases diagnosed in a particular stage category divided by the total cases diagnosed for that particular cancer. The categories of stages used were localized, regional, distant, and unstaged or unknown. When looking at some cancer sites we limited them to certain age groups corresponding to standard cancer screening recommendations by the U.S. Preventive Services Task Force (USPSTF) and supported by CDC. For example, female breast cancer stage data was limited to cases diagnosed in women 50 years of age and older because USPSTF recommends mammography screening in average-risk women in this age group. Racial differences in stage were tested using Chi-square statistics (Appendix B). Statistical significance was set at P<0.05.

Cancer staging describes the extent to which the patient's cancer has spread. Doctors design a treatment plan that is best for addressing a patient's disease, and identify clinical trials that may be helpful based on cancer staging. Staging can also be used to estimate a person's prognosis or likely outcome from cancer treatment.

Staging is based on knowledge of the way cancer develops. Cancer cells divide and grow without control or order. They can break away from the primary site of growth and enter the bloodstream or lymphatic system to form new tumors in other

organs of the body. This spread of cancer is called metastasis. As we learn more about cancer, different staging systems have evolved over time.

Staging systems that are used by doctors are generally more detailed and complex than are those used by cancer registries. In this report, we used a cancer registry summary staging system that can be expressed in the following categories:

- **In situ** cancer that is present only in the layer of cells in which it began.
- **Localized** cancer that is limited to the organ in which

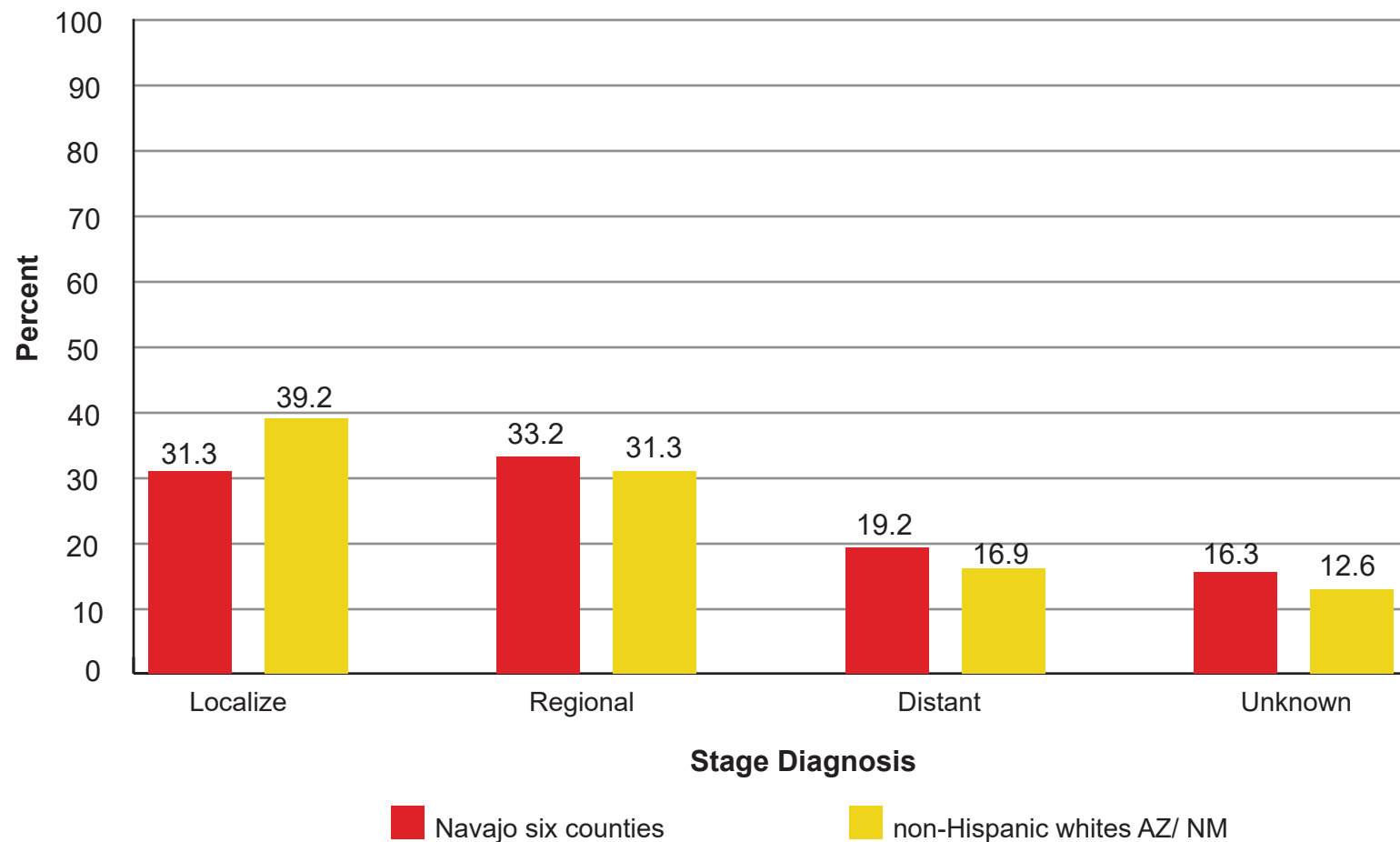
it began, without evidence of spread.

- **Regional** cancer that has spread beyond the original (primary) growth site to nearby lymph nodes or organs and tissues.
- **Distant** cancer that has spread from the primary growth site to distant organs or distant lymph nodes.
- **Unknown or Unstaged** is used to describe cases for which there is not enough information to indicate a stage.

DATA SUMMARY

- Colorectal cancer cases among Navajo males and females were mostly diagnosed in the regional stage whereas most cases were diagnosed in localized stage for non-Hispanic whites.
- Among Navajo females over half of breast cancer cases were diagnosed in the local stage but this proportion of early stage cancers was even higher among non-Hispanic white females.
- Navajo females (52.9%) were less likely to be diagnosed at the local stage than non-Hispanic white females (61.7%).
- Cervical cancer cases among Navajo females were equally as likely to be diagnosed in the local and regional stages and were similar to the proportions for non-Hispanic white females.

Figure 5. Colorectal cancer (age 50+) stage at diagnosis for Navajos^{1,a} compared to non-Hispanic whites, 2005 to 2013, males and females combined



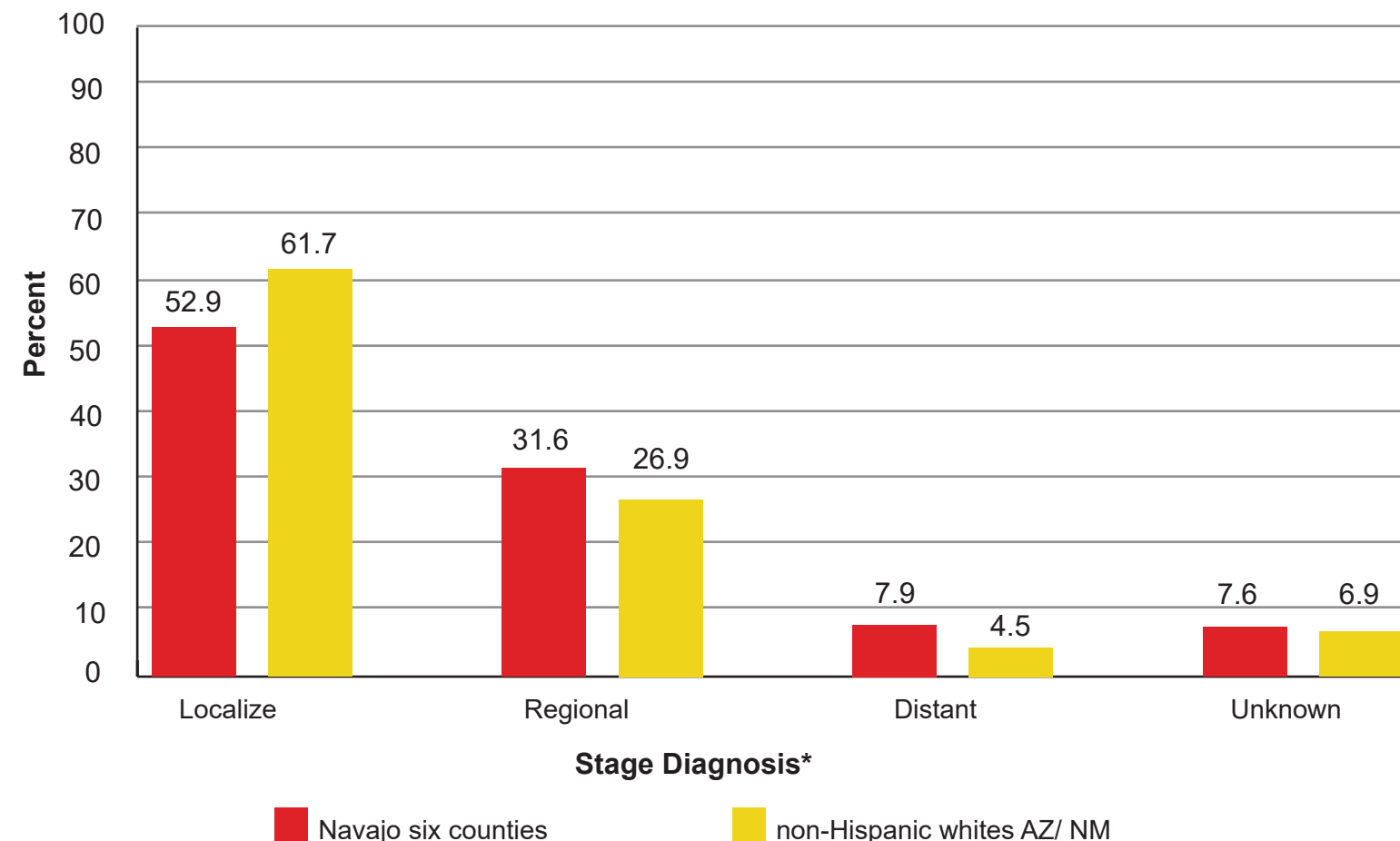
Source: ¹ Arizona Cancer Registry, New Mexico Tumor Registry and Utah Cancer Registry.

^aAmerican Indian/ Alaskan Native cancer incidence data in the six counties that comprise of most of Navajo Nation were used as a proxy for navajo cancer incidence rates; the six counties include: Apache County (AZ), Coconino County (AZ), Navajo County (AZ), McKinley County (NM), San Juan County (NM).

*Proportions are statistically different at p< 0.05

The percent distribution of stage for colorectal cancer is statistically different for Navajos and NHWs. A slightly higher percentage (52.4%) of colorectal cancer cases were diagnosed in the regional and distant stage among Navajo adults (ages 50+) compared to NHW of Arizona and New Mexico (48.2%). Cancer diagnosed in the localized stage is easier to treat and has better survival than distant cancer; however, fewer colorectal cancer cases were diagnosed at the local stage among Navajo adults (31.3%) compared to NHW of Arizona and New Mexico (39.2%).

Figure 6. Female breast cancer (age 40+) stage at diagnosis for Navajos^{1,a} compared to non-Hispanic whites, 2005 to 2013



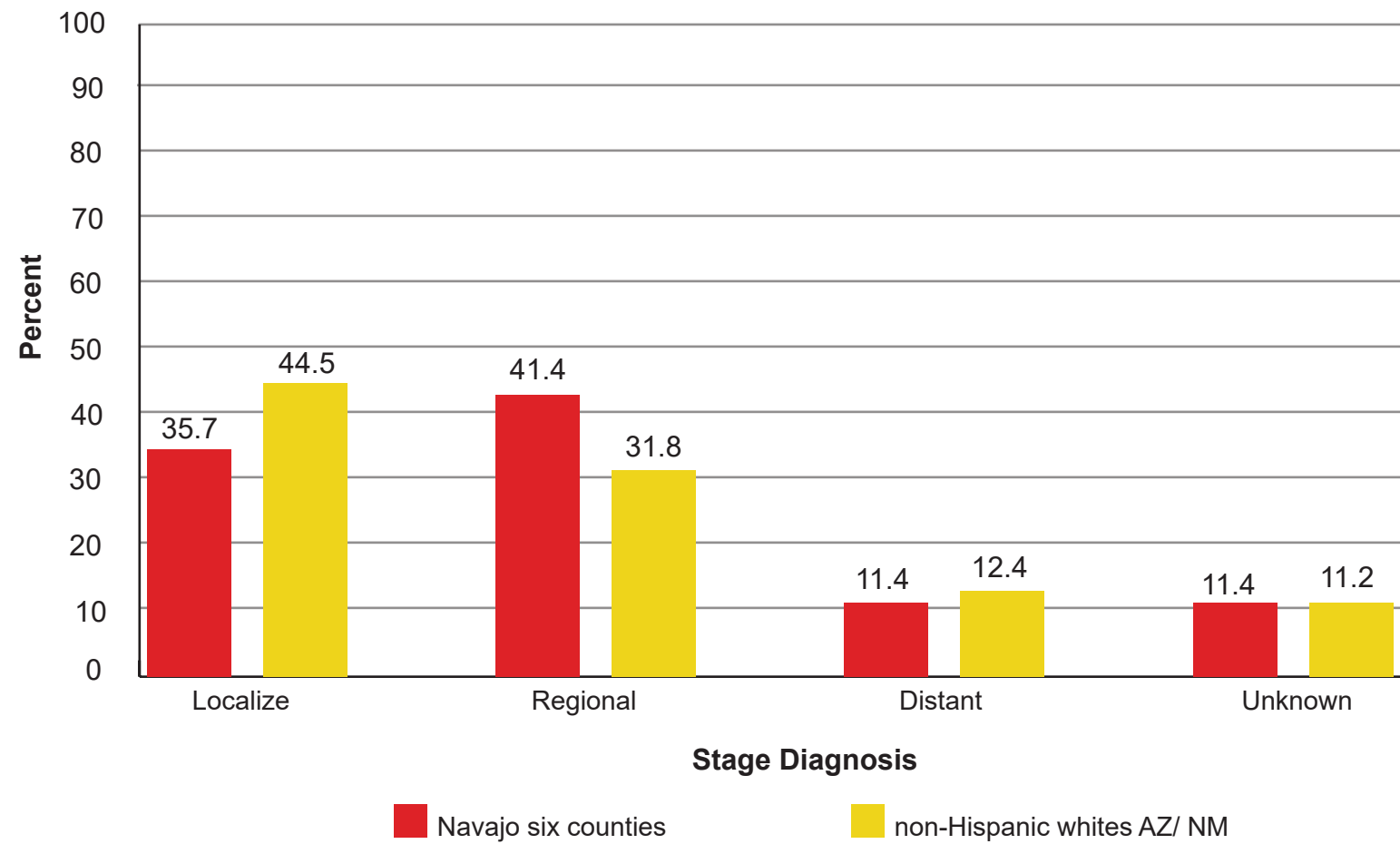
Source: ¹ Arizona Cancer Registry, New Mexico Tumor Registry and Utah Cancer Registry.

^aAmerican Indian/ Alaskan Native cancer incidence data in the six counties that comprise of most of Navajo Nation were used as a proxy for navajo cancer incidence rates; the six counties include: Apache County (AZ), Coconino County (AZ), Navajo County (AZ), McKinley County (NM), San Juan County (NM).

*Proportions are statistically different at p< 0.05

The percent distribution of stage for female breast cancer is statistically different for Navajos and NHWs. A large proportion of breast cancer cases were diagnosed in the localized stage among Navajo females ages 40+ (52.9%), which was lower than NHW females of Arizona and New Mexico (61.7%). The proportion of breast cancer cases diagnosed at the regional stage was higher among Navajo females (31.6%) compared to NHW females of Arizona and New Mexico (26.9%). There was also a higher proportion of breast cancer cases diagnosed at the distant stage in Navajo females (7.9%) than NHW females of Arizona and New Mexico (4.5%).

Figure 7. Cervical cancer (age 20+) stage at diagnosis for Navajos^{1,a} compared to non-Hispanic whites, 2005 to 2013, females only



Source: ¹ Arizona Cancer Registry, New Mexico Tumor Registry and Utah Cancer Registry.

^aAmerican Indian/ Alaskan Native cancer incidence data in the six counties that comprise of most of Navajo Nation were used as a proxy for navajo cancer incidence rates; the six counties include: Apache County (AZ), Coconino County (AZ), Navajo County (AZ), McKinley County (NM), San Juan County (NM).

The percent distribution of stage for cervical cancer was not statistically different for Navajos and NHWs. A large proportion of cervical cancer cases were diagnosed in the local and regional stage among Navajo females (age 20+), which was 77.1 percent.

SCREENING



Cancer screening tests are designed to clinically test asymptomatic or symptomatic individuals that may be at (average) risk for a particular type of cancer. The main purpose of screening is to detect cancers early in their development and

implement a treatment plan to improve survival outcome. This chapter focuses on three common cancer screening tests – Papanicolaou (Pap) test, Mammography, Colorectal tests (fecal occult blood test, sigmoidoscopy, colonoscopy).

The screening test for lung cancer was not available during the time period of this report (2005-2013).

METHODOLOGY

Navajo-specific screening estimates were selected from the Navajo Area IHS Government Performance and Results Act (GPRA) measures.²⁸ The GPRA is a federal reporting system that evaluates the performance of the healthcare system of the Navajo Area IHS by monitoring key health measurements. Within the panel of IHS GPRA health measures are the cancer screening measurements, which report annual screening rates for pap test, mammogram, and colorectal screening. Pap test, mammography, and colorectal screening rates have specific numerator and denominator definitions. In general, the numerators are the number of patients with documented screening test and patients who refused the test in the past year of the reporting period; and the denominators are the number of patients who were seen in the Navajo Area IHS during the reporting period.

Another Navajo-specific screening measurement tool used was the Navajo Nation Health Survey (only data from Chinle and Northern Agencies were available at the time of report), a Navajo-adapted version of the CDC Behavioral Risk Factor Surveillance System (BRFSS).²⁹ The CDC BRFSS is a national premiere health survey that collects self-reported data on U.S. residents regarding their health-related risk behaviors, chronic health conditions, and use of preventive services. Included in the survey are questions about cancer screening related to Pap test, mammography, and colorectal screening tests. Additionally, the AI/AN and NHW cancer screening estimates were collected from the BRFSS for the six counties.

The Healthy People 2020 target measurement for screening was also used to show established benchmarks for improving the health of all U.S. residents. The U.S. Department of Health and Human Services provides the benchmarks for the U.S. with regard to health promotion and disease prevention.

DATA SUMMARY

- Mammography screenings are lowest among the Navajo females in the IHS GPRA data, with over half of Navajo females having a recommended mammogram. In contrast, a much higher estimate (90 percent) of mammography screening was observed in Navajo females in the Northern Agency survey.
- Likewise, Pap screenings were observed to be the lowest for Navajo females in the IHS GPRA data, with over half of Navajo females having a recommended Pap test. Regardless of the data source, Navajo females have not met the Healthy People 2020 target percentages for recommended Pap tests.
- For colorectal screenings, Navajos report lower recommended colorectal screenings than the non-Hispanic white population. In addition, colorectal screening estimates for Navajos are below the recommended Health People target of 70.5 percent.

TABLE 1: Cancer screening prevalence for Navajo, American Indians/Alaska Natives, and non-Hispanic whites from multiple data sources.

Data Source	Year	Mammography	Papanicolaou (Pap) Test	Colorectal
		Percent (%)	Percent (%)	Percent (%)
Navajo Area IHS GPRA ¹	2015	52.0	53.5	35.7
Area-Wide GPRA (federal & tribal) ²	2015	52.2	54.3	34.6
Navajo Nation Health Survey ³				
Chinle Agency, Northern Agency	2013	70.6	64.7	20.8
	2015	90.3	76.5	44.1
AI/AN in six counties, BRFSS ⁴	2006, 2008, 2010	75.2	83.6	32.4
Non-Hispanic white in six counties, BRFSS ³	2006, 2008, 2010	78.4	86.2	57.4
Healthy People 2020 Target ⁵	N/A	81.1	93.0	70.5

¹ Pap test in the past 3 years for females age 24-64yrs, or Pap test in the past 3 years for females age 30-64; or either a Pap test in the past 3 years and a HPV DNA documented in the past 5 years, includes active clinical patients in IHS facilities only (Chinle, Crownpoint, Gallup, Kayenta, and Shiprock). Mammography among females aged 50-74; Colorectal cancer screening among adults aged 50 to 75 years; <https://www.healthypeople.gov/2020/topics-objectives/topic/cancer>. Note: Tuba City, Utah Navajo Health Systems, and Sage Memorial Hospital do not participate in GPRA reporting.

² Pap test in the past 3 years for females age 24-64yrs, or Pap test in the past 3 years for females age 30-64; or either a Pap test in the past 3 years and a HPV DNA documented in the past 5 years, includes active clinical patients in both IHS and tribal facilities (Chinle, Crownpoint, Fort Defiance, Gallup, Kayenta, Shiprock, and Winslow). Mammography among females aged 50-74; Colorectal cancer Screening among adults aged 50 to 75 years; <https://www.healthypeople.gov/2020/topics-objectives/topic/cancer>. Note: Tuba City, Utah Navajo Health Systems, and Sage Memorial Hospital do not participate in GPRA reporting.

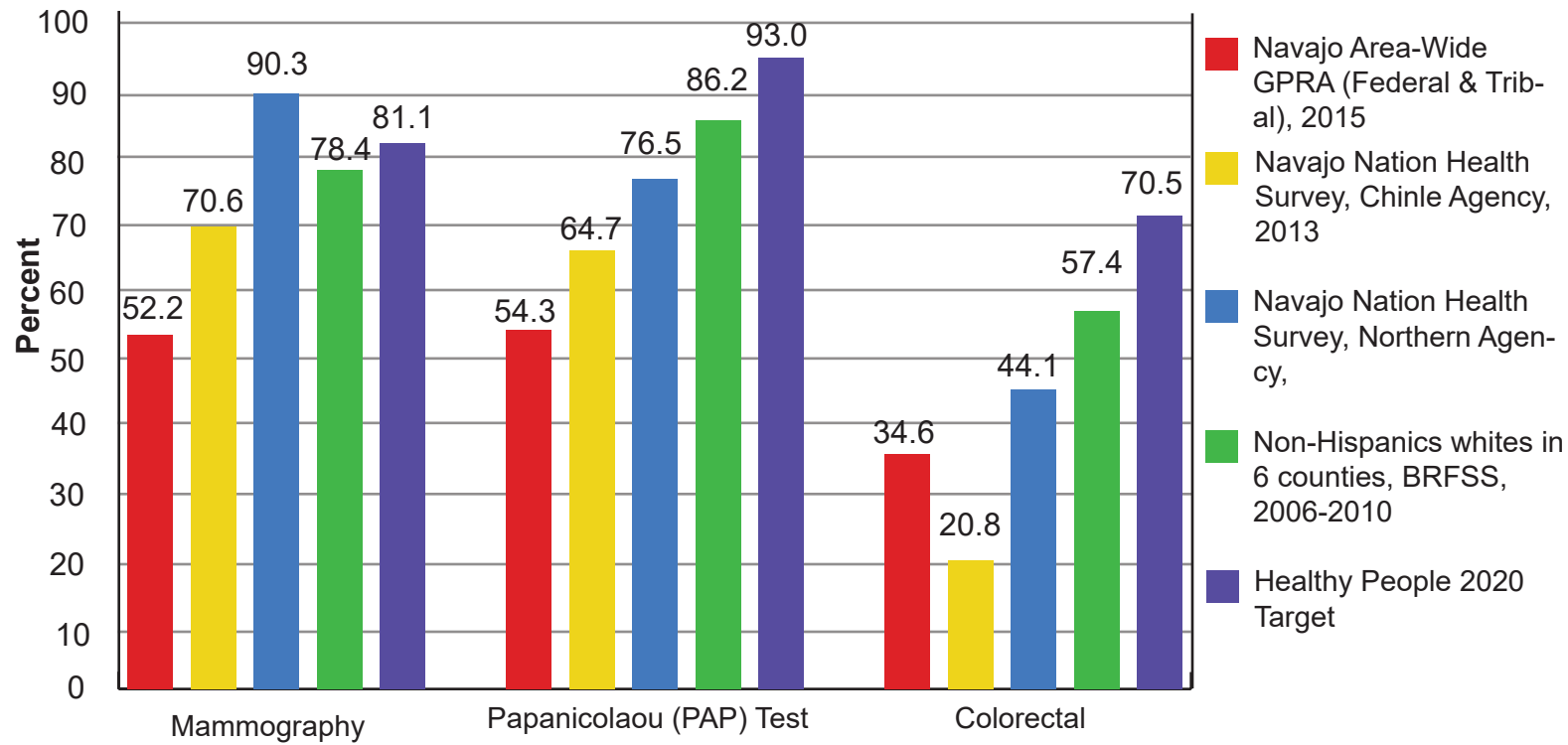
³ Navajo-adapted version (Navajo language translation) of the Centers for Disease Control and Prevention Behavioral Risk Factor Surveillance System; <http://www.cdc.gov/brfss/index.html>. Pap test in the past 3 years for females age 24-64yrs, or Pap test in the past 3 years for females age 30-64; Mammography among females aged 50-74; Colorectal cancer Screening among adults aged 50 to 75 years; <https://www.healthypeople.gov/2020/topics-objectives/topic/cancer>.

⁴ Pap test in the past 3 years for females age 21-65yrs, and without hysterectomy; Mammography in past 2 years for females age 50-74yrs; Fecal occult blood or endoscopy in past 5 years, age 50-74yrs; includes any AI/AN in the 6 counties of Arizona (Apache, Coconino, Navajo), Utah (San Juan), and New Mexico (San Juan and McKinley). Note: weighted percentages.

⁵ Pap test among females aged 21-65 years; Mammography among females aged 50-74; Colorectal cancer Screening among adults aged 50 to 75 years; <https://www.healthypeople.gov/2020/topics-objectives/topic/cancer>.

N/A= Not Available

Figure 8. Cancer screening prevalence for Navajo and non-Hispanic Whites



MORTALITY



Cancer mortality rates measure, at the population level, either the risk of dying from a specific type of cancer or from all cancers. These rates are important indicators of the burden of cancer, and are the preferred measure for evaluating secondary prevention programs. Reduction in cancer mortality is the standard

measure for evaluating cancer control efforts.¹⁷ The definition of cancer mortality rate is the number of persons dying during a specified period over in a specified population. The cancer mortality rate is expressed as cancer deaths per 100,000 population.

Given that the AI/AN population was younger than the U.S. NHW population, and for reasons of comparability with recent analyses and publications, mortality rates presented in this report have been age-adjusted by the direct method (or age standardization) with the U.S. 2000 standard population.

$$\text{Mortality Rate} = \frac{\text{Number of Cancer deaths}}{\text{Population at risk} \times 100,000}$$

METHODOLOGY

The AI/AN vital events data were collected from data furnished by National Centers for Health Statistics (NCHS) to the IHS. NCHS obtains birth and death records for all U.S. residents from the state health departments on the basis of information reported on official state birth and death certificates. The records received from NCHS by IHS do not contain names, addresses, tribal identity, or medical record identification numbers. Each vital record includes the single underlying cause of death and this is determined by following a standard criteria and data listed on the death certificate. The records also contain county of residence, which allowed selection of deaths of residents in the six counties that comprise the Navajo Nation.¹² For this report we examined only those AI/AN deaths for which the underlying cause of death was cancer, as determined by International Classification of Diseases, (ICD-10) codes. The cause of death recode as defined by the National Cancer Institute's Surveillance, Epidemiology, and End Results (SEER) Program was used.²² These data were used as numerators in the cancer mortality rate calculations.

The AI/AN population counts (i.e., the denominator in the mortality rate calculations) were based on 2000 U.S. Census Bureau county population estimates. During the decennial census, the U.S. Census Bureau counts those persons who identify themselves as AI/AN.

The Arizona and New Mexico NHW mortality and population data were derived from the National Cancer Institute's SEER database.²³ We calculated standardized rate ratios for Navajos using NHW rates as comparisons (Appendix C). P-values were also calculated and were used to determine whether rate differences between Navajos and NHW were statistically different. Statistical significance was set at P<0.05.

DATA SUMMARY

- The most common causes of cancer deaths (by counts) among the Navajo were from colon and rectum (colorectal) cancer, followed by stomach, pancreas, female breast, liver and intrahepatic bile duct (liver), prostate, kidney and renal pelvis (kidney), lung and bronchus (lung), ovary, and gallbladder cancers (Figure 9).

Navajos are eighty-five percent less likely to pass away from lung cancer and thirty-nine percent less likely to pass away from female breast cancer than non-Hispanic whites.

Navajos are 7.2 times more likely to pass away from gallbladder cancer, 4.4 times more likely to pass away from stomach cancer, 2.1 times more likely to pass away from kidney cancer, and 1.8 times more likely to pass away from liver cancer than non-Hispanic whites.

- Among Navajo males the leading causes of death from cancer were from prostate cancer, followed by stomach, colorectal, pancreas, kidney, liver, lung, lymphoma, esophageal, leukemia, and gallbladder cancers (Figure 11).

Navajo males are eighty-three percent less likely to pass away from lung cancer, fifty-nine percent less likely to pass away from leukemia, forty-eight less likely to pass away from esophageal cancer, and forty-three percent less likely to pass away from lymphoma cancer than non-Hispanic white males.

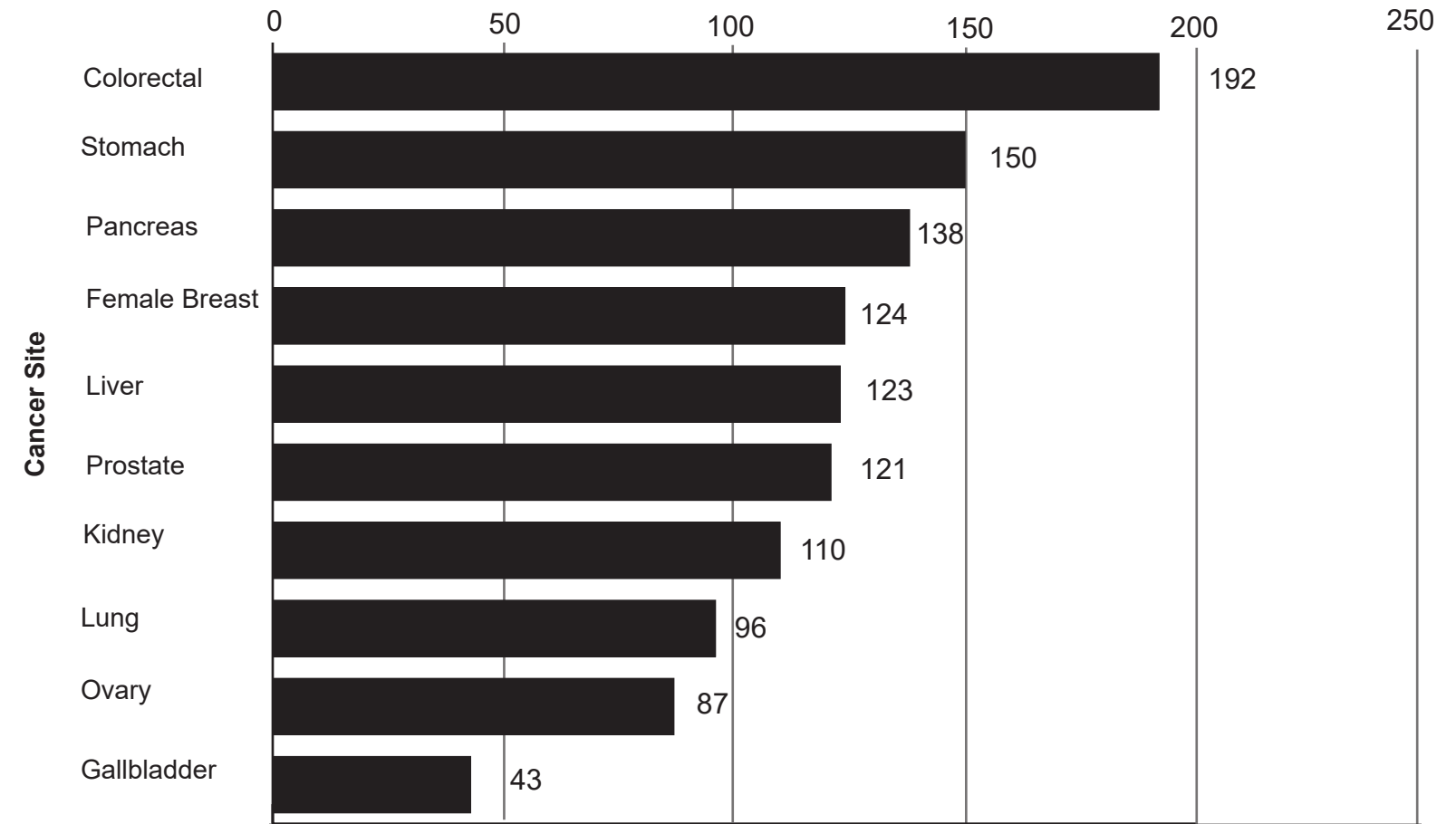
Navajo males are 7.3 times more likely to pass away from gallbladder cancer, 4.9 times more likely to pass away from stomach cancer, and 2.1 times more likely to pass away from kidney cancer than non-Hispanic white males.

- Among Navajo females the leading causes of death from cancer were from breast cancer followed by colorectal, ovary, pancreas, liver, stomach, kidney, lung, lymphoma, and gallbladder cancers (Figure 12).

Navajo females are eighty-seven percent less likely to pass away from lung cancer and thirty-nine percent less likely to pass away from breast cancer than non-Hispanic white females.

Navajo females are 6.8 times more likely to pass away from gallbladder cancer, 4.1 times more likely to pass away from stomach cancer, 2.3 times more likely to pass away from liver cancer, and 2.2 times more likely to pass away from kidney cancer than nonHispanic white females.

Figure 9. Leading causes of death by cancer site among the Navajo^{1,a}, counts of deaths 2005-2013, all ages

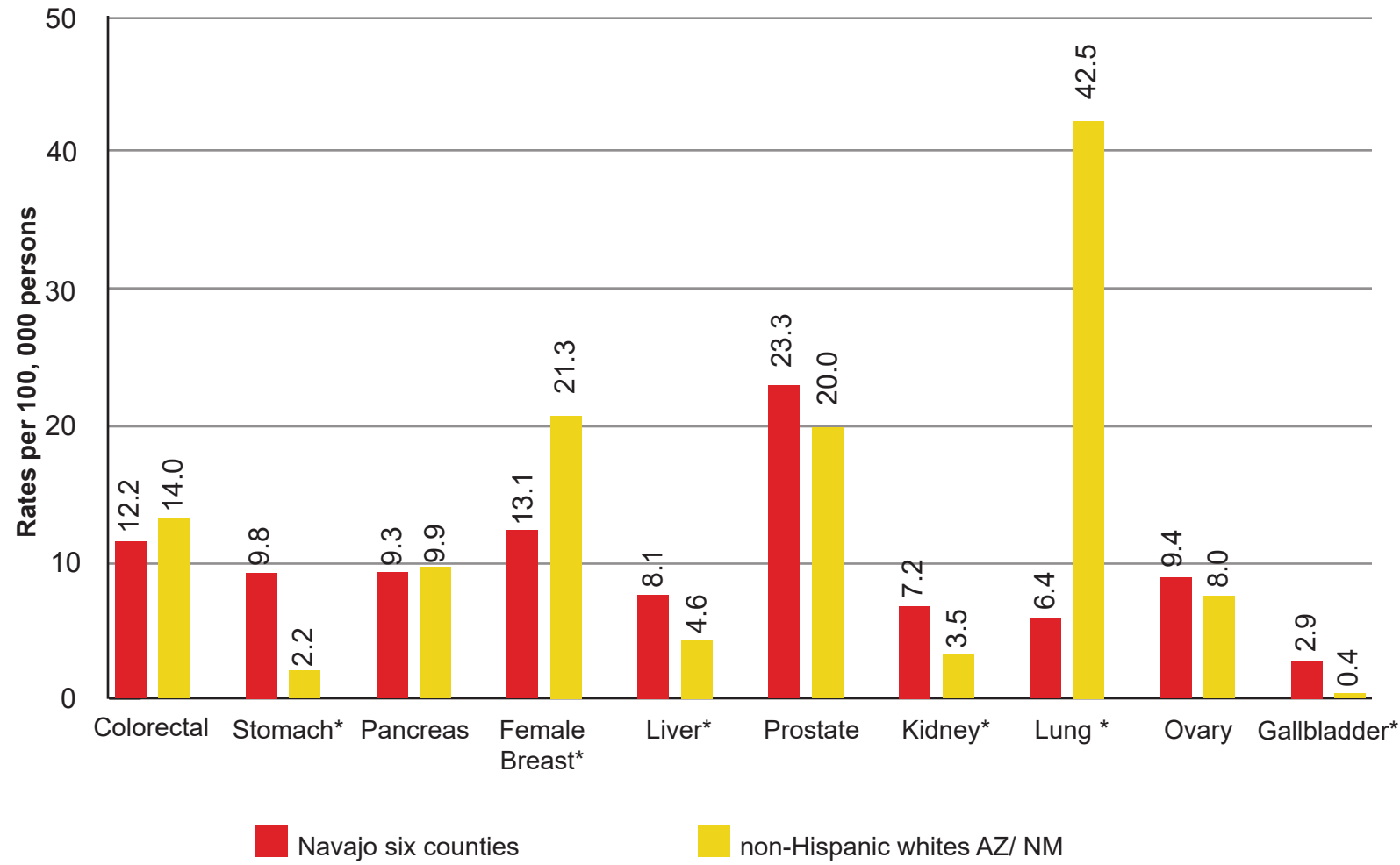


Source: ¹Mortality data provided by National Center for Health Statistics.

^a American Indian/Alaska Native cancer mortality data in the six counties that comprise most of Navajo Nation were used as a proxy for Navajo cancer mortality rates; the six counties included: Apache County (AZ), Coconino County (AZ), Navajo County (AZ), McKinley County (NM), San Juan County (NM), San Juan County (UT).

The most common causes of cancer deaths (by counts) among the Navajo were from colorectal cancer, followed by stomach, pancreas, female breast, liver, prostate, kidney, lung, ovarian, and gallbladder cancers.

Figure 10. Age-adjusted cancer mortality rates^{1,a} among the Navajo in Arizona^b, New Mexico, and Utah by cancer site and ethnicity, 2005-2013, males and females combined, all ages



Source: ¹Mortality data provided by National Center for Health Statistics.

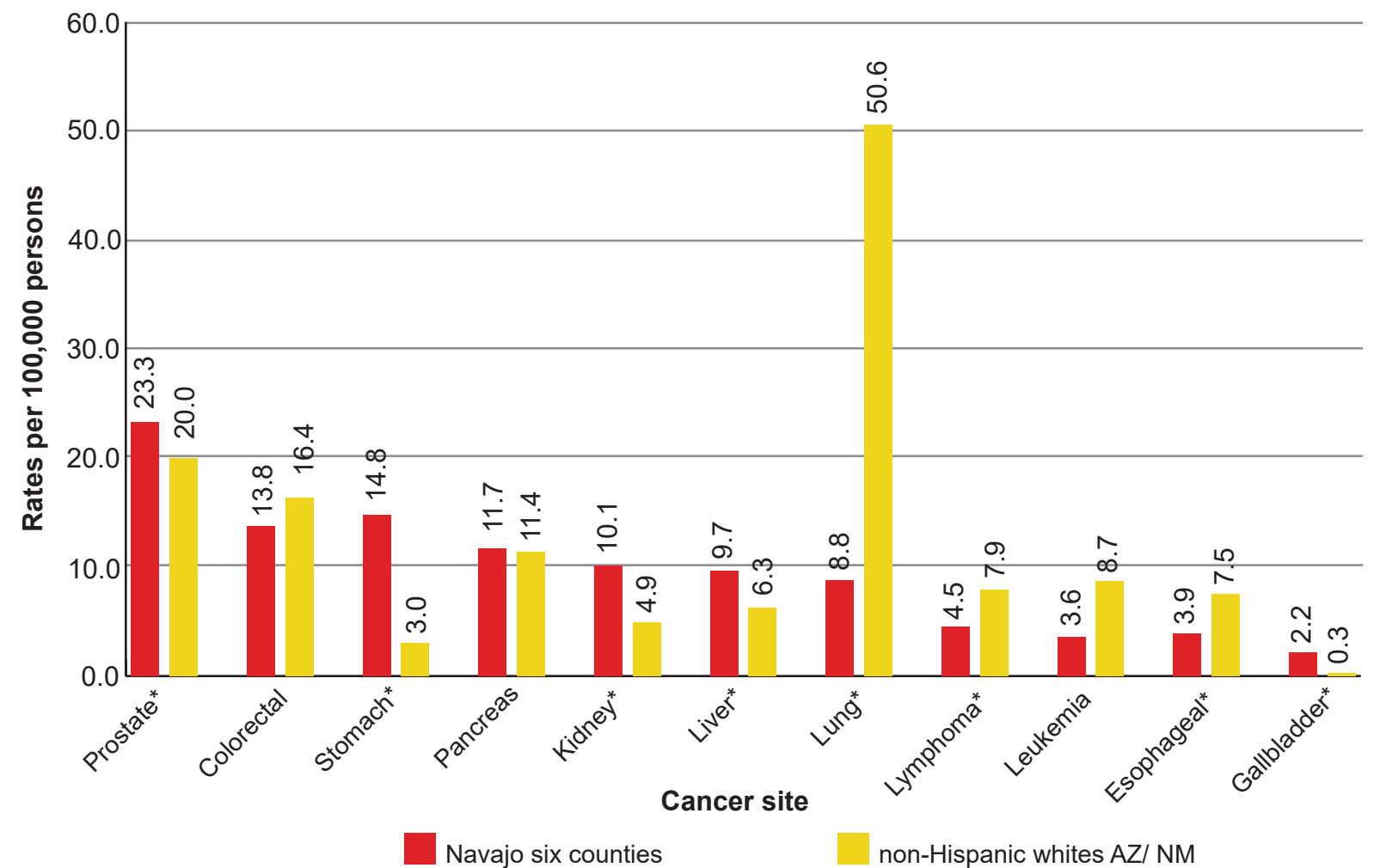
^a Rates are per 100,000 persons and are age-adjusted to the 2000 U.S. standard population.

^b American Indian/Alaska Native cancer mortality data in the six counties that comprise most of Navajo Nation were used as a proxy for Navajo cancer mortality rates; the six counties included: Apache County (AZ), Coconino County (AZ), Navajo County (AZ), McKinley County (NM), San Juan County (NM), San Juan County (UT).

*Rates are statistically different at p-value <0.05

Death rates from cancers of the stomach (RR=4.41), liver (RR=1.78), kidney (RR=2.06), and gallbladder (7.19) were significantly higher among the Navajos compared to NHWs. Conversely, death rates of female breast (RR=0.61) and lung (RR=0.15) cancers among the Navajo were significantly lower than NHW. Navajo cancer death rates of colorectal, pancreas, prostate, and ovary cancers were similar to NHWs.

Figure 11. Age-adjusted cancer mortality rates^a, among the Navajos^b, males in Arizona, New Mexico and Utah by cancer site and ethnicity, 2005-2013, males only all ages



Source: ¹Mortality data provided by National Center for Health Statistics.

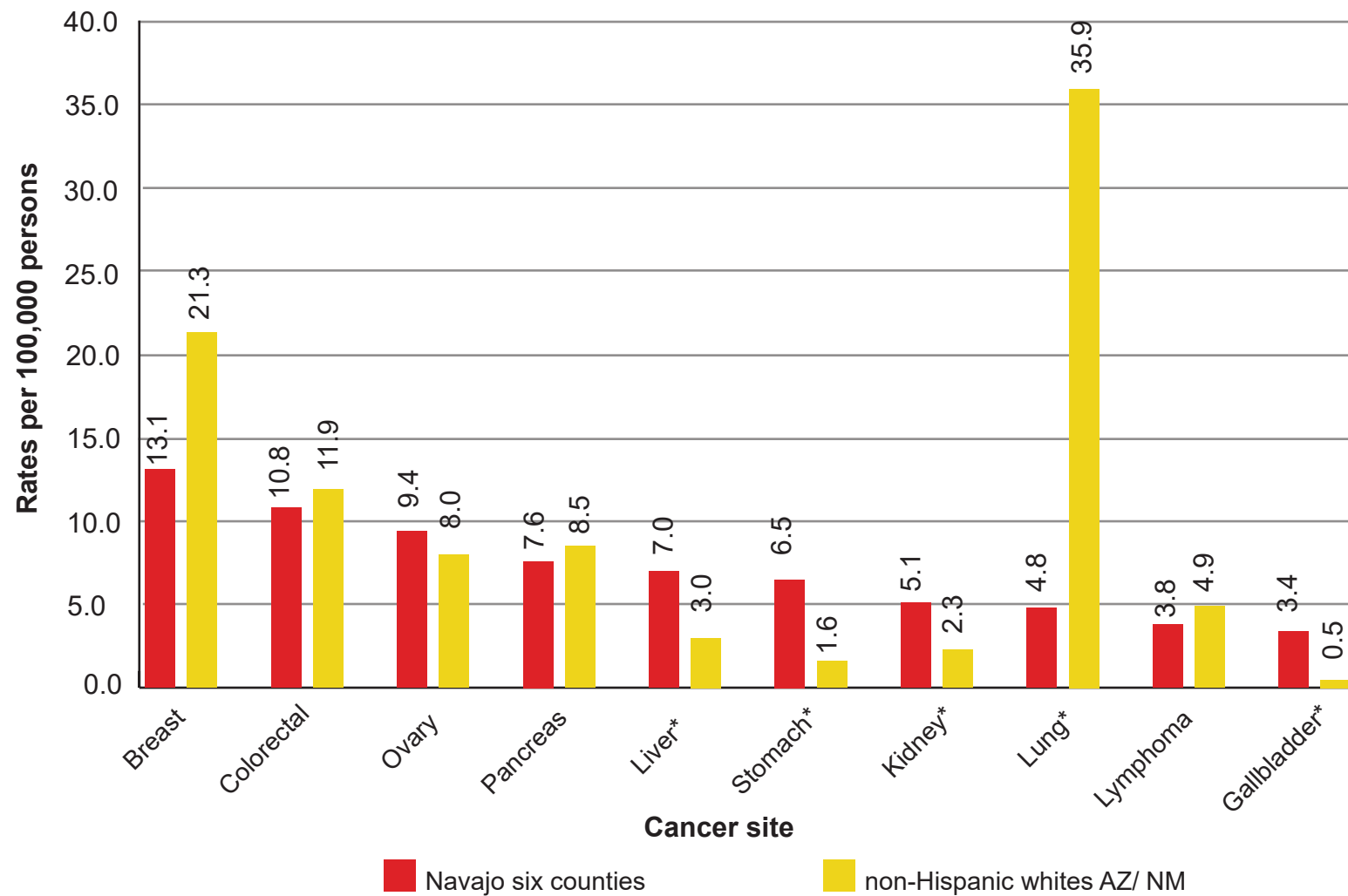
^a Rates are per 100,000 persons and are age-adjusted to the 2000 U.S. standard population.

^b American Indian/Alaska Native cancer mortality data in the six counties that comprise most of Navajo Nation were used as a proxy for Navajo cancer mortality rates; the six counties included: Apache County (AZ), Coconino County (AZ), Navajo County (AZ), McKinley County (NM), San Juan County (NM), San Juan County (UT).

*Rates are statistically different at p-value <0.05

For Navajo males the mortality rates for gallbladder (RR=6.41), stomach (RR=4.89), liver (RR=1.53), and kidney (RR=2.05) cancer were significantly higher compared to NHW males. Significantly lower mortality rates for Navajo males were observed for lung (RR=0.17), lymphoma (RR=0.57), esophageal (RR=0.52), and leukemia (RR=0.41) cancers than NHW males. No differences were seen between Navajos and NHWs for prostate, colorectal, and pancreatic cancers.

Figure 12. Age-adjusted cancer mortality rates^a, among the Navajos^b, females in Arizona, New Mexico and Utah by cancer site and ethnicity, 2005-2013, females only all ages



Source: ¹Mortality data provided by National Center for Health Statistics.

^a Rates are per 100,000 persons and are age-adjusted to the 2000 U.S. standard population.

^b American Indian/Alaska Native cancer mortality data in the six counties that comprise most of Navajo Nation were used as a proxy for Navajo cancer mortality rates; the six counties included: Apache County (AZ), Coconino County (AZ), Navajo County (AZ), McKinley County (NM), San Juan County (NM), San Juan County (UT).

*Rates are statistically different at p-value <0.05

Compared to NHW females, Navajo females had significantly lower mortality rates for breast (RR=0.61) and lung (RR=0.13) cancers. Significantly higher mortality rates among Navajo females were observed for gallbladder (RR=7.49), stomach (RR=4.10), liver (RR=2.35), and kidney (RR=2.22) cancer. Lymphoma and colorectal, ovarian, and pancreatic cancer mortality rates were similar for both Navajo and NHW females.

DISCUSSION

As the leading cause of death among Navajo females, and the second leading cause of death regardless of sex,²⁴ cancer is a major public health concern for the Navajo Nation. This report “Cancer Among the Navajo, 2005-2013,” includes the latest information on cancer epidemiology for Navajo residents of the Navajo Nation served by the Navajo Area IHS. This report used data from New Mexico Tumor Registry, Arizona Cancer Registry and Utah Cancer Registry.

To inform and educate the Navajo Nation. By better understanding the occurrence and patterns of cancer among Navajos, the Navajo Nation will be better positioned to develop solutions, interventions and relevant research.

The Navajo people have different patterns of cancer incidence, stage at diagnosis, screening rates and cancer mortality, when compared to NHW populations in these areas. They also appear to have different cancer screening prevalence.

INCIDENCE

The three cancers with the highest incidence rates were colorectal cancer, stomach cancer and kidney cancer. In comparison to NHW, Navajo Nation residents had more than 3 times higher incidence rates of stomach cancer and almost double the incidence rates of liver and kidney cancer, but lower incidence rates of colorectal cancer, non-Hodgkin’s Lymphoma and lung cancer.

The three cancers with the highest incidence rates were prostate, colorectal and stomach. Compared with NHW men, Navajo men had higher incidence rates of stomach cancer and liver cancer and lower incidence rates of prostate cancer, colorectal cancer, lung cancer, and non-Hodgkin’s Lymphoma.

For Navajo women, breast cancer was the most commonly diagnosed cancer, followed by ovarian cancer and colorectal cancer. Compared with NHW women, Navajo women had higher incidence rate of stomach cancer and lower incidence rates of breast cancer, uterine cancer and colorectal cancer.

STAGE AT DIAGNOSIS

The stage at diagnosis data tell us that among Navajo Nation residents, colorectal cancer and cervical cancer were most commonly diagnosed in the regional stage; breast cancer and prostate cancer were commonly diagnosed in the localized stage. In comparison with NHW women, Navajo women had higher proportions of later-stage diagnosis of cervical cancer and breast cancer. And Navajo men have much higher proportions of later-stage diagnosis of prostate cancer compared with NHW men. For example, more than fifteen percent of all men diagnosed with prostate cancer on the Navajo Nation were diagnosed in the distant stage, compared to only three percent of NHW men in Arizona and New Mexico.

SCREENING

The available sources of cancer screening data suggest that cancer screening among the Navajo is low, particularly for colorectal cancer. However, there are substantial differences for breast cancer screening based on data sources, with Navajo Area IHS GPRA suggesting much lower rates than the Navajo Nation Health Survey and BRFSS data. The BRFSS data suggests that NHW women receive mammography and pap test screenings at almost the same rates as AI/AN women in the six counties included, although colorectal cancer screening rates are much lower (57.4% NHW vs. 32.4% AI/AN). Notably, within the Navajo Nation Health Survey, screening rates for mammography, pap test and colorectal cancer screening were 12-25 percent lower in the Chinle Agency compared to the Northern Agency. Further, comprehensive and culturally appropriate education and awareness around screening and additional research to identify barriers to cancer screening in different regions are needed.

MORTALITY

According to the mortality data presented here, the cancers with the highest mortality rates among the Navajo were stomach cancer, liver cancer, and colorectal cancer. In comparison with NHW, Navajo had much higher mortality rates for cancers of the stomach (more than four times higher mortality rate per 100,000 people), liver (double the mortality rate), kidney (double the mortality rate), and lower rates for colorectal cancer and lung cancer. Among Navajo men, mortality from prostate cancer, stomach cancer, and liver cancer were most common. And, among Navajo women mortality from breast cancer, stomach cancer, and liver cancer were most common.

POTENTIAL CAUSES ASSOCIATED WITH FINDINGS

While the focus of this report was to report cancer data incidence, stage of diagnosis, screening, and mortality, the findings have to be evaluated in the context of the area. As mentioned, it is notable that this report (consistent with other reports⁸⁻⁹) found elevated rates of stomach, kidney, liver and gallbladder cancers. Potential environmental (for example, heavy metals in the environment), behavioral (for example, substance abuse), or genetic risk factors may be associated with the higher rates. For example, exposure to arsenic in drinking water has been associated with higher risk of liver, kidney and bladder cancers,²¹ and one study that tested wells on the Navajo Nation found elevated uranium, arsenic and bicarbonate concentrations in several wells used for drinking water.²²

Other driving factors could potentially include diet²³ and physical inactivity,²⁴ which are influenced by both behavioral and environmental factors. For example, lack of availability of nutritious foods may lead to eating unhealthy foods, large portion meals, consuming red meat and processed food, preparing food under intense heat, and not eating enough fruits and vegetables. Similarly, safety concerns discourage physical activity and include the lack of or not properly maintained sidewalks and street lights, bicycle paths, drinking fountains, walkways, and parks. These issues may be particularly relevant for vulnerable populations such as children, youth, women, pregnant women, elderly and individuals with disabilities living in rural and remote areas of the Navajo Nation. Further research into these exposures may lead to greater insight into potential underlying causes and inform prevention efforts.

Changes from the '1995-2004 Cancer Among the Navajo' to the current report.

Interpretation of any comparisons between the 'Cancer Among the Navajo 1995-2004' report in incidence, stage of diagnosis and mortality have to be interpreted with caution, given the use of different data, methodologies and population numbers used in the reports.

- Of the most commonly diagnosed cancers among the Navajo, age adjusted incidence rates were higher in 2005-2013 data for male prostate cancer (84.8 vs. 59.2 per 100,000 in 1995-2004), female breast cancer (57.2 vs 44.8), and combined male and female colorectal cancer (29.2 vs. 18.2) and kidney cancers (22.7 vs. 14.1).
- Modest increases (7 percent) in patients being diagnosed in the localized stage of colorectal cancer (males and females combined) and prostate cancer were reported.
- Screening rates for mammography and colorectal cancer appear to have improved from 1995-2004, particularly in the Navajo Nation Health Survey Northern Agency and BRFSS reports. However, the data is based on different sources.
- Mortality rates are very similar to 1994-2004, both in overall mortality rates (overall 124.6 vs. 123.1 per 100,000 in 1995-2004) and in cancer specific mortality. Rates of stomach, kidney and liver cancer remain higher than NHW populations.

DATA LIMITATIONS

Several limitations should be considered when interpreting the results presented in this report including racial misclassifications, migration and limited capture of all Navajo data.^{29,30}

Cancer incidence, mortality and stage of diagnosis data was limited to Navajos residing in the six county regions and captured in the New Mexico Tumor Registry, Arizona Cancer Registry and Utah Cancer Registry. Therefore, the report excluded Navajos who resided outside the six county regions.

Tuba City Regional Health Care Corporation, Utah Navajo Health System, Inc., and Sage Memorial Hospital do not participate in GPRA reporting therefore Navajos seeking cancer screenings in the clinical facilities are not captured in the GPRA reporting.

Data presented focus on the contiguous Navajo Nation, excluding the three Navajo satellite communities of Ramah, Alamo and Tohajiilee in New Mexico. They are non-contiguous with the larger Navajo Nation land base. These satellite communities are served by the Albuquerque Area Indian Health Service were excluded because the Navajo Cancer Workgroup did not have access to the Albuquerque Area IHS RPMS.

At the time of data analysis, Navajo-specific cancer incidence and mortality data were not available. The cancer incidence and mortality rates among AI/AN who resided in a six county region that comprised the Navajo Nation were used to serve as a proxy for estimating the Navajo cancer incidence and mortality rates. Navajos residing in these six counties represent about eighty percent of the total AI/AN population in these counties.

Racial misclassification is a common issue regarding AI/AN cancer data, which leads to underestimation of the true burden of cancer.³¹ To decrease misclassification, cancer registry data were linked with IHS data. Some cases with race coded as AI/AN were not able to be linked to IHS data while many cases which are not coded as AI/AN were able to be linked to IHS data and are reclassified as AI/AN. However, such data linkage did not completely resolve all misclassification issues. This method of correcting misclassification did not address AI/AN who did not receive health care within IHS.

RECOMMENDATIONS

Using cancer data from the Arizona Cancer Registry (NPCR), New Mexico Tumor Registry (SEER), Utah Cancer Registry (SEER), NCHS Vital Statistics Data, and Navajo Nation Health Survey, the Navajo Cancer Workgroup was able to identify the leading cancers that impact the health of the Navajo people. The data showed differences in cancer burden between the Navajo and NHW of Arizona and New Mexico and also indicated that both Navajo men and women have different cancer experiences.

In view of these results, the following recommendations constitute a framework that public health professionals, healthcare providers, and communities can use to reduce the cancer burden of the Navajo people:

- Expand collaboration among Navajo tribal health programs, Navajo Senior Centers, Indian Health Service, and tribally operated facilities and local communities in order to translate these data into targeted and culturally appropriate cancer prevention and intervention programs.
- Continue meaningful partnership with state cancer registries to further utilize and improve population-based cancer surveillance data and maintain on-going surveillance of cancer among the Navajo. This should include continued efforts to improve racial classification of individuals in a variety of health and surveillance data systems.
- Promote research that examines risk factors for many of these cancers, potential causes behind later diagnoses for screenable cancers, and research on culturally appropriate and effective approaches to improve screening.
- Promote research on possible causes of cancers that have higher incidence and mortality among Navajo compared to NHW populations (stomach, kidney, and liver cancer), and approaches to promote early detection and treatment in these populations.
- In the context of regional variations in screening rates, increase targeted and culturally appropriate education and awareness, screening and prevention among those geographic areas within the Navajo Nation with the lowest screening rates and highest incidence and mortality rates.
- Increase education and training for health care providers regarding current cancer screening practices and guidelines. Offer Continuing Medical Education (CME) for medical health care professionals.

American Cancer Society
www.cancer.org

Arizona Cancer Registry, Arizona Department of Health Services
www.azdhs.gov/phs/phstats/acr/index.htm

Cancer Control P.L.A.N.E.T.
Cancercontrolplanet.cancer.gov

Centers for Disease Control and Prevention (CDC) Cancer Prevention and Control
www.cdc.gov/cancer

Community Outreach and Patient Empowerment (COPE) Project
www.facebook.com/COPEProject

Indian Health Service
www.ihs.gov/epi/index.cfm?module=epi_cancer_main

National Cancer Institute
www.cancer.gov

Native American Cancer Prevention – Northern Arizona University and University of Arizona
Tel: 928-523-8593
Nau.edu/NACP

Native American Cancer Research
natamcancer.org/index.html

Navajo Epidemiology Center
Tel: (928) 871-6539
www.nec.navajo-nsn.gov

Navajo Nation Breast and Cervical Cancer Screening Program
Tel: (928) 871-6348
www.nndoh.org/bccp

New Mexico Cancer Center, Gallup, NM
Tel: 505-726-2400
www.nmcancercenter.org/about/locations/gallup

New Mexico Department of Health
nmhealth.org

New Mexico Tumor Registry
Nmtrweb.unm.edu

San Juan Regional Cancer Center
Tel: (505) 609-6259
www.ourcancercenter.com

Tribal Epidemiology Centers
Tribalepicenters.org

University of New Mexico Comprehensive Cancer Center
cancer.unm.edu

University of Utah, Huntsman Cancer Institute
www.huntsmancancer.org

Term	Definition
RPMS	The Resource and Patient Management System (RPMS) is a decentralized automated information system of over 50 integrated software applications. RPMS software modules fall into three major categories: clinical, administrative, and infrastructure applications.
GPRA	Government Performance Results Act mandates federal measures to monitor the performance of federal agencies according to specific health and treatment guidelines. Meeting these target measures demonstrates the effectiveness of the federal agency to comply with identified strategic and annual performance goals.
Local Stage	A cancer that is limited to the organ of origin; it has spread no farther than the organ in which it started.
Regional Stage	A cancer that extends beyond the limits of the organ of origin; cancer becomes regional when there is the potential for spread by more than one lymphatic or vascular supply route.
Distant Stage	Cancer cells have broken away from the primary cancer, have traveled to other parts of the body, and have begun to grow at the new location(s); distant stage is also called remote, diffuse, disseminated, metastatic, or secondary disease
Unknown Stage	Not enough information exists to categorize a case; it must be recorded as unstaged.
Incidence Rate	The number of new cancer cases occurring in a population during a specified period in time.
Mortality Rate	The number of persons dying during a specified period of time within a population.
Age-standardization	A procedure for adjusting rates (e.g., death rates) designed to minimize the effects of differences in age composition when comparing rates for different populations.
Population-based	A registry that includes all persons inhabiting a country, city, or other specified place or area.

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Appendix A

Cancer incidence rates and rate ratios for the top cancers among Navajos compared to NHWs, CHSDA, 2005-2013, All Ages

Site	Navajo (6-county)			AZ & NM NHW			Navajo: AZ & NM NHW		
	Rate	95% CI	Count	Rate	95% CI	Count	Rate Ratio	95% CI	P-value

Males and Females

All Sites*	291.31	278.63-304.38	2,131	409.31	407.58-411.04	228,166	0.71*	0.68-0.74	0.00
Colon and Rectum	23.72	28.62-37.21	245	35.72	35.22-36.22	20,264	0.92	0.80-1.04	0.19
Kidney and Renal Pelvis	25.62	21.98-29.66	189	13.96	13.64-14.29	7,718	1.84*	1.57-2.13	0.00
Stomach*	14.96	12.02-18.34	95	4.25	4.08-4.43	2,420	3.52*	2.81-4.33	0.00
Non-Hodgkin lymphoma*	12.02	9.58-14.86	90	16.53	16.19-16.89	9,101	0.73*	0.58-0.90	0.00
Pancreas	12.62	9.98-15.69	83	10.87	10.61-11.15	6,365	1.16	0.92-1.45	0.22
Thyroid*	8.46	6.55-10.73	70	15.46	15.08-15.84	6,918	0.55*	0.42-0.70	0.00
Liver*	9.91	7.59-12.67	65	4.84	4.66-5.03	2,818	2.05*	1.56-2.63	0.00
Lung and Bronchus*	10.44	7.99-13.33	65	56.60	55.99-57.22	33,358	0.18*	0.14-0.24	0.00
Leukemia*	6.70	5.06-8.71	62	10.99	10.70-11.29	5,863	0.61*	0.46-0.79	0.00
Myeloma*	6.60	4.80-8.81	47	4.48	4.31-4.66	2,612	1.47*	1.07-1.97	0.02

Males and Females

All Sites*	318.57	297.60-340.51	971	443.55	440.97-446.14	118,136	0.72*	0.67-0.77	0.00
Prostate*	84.95	73.77-97.19	226	104.59	103.39-105.80	29,774	0.81*	0.70-0.93	0.00
Colon and Rectum	37.73	31.24-45.10	131	40.52	39.74-41.31	10,655	0.93	0.77-1.11	0.46
Kidney and Renal Pelvis*	37.78	30.88-45.66	118	18.49	17.96-19.03	4,854	2.04*	1.67-2.48	0.00
Stomach*	20.70	15.34-27.15	55	6.12	5.82-6.43	1,615	3.38*	2.49-4.46	0.00
Non-Hodgkin Lymphoma*	12.43	8.69-17.14	41	19.66	19.10-20.22	5,016	0.63*	0.44-0.87	0.00
Lung and Bronchus*	15.94	11.20-21.80	40	63.64	62.69-64.61	17,351	0.25*	0.18-0.34	0.00
Pancreas	13.39	9.24-18.59	37	12.38	11.95-12.81	3,350	1.08	0.75-1.51	0.70

Leukemia*	8.09	5.31-11.76	32	13.78	13.31-14.26	3,437	0.59*	0.38-0.85	0.00
Liver*	11.30	7.56-16.09	32	7.44	7.11-7.77	2,043	1.52*	1.01-2.17	0.04
Myeloma	8.05	5.03-12.09	24	5.55	5.27-5.85	1,484	1.45	0.90-2.19	0.12
Thyroid*	3.88	2.19-6.40	16	7.39	7.03-7.76	1,729	0.53*	0.30-0.87	0.01

Females

All Sites*	277.48	261.41-294.24	1,160	383.92	381.55-386.31	110,030	0.72*	0.68-0.77	0.00
Breast*	64.44	57.04-72.52	282	118.69	117.37-120.03	33,586	0.54*	0.48-0.61	0.00
Colon and Rectum	28.25	23.21-34.01	114	31.46	30.81-32.12	9,609	0.9	0.74-1.08	0.27
Uterus	21.63	17.50-26.43	97	20.49	19.95-21.03	6,060	1.06	0.85-1.29	0.63
Kidney and Renal Pelvis*	16.79	13.04-21.25	71	9.93	9.55-10.32	2,864	1.69*	1.31-2.15	0.00
Ovary	15.54	11.96-19.82	66	12.01	11.59-12.44	3,437	1.29	0.99-1.66	0.06
Thyroid*	12.23	9.15-16.00	54	23.49	22.82-24.18	5,189	0.52*	0.39-0.68	0.00
Non-Hodgkin Lymphoma	11.76	8.63-15.61	49	13.79	13.35-14.24	4,085	0.85	0.62-1.13	0.30
Pancreas	12.12	8.82-16.18	46	9.53	9.19-9.88	3,015	1.27	0.92-1.70	0.14
Leukemia*	5.84	3.88-8.45	30	8.64	8.28-9.01	2,426	0.68*	0.45-0.98	0.04
Lung and Bronchus*	6.71	4.31-9.89	25	50.86	50.07-51.67	16,007	0.13*	0.08-0.19	0.00
Myeloma	5.59	3.51-8.41	23	3.57	3.36-3.79	1,128	1.56	0.98-2.36	0.06

Appendix B

Cancer stage at diagnosis for Navajo and NHWs in Arizona and New Mexico, 2005-2013, All Ages

Group	Local	Regional	Distant	Unknown	P-value
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Colorectal cancer (50+ years)

Navajo*	121	31.3%	128	33.2%	74	19.2%	63	16.3%	0.003
AZ & NM NHW	7,377	39.2%	5,884	31.3%	3,169	16.9%	2,372	12.6%	

Female breast cancer (40+ years)

Navajo*	280	52.9%	167	31.6%	42	7.9%	40	7.6%	0.0000
AZ & NM NHW	20,094	61.7%	8,754	26.9%	1,454	4.5%	2,252	6.9%	

Cervical cancer (20+ years)

Navajo*	25	35.7%	29	41.4%	8	11.4%	8	11.4%	0.3751
AZ & NM NHW	609	44.5%	436	31.8%	170	12.4%	154	11.2%	

Appendix C

Death rates and rate ratios for the leading cancer causes of death among Navajos compared to NHWs, All Ages, CHSDA, 2005-2013

COD	Navajo (6-county)			AZ & NM NHW			Navajo: AZ & NM NHW		
	Rate	95% CI	Count	Rate	95% CI	Count	Rate Ratio	95% CI	P-value

Males and Females

All cancers	121.8	116.2-127.6	1,883	157.3	156.3-158.4	91,206	0.77	0.7383-0.8112	0.0000
CRC	12.2	10.5-14.1	192	14.0	13.7-14.3	8,081	0.87	0.7482-1.0081	0.0648
Stomach*	9.8	8.3-11.6	150	2.2	2.1-2.4	1,269	4.41*	3.678-5.2364	0.0000
Pancreas	9.3	7.8-11.0	138	9.9	9.6-10.2	5,839	0.94	0.7869-1.1174	0.5164
Female Breast*	13.1	10.8-15.6	124	21.3	20.7-21.8	6,467	0.61*	0.5088-0.7350	0.0000
Liver*	8.1	6.7-9.7	123	4.6	4.4-4.7	2,668	1.78*	1.4644-2.1337	0.0000
Prostate	23.3	19.2-27.8	121	20.0	19.5-20.6	5,045	1.16	0.9578-1.3936	0.1267
Kidney*	7.2	5.9-8.7	110	3.5	3.3-3.6	2,033	2.06*	1.6761-2.5034	0.0000
Lung*	6.4	5.2-7.9	96	42.5	42.0-43.0	25,090	0.15*	0.1217-0.1850	0.0000
Ovary	9.4	7.5-11.6	87	8.0	7.7-8.3	2,485	1.17	0.9327-1.4555	0.1716
Gallbladder*	2.9	2.1-3.9	43	0.4	0.4-0.5	239	7.19*	5.0214-9.9867	0.0000

Males

All cancers	142.4	132.8-152.4	908	186.1	184.5-187.8	49,042	0.76	0.7130-0.8191	0.0000
Prostate	23.3	19.2-27.8	121	20	19.5-20.6	5,045	1.16	0.9578-1.3936	0.1267
CRC	13.8	11.1-16.9	98	16.4	15.9-16.9	4,277	0.84	0.6728-1.0343	0.1040
Stomach*	14.8	11.8-18.2	93	3	2.8-3.2	779	4.89*	3.854-6.1011	0.0000
Pancreas	11.7	9.1-14.8	73	11.4	11.0-11.9	3,088	1.03	0.7926-1.2988	0.8755
Kidney*	10.1	7.7-12.9	67	4.9	4.6-5.2	1,308	2.05*	1.5601-2.6431	0.0000

Liver*	9.7	7.3-12.4	61	6.3	6.0-6.6	1,722	1.53*	1.1489-1.9765	0.0039
Lung*	8.8	6.5-11.5	54	50.6	49.7-51.4	13,690	0.17*	0.1287-0.2278	0.0000
Lymphoma*	4.5	3.0-6.4	33	7.9	7.6-8.3	2,029	0.57*	0.3839-0.8141	0.0011
Leukemia*	3.6	2.3-5.3	29	8.7	8.4-9.1	2,222	0.41*	0.2665-0.6065	0.0000
Esophageal*	3.9	2.5-5.8	26	7.5	7.2-7.9	2,054	0.52*	0.3337-0.7721	0.0005
Gallbladder*	2.2	1.1-3.8	13	0.3	0.3-0.4	93	6.41*	3.1894-11.4260	0.0000

Females

All cancers	108.8	102.0-116.0	975	134.9	133.6-136.2	42,164	0.8069	0.7557-0.8605	0.0000
Breast*	13.1	10.8-15.6	124	21.3	20.7-21.8	6,467	0.61*	0.5088-0.7350	0.0000
Colorectal	10.8	8.7-13.3	94	11.9	11.5-12.3	3,804	0.91	0.7311-1.1169	0.3894
Ovary	9.4	7.5-11.6	87	8.0	7.7-8.3	2,485	1.17	0.9327-1.4555	0.1716
Pancreas	7.6	5.9-9.7	65	8.5	8.2-8.9	2,751	0.90	0.6865-1.1442	0.4047
Liver*	7.0	5.4-9.0	62	3.0	2.8-3.2	946	2.35*	1.7822-3.0477	0.0000
Stomach*	6.5	4.9-8.4	57	1.6	1.4-1.7	490	4.10*	3.0403-5.4045	0.0000
Kidney*	5.1	3.6-6.8	43	2.3	2.1-2.5	725	2.22*	1.5864-3.0232	0.0000
Lung*	4.8	3.4-6.5	42	35.9	35.2-36.6	11,400	0.13*	0.0953-0.1800	0.0000
Lymphoma	3.8	2.6-5.3	33	4.9	4.7-5.2	1,570	0.77	0.5235-1.0805	0.1395
Gallbladder*	3.4	2.3-4.9	30	0.5	0.4-0.5	146	7.49*	4.8254-11.1545	0.0000



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