Diabetes Prevention and Control in Alaska

Section of Chronic Disease Prevention and Health Promotion
Alaska Department of Health and Social Services

2019

Diabetes Prevention and Control in Alaska, 2019

A report of the Section of Chronic Disease Prevention and Health Promotion

Alaska Department of Health and Social Services

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Suggested Citation

Alaska Department of Health and Social Services. Diabetes Prevention and Control in Alaska – 2019. Anchorage, Alaska: Section of Chronic Disease Prevention and Health Promotion, Division of Public Health, Alaska Department of Health and Social Services; February 2019.

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Executive Summary

Diabetes is among Alaska's leading causes of death, and an important public health priority. This report summarizes the most recently available information about diabetes and prediabetes prevalence, screening, treatment, risk factors, illness and death in Alaska. The purpose of this report is to provide information for partners in Alaska who are working to prevent diabetes and improve care for people with diabetes.

The report includes self-reported information about behaviors related to diabetes such as drinking sugary drinks, physical inactivity or smoking; whether they have already been diagnosed with diabetes or prediabetes; and, for those who have been diagnosed with diabetes, whether they are getting appropriate medical care and self-care. Rates and numbers of diabetes-related hospitalizations, outpatient hospital visits, and death are described for different population groups and regions. Alaska's evidence-based public health activities to reduce the burden of diabetes, including economic costs, are also briefly discussed.

Key findings include:

- *Prevalence of diabetes in Alaska.* According to the most recently available data, 7.5% of adults in Alaska report being diagnosed with diabetes and another 11.1% of adults report being diagnosed with prediabetes. More than 100,000 Alaska adults have been diagnosed with diabetes or prediabetes; but an even greater number are likely at risk and do not know it. The prevalence of diabetes has significantly increased during recent years, by an average of 0.6% per year during the past 10 years. This is similar to national trends.
- *Diabetes-related death (mortality).* Diabetes is the 8th leading cause of death in Alaska, identified as a cause of death for 3,662 Alaskans between 2007-2016: 889 as the underlying cause of death (i.e., direct cause), and 2,773 as a contributing cause of death. Although diabetes prevalence increased over the past decade, diabetes-related death rates have declined significantly during the same period.
- *Diabetes-related hospitalizations and outpatient treatment.* In total, during 2016 diabetes contributed to the need for services in 70,487 hospital visits – 9,067 of these were inpatient visits, where the person was admitted to a hospital, and 7% indicated diabetes as the primary diagnosis, or reason care was needed. The remaining 61,420 cases were outpatient visits (i.e., emergency department, outpatient surgery, outpatient observation, imaging labs, or other services), and about one-third (33%) of those indicated diabetes as the primary diagnosis.
- *Comparisons by demographic group.* Diabetes prevalence increased with age: from 2.0% among people ages 18-44 to 19.3% among people ages 65 and older. Diabetes prevalence was similar for men and women, but diabetes-related hospitalizations were greater among women than men, and death rates are greater among men than women.
- *Comparisons by race.* More Alaska Native people and Black or African American people have diabetes or prediabetes than Whites in Alaska. Diabetes-related death and hospitalization rates were greater among Asian, Pacific Islander, and Black or African American people in Alaska than among Whites. Hospitalization rates – but not death rates – were greater among Alaska Native people than Whites.

- *Regional comparisons.* Relative to the state as a whole, the prevalence of diabetes was higher in the Southeast-southern region, and lower in Fairbanks. Diabetes-related death rates were lower than the state average in Fairbanks, Kenai Peninsula, and the Yukon-Kuskokwim regions, which may be related to a combination of factors.
- *Screening for diabetes.* The American Diabetes Association recommends screening and testing for type 2 diabetes or prediabetes every three years at minimum for adults ages 45 or older, and adults of any age who are overweight or obese. About half (52.0%) of Alaska adults without diabetes have been tested for diabetes within the past three years; conservatively, 76% of Alaska adults met criteria for needing screening. Screening rates were lower in the Northwest and Yukon-Kuskokwim Delta regions than in the state overall.
- *Quality healthcare for people with diabetes.* Most Alaska adults with diabetes saw a healthcare provider for diabetes care in the past year (86%), however only about one-third of people with diabetes met a "quality of care" standard for effective clinical services (annual eye and foot exams, and a glycosylated hemoglobin [A1c] test at least twice per year).
- *Effective self-care practices*. More than half of Alaska adults with diabetes (60%) said they checked their own blood glucose daily, and 60% said they had ever taken a diabetes self-management class. Prevalence of these same two self-care practices was lower among Alaska Native people with diabetes than non-Native Alaskans (48% and 50% among Alaska Native people, respectively).
- *Risk factors*. Two-thirds (67%) of Alaska adults had two or more out of six key risk factors for developing or complicating diabetes; only 10% did not have any of these risk factors. Obesity or overweight was the most common risk factor among Alaska adults, affecting nearly two-thirds of adults, followed by physical inactivity, high blood pressure, high cholesterol, drinking sugary drinks every day, and smoking cigarettes.
- *Data gaps*. Currently, there is no information about diabetes prevalence among children in Alaska. However findings from a recent assessment show that between one-third and more than one-half of Alaska children in grades K-8 are overweight or obese, placing them at-risk and indicating that continued efforts to encourage healthy eating and physical activity among youth are important for preventing onset of type 2 diabetes.

Key activities by DHSS and partners to prevent diabetes in Alaska include:

- Providing education and information to the Alaska public.
- Promoting diabetes prevention programs (DPP) and diabetes self-management education and support (DSMES) programs.
- Supporting healthcare systems to improve screening for type 2 diabetes and care for people with diabetes.
- Expanding access to diabetes self-management.

Introduction

This report summarizes the most recently available information about diabetes prevalence, screening, risk factors, care practices, illness, and death in Alaska. The information can be used by Alaska public health partners and stakeholders – clinical and public health professionals, as well as other health advocacy partners and the public – to support continued planning and evaluation of diabetes prevention and control efforts.

What is diabetes? [1]

Diabetes is a chronic (long-lasting) disease that affects how the body turns food into energy. After being eaten, food is broken down into sugar ("glucose") and released into the bloodstream. The pancreas makes a hormone called insulin, which allows blood sugar to enter the body's cells for energy.

When a person has diabetes his/her body cannot make insulin, does not make enough insulin, or cannot use insulin as well as it should. The result is that too much sugar stays in the bloodstream. Over time, this can cause serious health problems including heart disease, vision loss, and kidney disease. Although there is no cure, the effects of diabetes can be reduced by living a healthy lifestyle, taking medications if prescribed, learning self-management skills, and working closely with a healthcare team to manage the condition.

Types of diabetes

There are three main types of diabetes.

Type 1 diabetes is when the body cannot make insulin. Only about 5% of people with diabetes have this type. Symptoms often develop quickly, and diagnosis is usually made among children, teens, and young adults. People with type 1 diabetes need to take insulin every day to survive. Currently, no one knows how to prevent this type of diabetes.

Type 2 diabetes is when the body does not make enough insulin or is unable to use insulin well and cannot keep blood sugar at normal levels. Most people with diabetes – about 9 out of 10 – have this type. It typically develops over many years and is usually diagnosed among adults, although now more young people are being diagnosed with it than in the past. There are usually no symptoms, so a blood test is needed to determine if someone has it. Type 2 diabetes can be prevented or delayed by healthy eating, regular physical activity, and losing weight if needed.

Gestational diabetes develops in pregnant women who have never had diabetes, and usually goes away after the baby is born. This condition creates some risks for the baby and increases risk of type 2 diabetes for the mother later in life.

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[1] Content in this introductory section is adapted from the Centers for Disease Control and Prevention (CDC) publication *About Diabetes.* June 1, 2017. *https://www.cdc.gov/diabetes/basics/diabetes.html*

Prediabetes

When a person has higher than normal blood sugar levels, but not high enough to be diagnosed as type 2 diabetes, this health condition is called "prediabetes." This is a serious condition that puts a person at risk for developing type 2 diabetes, heart disease, and stroke.

Why is diabetes a public health priority in Alaska?

This report provides the most current data available to describe the prevalence of diabetes and associated risk factors in Alaska. Based on this information, an estimated 41,000 adults in Alaska have been diagnosed with type 1 or type 2 diabetes, and another 62,000 have been diagnosed with prediabetes. This means that more than 100,000 Alaska adults are currently affected and at risk for a variety of serious health consequences.

The U.S. Centers for Disease Control and Prevention (CDC) reports that as many as two of every five American adults will develop type 2 diabetes in their lifetime, more people are developing diabetes during youth, and that racial and ethnic minorities continue to be affected at higher rates than other groups.[2]

Alaska has a unique population; one key factor is age. The state is relatively "younger" than other states: in the 2010 U. S. Census, Alaska's median age was 33.8 years, compared to the U.S. overall median age of 37.2 years. However, during recent years, the population in Alaska has been changing: the percent of Alaska's population over age 65 was 8% in 2010 (about 56,000 people) and 11% in 2017 (about 83,000 people).[3] This change means that health conditions that affect older people – such as diabetes – will become an even greater public health concern for Alaska in the future.

Diabetes in Alaska

As of 2016:

- **7.5%** of adults have known diabetes.
- **11.1%** of adults have known prediabetes.

More than **100,000** Alaska adults have been diagnosed with diabetes or prediabetes, but more are likely at risk and do not know it.

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[2] Centers for Disease Control and Prevention (CDC) *About Diabetes.* June 1, 2017. *https://www.cdc.gov/diabetes/basics/diabetes.html*

[3] United States Census Bureau, 2016. Annual estimates of the resident population for selected age groups for the U.S. and Alaska.

Methods

The following is a summary of the data sources, key definitions, analytic approaches, and notes on the presentation of data in this report. Additional detail is available in the Appendix.

Data Sources

- *Prevalence of diabetes and prediabetes and related risk factors.* The prevalence of these factors in Alaska was obtained from the Alaska Behavioral Risk Factor Surveillance System (BRFSS). The BRFSS is an anonymous telephone survey of adults age 18 and older that is sponsored by the Centers for Disease Control and Prevention (CDC), and has been conducted in Alaska since 1991. Data from 2016 were the most recent data available for this report. It is the state's primary source of information on health risks and behaviors among the general population of adults. For the purposes of this report, "diabetes prevalence" refers to individuals' self-reported health care provider diagnosis of diabetes.
- *Hospitalizations.* Inpatient and outpatient data for people of all ages were provided by the Alaska Health Facilities Data Reporting (HFDR) program for 2016, the most recent data available. Prior years of data were not used because of concerns about completeness of data, as mandatory reporting did not begin until 2015. In addition, there was a significant change in the hospital data coding system during fall 2015 which substantially affected reporting. Only Alaska residents are included in the hospitalization data.
- *Deaths.* Information on cause of death (mortality) among adults was taken from the death certificate. Unless otherwise noted, Alaska statewide and U.S. data were obtained from the CDC WONDER Online Database, which includes data from all vital statistics programs in the U.S. Regional data included in this report, and data describing specific types of diabetes-related deaths, were obtained directly from the Alaska Health Analytics and Vital Records Section (HAVRS) within the Division of Public Health. Only Alaska residents are included in Alaska-specific rates. Data from 2016 were the most recent data available for this report.

Key Definitions

- *Race and ethnicity*: Identification of race and ethnicity varied by data source. In BRFSS, Alaska Native people includes all individuals who reported American Indian or Alaska Native as one of their race groups, regardless of ethnicity; Hispanic includes all others who identified as Hispanic ethnicity, regardless of race; Black or African American, White and Asian includes those who identified these as their race and were non-Hispanic; and "other" race groups include those who reported Pacific Islander, other, or multiple race groups that did not include Alaska Native or Hispanic ethnicity. In the hospitalization data, race is assigned as noted in the medical record; people with Hispanic ethnicity were reported separately, and all race groups are non-Hispanic. Race and ethnicity are reported as recorded on the death certificate.

- *Alaska region*s: Data are presented geographically in this report for Behavioral Health Systems Regions (BHSR). These are 11 reporting regions in Alaska with at least 20,000 individuals, allowing sufficient population sizes for reporting data on behavioral health services in compliance with the federal Health Insurance Portability and Accountability Act (HIPAA) Privacy Rule. For BRFSS, "rural Alaska" includes those living in Northern and Southwest Alaska, as defined by the sampling regions for Alaska BRFSS. This includes Northwest, Yukon-Kuskokwim (Y-K) Delta, and Southwest regions, as well as Denali Borough, and the Census Areas Yukon-Koyukuk and Southeast Fairbanks.

- *Low SES*: For BRFSS, "low socio-economic status (SES)" includes those who live in a household that is less than185% of the federal poverty level, or who have completed less than a high school education.
- *Cause of death*: Only underlying (proximal) cause of death from diabetes is reported for state trends, gender, and race groups. However, for regional presentations, both underlying and contributing cause of death are reported in combination, so that more regions have reportable numbers (i.e., fewer regions have data suppressed due to small numbers). For this reason, death rates shown in tables and figures with regional data will be larger than those displaying statewide data.

Analytic Approaches

- *Confidence intervals.* Our report uses 95% confidence intervals. If there is no bias in the data collection system, there is a 95% chance (95 times out of 100 times) that the confidence interval around an estimate will include the true value. When confidence intervals for two estimates in the same data system do not overlap, those two estimates are "significantly" different from one another.
- *Age adjustment.* Age adjustment (sometimes called age standardization) is a statistical process that allows communities and states with different age structures to be compared. Age adjustment removes the influence of the differences in age distributions that occur from one population to another. Since the risk of developing chronic disease (e.g., diabetes, heart disease) is strongly associated with age, a geographic area with a high proportion of elderly residents could not be accurately compared with a younger-age populated area unless rates were adjusted to a standard reference population – the older community group would always naturally have a higher rate even if the two communities had the same risk.
- *Suppression of small numbers.* Estimates or counts based on small numbers were suppressed based on guidelines from the State of Alaska.

Notes on Presentation of Data

Throughout this report, visual cues are used to help the reader understand what types of data are being presented:

- Data shown on a vertical axis (i.e., column charts) included both Alaska statewide and U.S. data.
- Trend line charts are also used for Alaska statewide data and include U.S. data when available.
- Data shown on a horizontal axis (i.e., bar charts) are for Alaska alone, including contrasting sub-groups within the state.
- All regional data are presented both with a map to provide geospatial context and a bar chart; colors were assigned by region to provide visual cues about relative rates, but different shades should not be interpreted as statistically significant differences.
- Confidence intervals are displayed in several ways in this report: as "dumbbell" error bars, as shaded areas around a trend line, and sometimes as "+" values around a reported point estimate.
- To summarize data across groups and regions, a color block "patchwork" table is included near the end of this report. Different colors were used to provide visual cues about relative rates, and patterns of risks across groups, but should not be interpreted as statistically significant differences.
- Descriptions of "significant" differences between groups are included in text only when statistically-based approaches found that the differences measured between groups are unlikely to

be due to variability in estimates or chance. Non-significant differences are typically not described in text as being "different" (e.g., higher or lower than other groups).

Diabetes and Prediabetes Prevalence

Diabetes prevalence. The prevalence of diabetes among Alaska adults in 2016 was 7.5% (95% confidence interval 6.9-7.7%). This translates to about 41,000 adults in Alaska who have been diagnosed with diabetes by a healthcare provider.

The prevalence of diabetes among Alaska adults has increased during recent years: age-adjusted rates[4] significantly increased over the past 20 years, at an average rate[5] of 0.6% per year during the past 10 years (see Figure 1). This is similar to increases that have been seen nationally. Alaska's prevalence has been similar to or slightly less than the national prevalence during the same period.

Prediabetes prevalence. The prevalence of prediabetes among Alaska adults in 2016 was 11.1% (95% confidence interval 9.9%-12.4%). This translates to approximately 62,000 adults who have been diagnosed with prediabetes.

The prevalence of prediabetes has significantly increased since it was first measured in Alaska: age-adjusted trends show a significant increase at the rate of approximately 4% per year since 2008 (see Figure 2). Currently, there is not a national annual source of data for diagnosed prediabetes to directly compare with Alaska's prevalence and trends of diagnosed prediabetes, but using data collected from about half of states, the CDC estimated that in 2015 the national state-level median for adults diagnosed with prediabetes was 7.0%.[6]

Undiagnosed conditions. Notably, many adults have diabetes or prediabetes and do not know it. A national study conducted in 2011-2014 used fasting blood glucose and hemoglobin A1C measurements taken from a sample of U.S. adults to determine whether individuals had diabetes or prediabetes, and also asked people whether they had been diagnosed by a health professional with either condition. They found that about 2.7% of U.S. adults had undiagnosed diabetes – about one in four of the people with physically measured diabetes.[7] Based on these findings, another 15,000 adults in Alaska may have diabetes and not know they have it. The same study estimated that 33.9% of U.S. adults had prediabetes, but only about one in ten of these people with prediabetes reported being told by a health professional that they had this condition. Similarly, the number of Alaskans with prediabetes is likely to be much greater than the 62,000 estimated adults with prediabetes reported here; based on national prevalence estimates, perhaps as many as 123,000 more Alaska adults may be affected.

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[4] Reader note: age-adjusted prevalence estimates shown in Figure 1 are different than the most current statewide prevalence data highlighted in the first section of this report – age-adjustment is used to examine trends without the influence of changing age distributions in the state, and to compare to the U.S. without the influence of different underlying age distributions.

[5] This means a 0.6% increase per year relative to the prior year, not a .6 percentage point increase in prevalence.

[6] Centers for Disease Control and Prevention (CDC). *Diabetes Report Card 2017.* Atlanta, GA: Centers for Disease Control and Prevention, U.S. Department of Health and Human Services; 2018. Available at https://www.cdc.gov/diabetes/pdfs/library/diabetesreportcard2017-508.pdf (last accessed 7/27/18)

[7] Centers for Disease Control and Prevention (CDC). *National Diabetes Statistics Report, 2017 Estimates of Diabetes and Its Burden in the United States.* August 8, 2017. https://www.cdc.gov/diabetes/pdfs/data/statistics/national-diabetes-statistics-report.pdf See Table 1a. for prevalence of undiagnosed diabetes. (last accessed 7/27/18)

Summary of people affected. In sum, more than 100,000 Alaska adults have been diagnosed with diabetes or prediabetes, yet the actual number of people who are affected may be much greater – perhaps as many as 241,000 in total[8] – because of the large share of people who have not been screened and diagnosed.

Differences by demographic groups. We examined five years of combined data in order to compare differences in diagnosed diabetes and prediabetes prevalence among major Alaska subpopulations.[9] Figure 3 contrasts the prevalence of diabetes alone among subgroups, while Figure 4 shows the prevalence of both diabetes and prediabetes among subgroups. Prediabetes made up more than half of the total of combined diabetes and prediabetes among all adults (54%); it made up a relatively greater share of the total for women, Alaska Native, and younger adults (ages 18-44).

The prevalence of diabetes was similar among men and women in the state, but the prevalence of prediabetes and combined diabetes/prediabetes was greater among women than men.

Diabetes and combined diabetes/prediabetes prevalence were each higher among Black or African American adults than among other groups. Prediabetes and combined diabetes/prediabetes prevalence were higher among Alaska Native adults in comparison to Whites.

The prevalence of diabetes, prediabetes, and their combination were each higher among people with fewer economic resources (low SES) than among people with more economic resources (higher SES).

There were no significant differences in the prevalence of diabetes by urban (Anchorage, Mat-Su) and rural location overall.

The prevalence of diabetes increased significantly by age: from 2.0% among people ages 18-44 to 19.3% among adults ages 65 and older. Prediabetes and combined diabetes/prediabetes also increased significantly by age. When examining diabetes and prediabetes combined, one in four adults ages 55-64 were affected (25.0%), and nearly one in three adults ages 65 and older (32.9%) were affected.

Differences by region. We examined five years of combined data to describe differences in diabetes prevalence for Alaska's Behavioral Health Systems regions (see Figure 5). Relative to the state overall, the prevalence of diabetes was significantly higher in the Southeast (SE)-southern region, and significantly lower in Fairbanks. Other regions of the state were not significantly different from the state overall, although the prevalence was different among some regions from one another (e.g., prevalence is higher in the Kenai Peninsula than Fairbanks).

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[8] This is the sum of adults with known diabetes or prediabetes and the estimated additional 22% of adults with undiagnosed diabetes or prediabetes (see table 3a in *National Diabetes Statistics Report, 2017 Estimates of Diabetes and Its Burden in the United States.* Available at https://www.cdc.gov/diabetes/pdfs/data/statistics/national-diabetes-statistics-report.pdf)

[9] Reader note: state prevalence estimates for 5 years of data combined are different than the most current statewide prevalence data highlighted in the first section of this report.

Figure 6 shows regional patterns in the prevalence of prediabetes. Relative to the state overall, prevalence was significantly lower in Fairbanks, and other regions are not significantly different. The prevalence of prediabetes was lower in Fairbanks relative to several other individual regions as well.

Figure 1: Prevalence of ever being diagnosed with diabetes among adults
Alaska and U.S., 1991-2016 (U.S. through 2015), age-adjusted
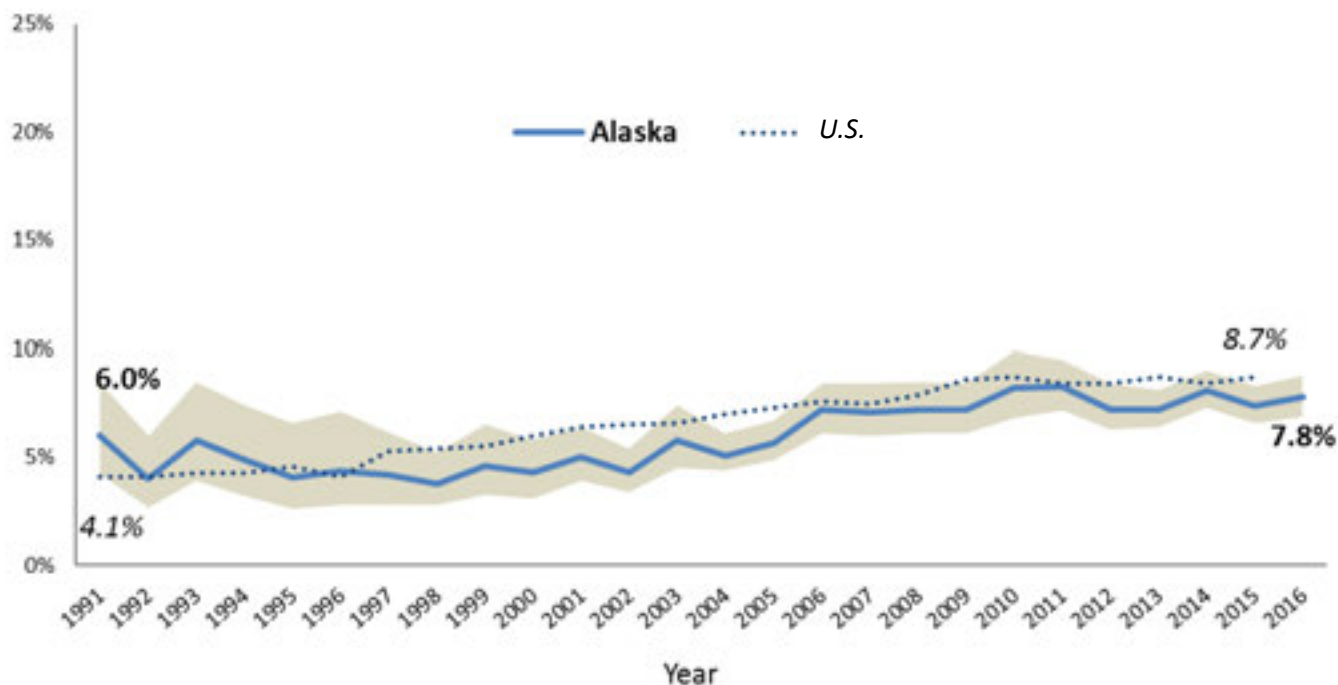
Prevalence estimates are age-adjusted to the U.S. 2000 population, using 4 groups (18-34, 35-44, 45-64, 65+)

Shading shows 95% confidence interval for Alaska's annual rates. 95% confidence interval for U.S. rates averages to ± 1.4%.

Alaska data source: Alaska BRFSS Combined File. Question: *Has a doctor, nurse, or other health professional ever told you that you have diabetes?* (excludes female respondents who said that was only when they were pregnant)

U.S. data source: National Health Interview Survey (NHIS). Downloaded from www.cdc.gov/diabetes/data; Division of Diabetes Translation - Centers for Disease Control and Prevention.

Alaska trend was tested using Joinpoint software. Linear regression test for trend between 2007-2016 showed a statistically significant increase during that period with approximately 0.6% relative increase in prevalence per year.

Supporting table for Figure 1: Prevalence of diagnosed diabetes among adults
Alaska and U.S., 1991-2016 (U.S. through 2015), age-adjusted

Year	Alaska			U.S.	% Difference (AK from U.S.)	+ AK higher than U.S. − AK lower than U.S. Blank: no significant difference*
	Annual Prevalence	Lower CI	Upper CI	Annual Prevalence		
1991	6.0%	4.2%	8.5%	4.1%	1.9%	
1992	4.0%	2.7%	6.0%	4.1%	-0.1%	
1993	5.8%	3.9%	8.5%	4.3%	1.5%	
1994	4.9%	3.2%	7.4%	4.3%	0.6%	
1995	4.1%	2.6%	6.6%	4.6%	-0.5%	
1996	4.4%	2.8%	7.1%	4.1%	0.3%	
1997	4.2%	2.8%	6.2%	5.3%	-1.1%	
1998	3.8%	2.8%	5.2%	5.4%	-1.6%	
1999	4.6%	3.3%	6.5%	5.5%	-0.9%	
2000	4.3%	3.1%	5.8%	6.0%	-1.7%	
2001	5.0%	3.9%	6.4%	6.4%	-1.4%	
2002	4.3%	3.4%	5.4%	6.5%	-2.2%	-
2003	5.8%	4.5%	7.4%	6.6%	-0.8%	
2004	5.1%	4.4%	6.1%	7.0%	-1.9%	-
2005	5.7%	4.9%	6.7%	7.3%	-1.6%	-
2006	7.2%	6.1%	8.4%	7.6%	-0.4%	
2007	7.1%	6.0%	8.4%	7.5%	-0.4%	
2008	7.2%	6.1%	8.5%	7.9%	-0.7%	
2009	7.2%	6.1%	8.4%	8.6%	-1.4%	
2010	8.2%	6.8%	9.9%	8.7%	-0.5%	
2011	8.3%	7.2%	9.5%	8.4%	-0.1%	
2012	7.2%	6.3%	8.4%	8.4%	-1.2%	
2013	7.2%	6.4%	8.1%	8.7%	-1.5%	-
2014	8.1%	7.3%	9.0%	8.4%	-0.3%	
2015	7.4%	6.6%	8.3%	8.7%	-1.3%	-
2016	7.8%	6.9%	8.8%			

Prevalence estimates are age-adjusted to the U.S. 2000 population, using 4 groups (18-34, 35-44, 45-64, 65+)

Alaska data source: Alaska BRFSS Combined File. Question: *Has a doctor, nurse, or other health professional ever told you that you have diabetes?* (excludes female respondents who said that was only when they were pregnant)

U.S. data source: National Health Interview Survey (NHIS). Downloaded from www.cdc.gov/diabetes/data; Division of Diabetes Translation, Centers for Disease Control and Prevention.

*Alaska rates are marked as higher (+) or lower (−) than the U.S. if the confidence intervals of age-adjusted estimates do not overlap. 95% confidence interval for U.S. rates averages to + 0.3%.

Alaska trend was tested using Joinpoint software. Linear regression test for trend between 2007-2016 showed a statistically significant increase during that period with approximately 0.6% relative increase in prevalence per year.

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Figure 2: Prevalence of ever being diagnosed with prediabetes among adults
Alaska, 2008-2016, age-adjusted
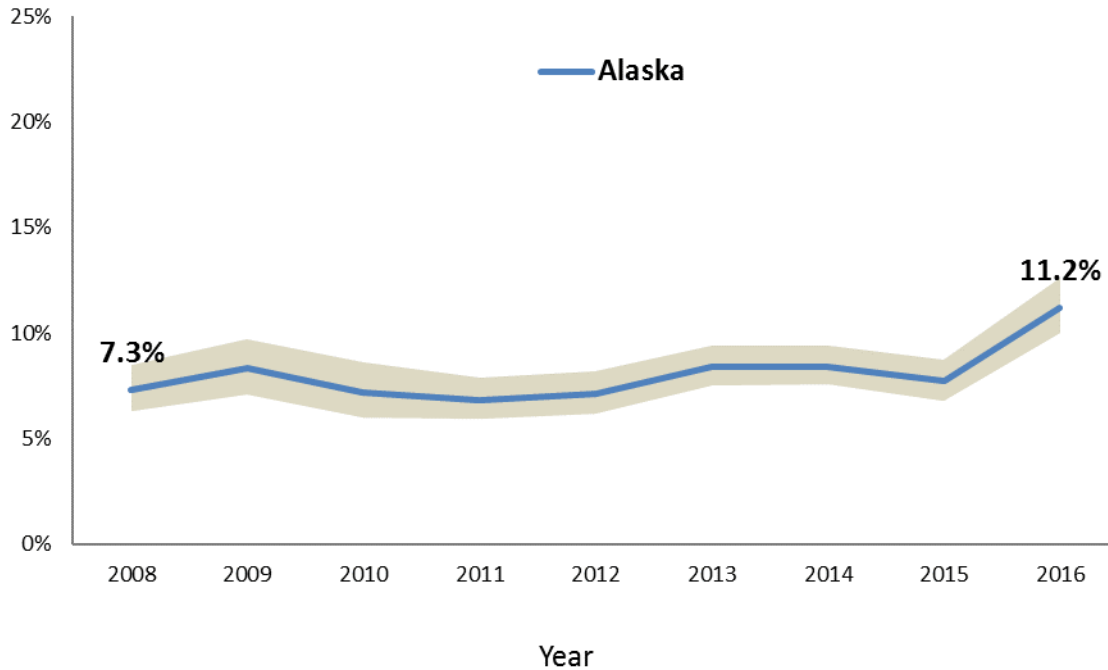
Supporting table for Figure 2: Prevalence of diagnosed prediabetes among adults
Alaska, 2008-2016, age-adjusted

	Alaska		
Year	**Annual Prevalence**	**Lower CI**	**Upper CI**
2008	7.3%	6.3%	8.5%
2009	8.3%	7.1%	9.7%
2010	7.2%	6.0%	8.6%
2011	6.8%	5.9%	7.9%
2012	7.1%	6.2%	8.2%
2013	8.4%	7.5%	9.4%
2014	8.4%	7.6%	9.4%
2015	7.7%	6.8%	8.7%
2016	11.2%	10.0%	12.6%

Prevalence estimates are age-adjusted to the U.S. 2000 population, using 4 groups (18-34, 35-44, 45-64, 65+)

Shading shows 95% confidence interval for Alaska's annual rates.

Data source: Alaska BRFSS Combined File. Question: *Have you ever been told by a doctor or other health professional that you have pre-diabetes or borderline diabetes?* This does include women who were told only while pregnant.

Comparable national data are not available for prediabetes.

Figure 3: Prevalence of ever being diagnosed with diabetes among adults, by demographic group
Alaska, 2012-2016

Demographic group	Prevalence
All Adults	7.3%
Male	7.2%
Female	7.5%
†Alaska Native	7.6%
Black/African American	15.8%
Other or Multi-race	6.6%
Asian	7.5%
Hispanic	9.1%
White	6.7%
*Low SES	8.1%
Higher SES	5.6%
Rural	7.4%
Rest of State	7.3%
†Age 18-44	2.0%
45-54	7.5%
55-64	13.3%
65+	19.3%
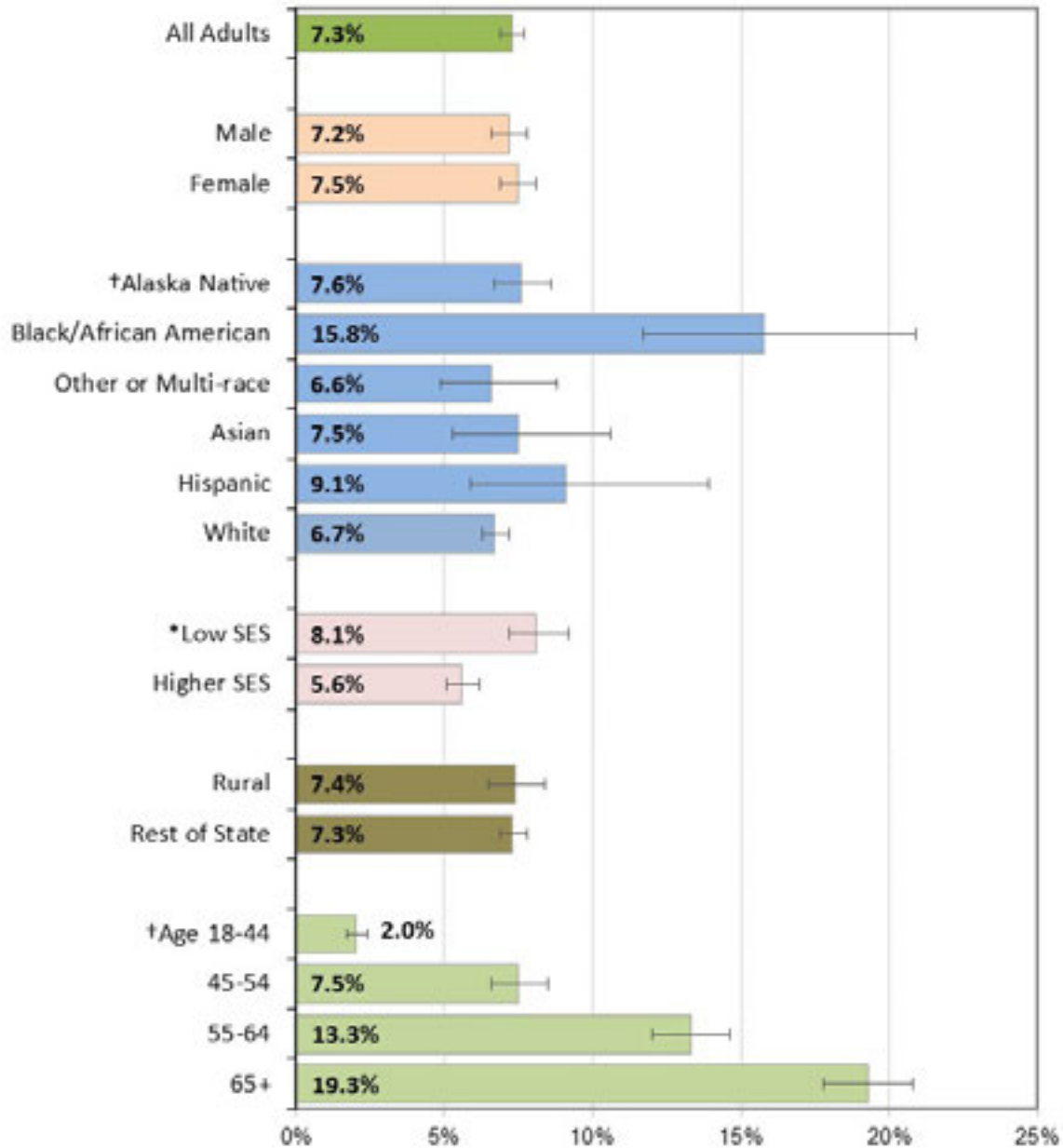
Data source: Alaska BRFSS Combined File. Supporting data for this graph are included in Appendix Table 1.

*Indicates significant difference between dichotomous groups.

†Indicates intergroup differences (chi-square test).

Definitions:

Low socio-economic status (SES) includes those who live in a household that is at <185% of the federal poverty level, or have completed less than a high school education.

Rural Alaska includes those living in Northern and Southwest Alaska, as defined by the sampling regions for Alaska BRFSS. This includes Northwest, Yukon-Kuskokwim (Y-K) Delta, and Southwest regions, as well as Denali Borough, and the Census Areas Yukon-Koyukuk and Southeast Fairbanks.

Figure 4: Prevalence of ever being diagnosed with diabetes or prediabetes among adults, by demographic group

Alaska, 2012-2016

	Diabetes	Prediabetes	Both
All Adults	7.3%	8.5%	15.8%
*Male	7.2%	6.4%	13.6%
Female	7.5%	10.7%	18.2%
†Alaska Native	7.6%	11.2%	18.8%
Black/African American	15.8%	11.4%	27.2%
Other or Multi-race	6.6%	7.5%	14.1%
Asian	7.5%	9.4%	16.9%
Hispanic	9.1%	6.7%	15.8%
White	6.7%	7.9%	14.6%
*Low SES	8.1%	10.0%	18.1%
Higher SES	5.6%	8.1%	13.7%
Rural	7.4%	8.8%	16.2%
Rest of State	7.3%	8.5%	15.8%
†Age 18-44	2.0%	5.3%	7.3%
45-54	7.5%	10.3%	17.8%
55-64	13.3%	11.7%	25.0%
65+	19.3%	13.6%	32.9%

Legend: ▮ Diabetes ▯ Prediabetes
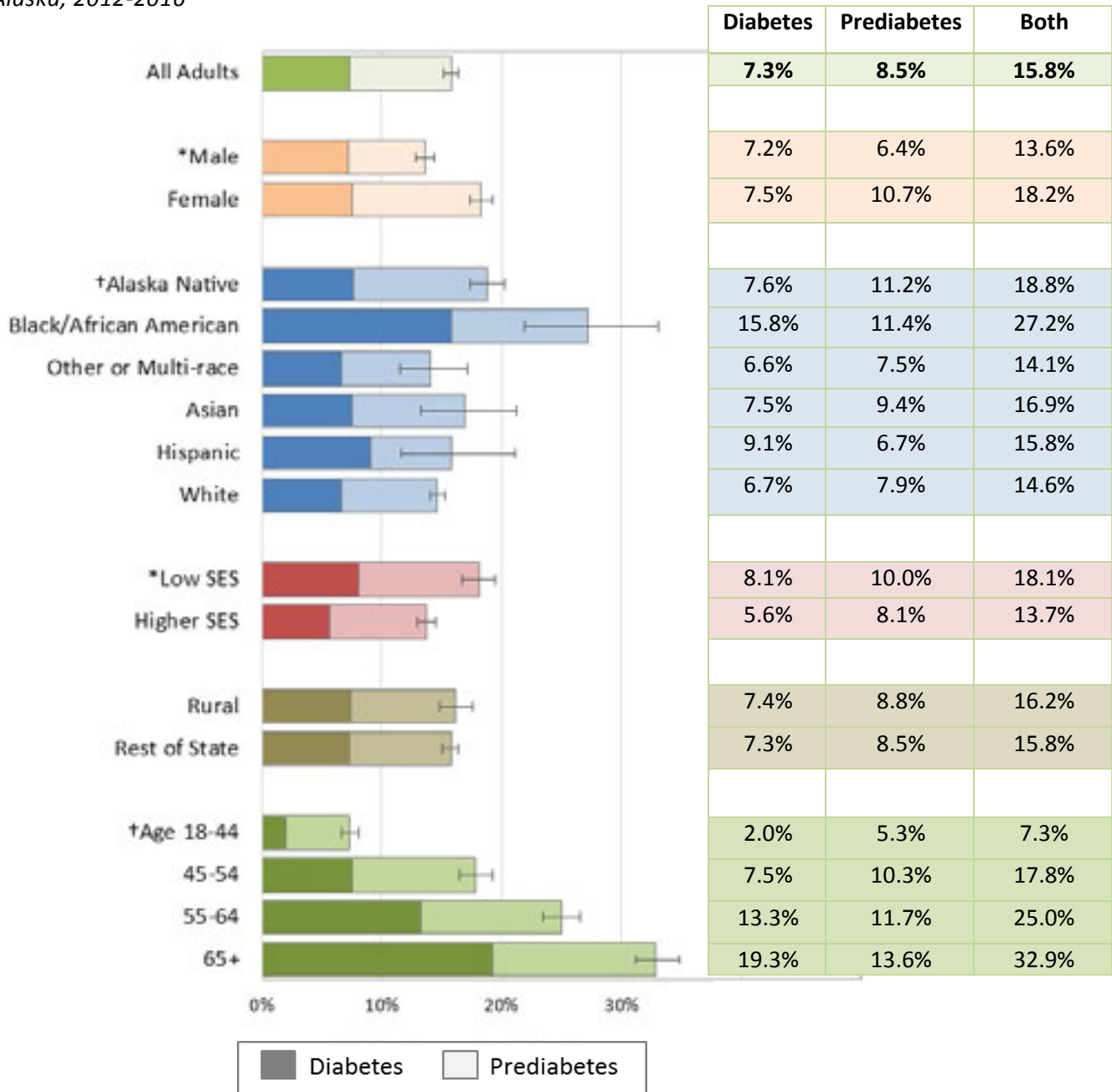
Data source: Alaska BRFSS Combined File. Supporting data for this graph are shown in Appendix Table 1.
*Indicates significant difference between dichotomous groups for combined diabetes and prediabetes.
†Indicates intergroup differences (chi-square test) for combined diabetes and prediabetes.
   Definitions:
   Low socio-economic status (SES) includes those who live in a household that is at <185% of the federal poverty level, or have completed less than a high school education.
   Rural Alaska includes those living in Northern and Southwest Alaska, as defined by the sampling regions for Alaska BRFSS. This includes Northwest, Yukon-Kuskokwim (Y-K) Delta, and Southwest regions, as well as Denali Borough, and the Census Areas Yukon-Koyukuk and Southeast Fairbanks.

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Figure 5: Prevalence of ever being diagnosed with diabetes among adults, by Behavioral Health Systems Region

Alaska, 2012-2016

Prevalence of ever being diagnosed with diabetes by Behavioral Health Systems Region

Alaska adults, 2012-2016

	Prevalence	Lower CI	Upper CI
State of Alaska	**7.3%**	**6.9%**	**7.7%**
Anchorage	7.5%	6.7%	8.3%
Fairbanks*	5.9%	5.1%	6.8%
Juneau	6.1%	4.9%	7.6%
Kenai Peninsula	8.1%	7.1%	9.2%
Mat-Su	7.6%	6.7%	8.6%
Northwest	5.8%	4.4%	7.6%
Other Interior	8.3%	7.1%	9.7%
SE-northern	7.6%	6.1%	9.4%
SE-southern*	9.6%	7.7%	12.0%
Southwest	5.2%	3.6%	7.6%
Y-K Delta	8.8%	7.2%	10.8%
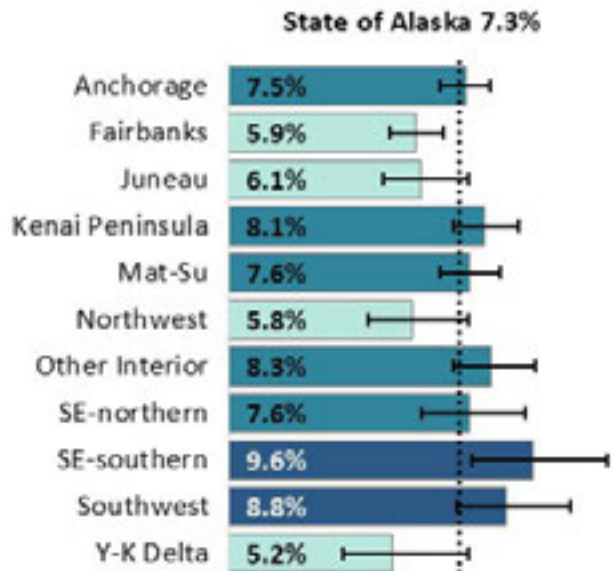
Data source: Alaska BRFSS Combined File.

*Indicates significant difference between region and state overall.

Figure 6: Prevalence of ever being diagnosed with prediabetes among adults, by Behavioral Health Systems Region

Alaska, 2012-2016

Prevalence of ever being diagnosed with prediabetes by Behavioral Health Systems Region

Alaska adults, 2012-2016

	Prevalence	Lower CI	Upper CI
State of Alaska	**8.5%**	**8.1%**	**9.0%**
Anchorage	8.8%	7.9%	9.7%
Fairbanks*	6.4%	5.6%	7.3%
Juneau	9.1%	7.6%	11.0%
Kenai Peninsula	9.6%	8.4%	11.0%
Mat-Su	8.3%	7.4%	9.4%
Northwest	10.6%	8.3%	13.4%
Other Interior	8.7%	7.2%	10.3%
SE-northern	7.8%	6.3%	9.6%
SE-southern	9.3%	7.7%	11.2%
Southwest	8.2%	6.6%	10.1%
Y-K Delta	8.9%	7.0%	11.3%

Data source: Alaska BRFSS Combined File.

*Indicates significant difference between region and state overall.

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Gestational Diabetes[10]

Gestational diabetes occurs when women who did not have diabetes develop higher than normal blood glucose levels while pregnant, raising the risk of complications for both 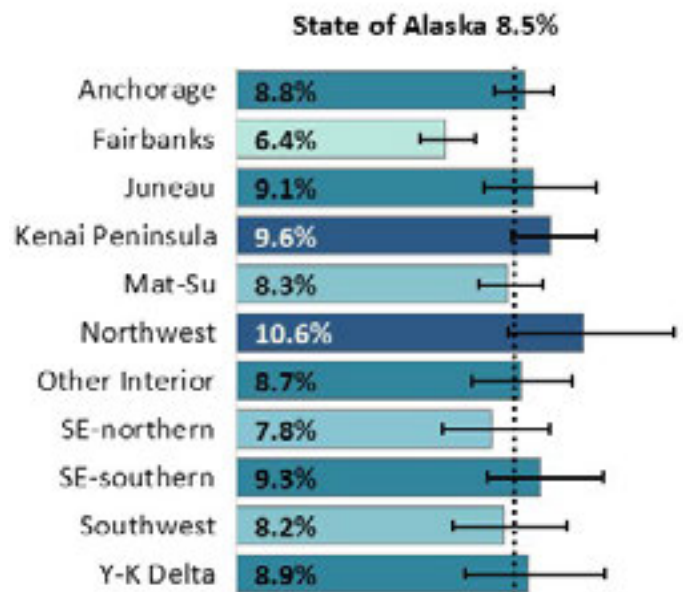mother and baby. It is usually diagnosed during prenatal visits, and typically goes away after delivery. Most women do not experience any symptoms. Mothers with gestational diabetes are more likely to have large babies (over 9 pounds), which can complicate delivery and increase the risk of needing a cesarean section. Infants born to women with gestational diabetes have a higher risk of developing diabetes.

Risk factors for gestational diabetes include being overweight before pregnancy and having a family history of diabetes. It is more common among American Indian/Alaska Native, Hispanic, Native Hawaiian, Pacific Islander, and African American women.

Having gestational diabetes is also associated with developing type 2 diabetes later in life. To reduce this risk, women should receive routine diabetes screenings after pregnancy, stay physically active, eat a healthy diet, and maintain a healthy weight.

The percentage of adult women in Alaska who have ever been diagnosed with gestational diabetes has been stable during recent years. The most recent prevalence estimate for gestational diabetes is 1.8% among Alaska women in 2016, as measured by the Alaska BRFSS. This is similar to the national prevalence for gestational diabetes in 2015 (the most recent year of data available), which was 1.7%.[11]

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[10] General descriptive content in this section was adapted from the Centers for Disease Control and Prevention (CDC) *Gestational Diabetes* website, updated July 25, 2017. https://www.cdc.gov/diabetes/basics/gestational.html and CDC *Gestational Diabetes* publication CS248137 https://www.cdc.gov/diabetes/pubs/pdf/gestationalDiabetes.pdf (last accessed 7/27/18)

[11] Alaska Department of Health and Social Services, *Health Indicator Report of Diabetes: Gestational Diabetes.* published 9/21/17. http://ibis.dhss.alaska.gov/indicator/view/DiabGestDiab.year.html (last accessed 6/27/18)

Burden of Diabetes

Diabetes-related Deaths

Diabetes is one of the leading causes of death (mortality) among adults, both in Alaska and in the U.S. Contribution to death can be indicated on the death certificate in one of two ways:

Underlying cause is the proximal or direct cause of death. This is the condition or injury that initiated the chain of events that led directly and inevitably to death.

Contributing cause is any condition or injury that initiated the events leading to death, but which itself is not the immediate cause of death.

For the purposes of this report, "diabetes-related deaths" can refer to either deaths where diabetes is the underlying cause, or deaths where diabetes is either the underlying or a contributing cause; notes will identify which classification is used.

In 2016, there were 122 deaths directly caused by diabetes, making it the eighth leading cause of death in the state (see Table 1). The rate of diabetes death was slightly lower in Alaska than for the U.S. overall.

Table 1: Leading causes of death in Alaska and the U.S. (2016)

Cause of Death by Rank in Alaska	Alaska Deaths			U.S. Deaths	
	Number	%	Age-adjusted Rate	Age-adjusted Rate	Rank
1. Cancer	974	22%	152.5	155.8	2
2. Diseases of the Heart	814	18%	136.3	165.5	1
3. Unintentional Injuries	429	9%	61.9	47.4	3
4. Chronic Lower Respiratory Disease	236	5%	40.4	40.6	4
5. Stroke	193	4%	38.2	37.3	5
6. Suicide	186	4%	25.3	13.5	10
7. Chronic Liver Disease and Cirrhosis	123	3%	15.9	10.7	12
8. Diabetes	**122**	**3%**	**18.6**	**21.0**	**7**
9. Alzheimer's Disease	109	2%	25.4	30.3	6
10. Influenza and Pneumonia	60	1%	12.4	13.5	8
Subtotal for top 10 causes	3,246	72%			
Total deaths	4,520	100%			

Alaska Data source: State of Alaska, Department of Health and Social Services. Alaska Vital Statistics 2016 Annual Report. Available at http://dhss.alaska.gov/dph/VitalStats/Documents/PDFs/VitalStatistics_AnnualReport_2016.pdf (last accessed 1-18-2019)

Underlying cause. Only Alaska residents are included in Alaska estimates.

U.S. data source: Xu JQ, Murphy SL, Kochanek KD, Bastian B, Arias E. Deaths: Final data for 2016. National Vital Statistics Reports; vol 67 no 5. Hyattsville, MD: National Center for Health Statistics. 2018. Available at https://www.cdc.gov/nchs/data/nvsr/nvsr67/nvsr67_05.pdf (last accessed 1-18-2019)

Between 2007 and 2016, a total of 3,662 deaths were related to diabetes in Alaska – an average of more than 360 per year. About one in three (32%) of these deaths were directly caused by diabetes, as indicated on the death certificate (i.e., the "underlying cause of death"), while the remaining two-thirds (68%) indicated that diabetes contributed to the death but was not the direct cause (i.e., "contributing cause of death") (see Figure 7).

Figure 7: Diabetes-related deaths
Alaska, 2007-2016
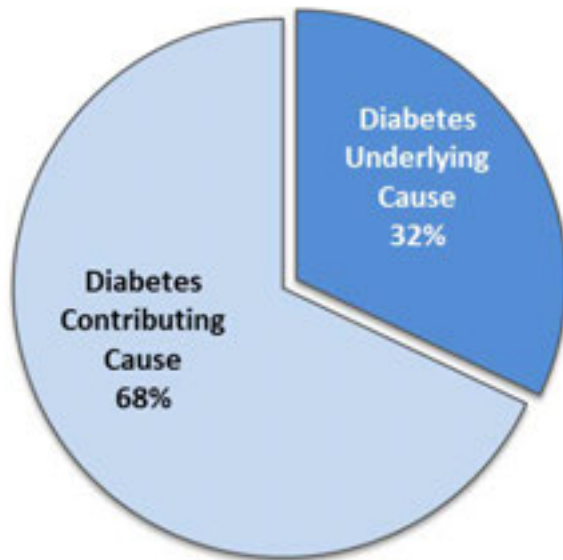
Data source: Alaska Division of Public Health, Health Analytics and Vital Records Section, Mortality Data.

3,662 total deaths: 889 underlying cause; 2,773 contributing cause.

Trends in diabetes deaths. Despite increasing prevalence, diabetes-related deaths have declined in Alaska during recent years (see Figure 8). Between 1999 and 2016, the rate of diabetes-related deaths in Alaska declined significantly from 23.8 to 19.3 per 100,000—a relative decline of approximately 1.4% per year. Death rates have not been different in Alaska than the U.S. during any years.

Diabetes deaths by demographic group. We combined five years of death data to describe diabetes-related death rates among specific populations of Alaska. The rate of diabetes deaths was higher among men than women in Alaska, similar to the U.S. (see Figure 9). While the rate of diabetes deaths among men was not different than the U.S., the rate among women in Alaska was slightly lower than for the U.S.

Diabetes death rates were higher among Asian/Pacific Islanders and Black/African Americans than the state average, and also higher than for Whites (see Figure 10). While overall rates of death from diabetes were similar between Alaska and the U.S., rates were significantly higher in Alaska among Asian/Pacific Islanders, but significantly lower among American Indian/Alaska Native people.

We combined 10 years of death data, for underlying and contributing causes combined, to provide sufficient data to describe diabetes-related death rates for Alaska's regions (see Figure 11). In comparison to the state overall, diabetes-related death rates were lower in Fairbanks, Kenai and Yukon-Kuskokwim (Y-K) regions. These lower death rates could be due to diabetes-specific factors, such as lower prevalence (the prevalence in Fairbanks was significantly lower than the state average, see Figure 5), higher incidence in these regions of other competing causes of death, differences in reporting causes of death, or a combination of several factors.

Figure 8: Diabetes-related death rates among adults
Alaska and U.S., 1999-2016, age-adjusted, underlying cause only
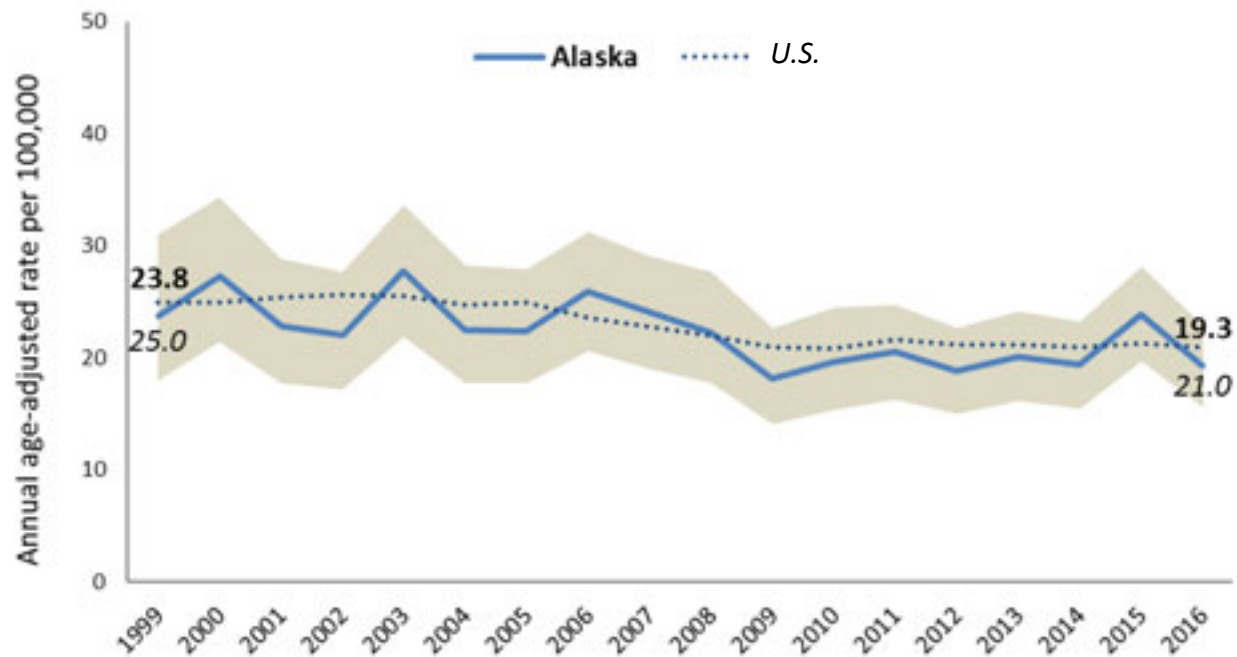
Shading shows 95% confidence interval for Alaska's annual rates. 95% confidence interval for U.S. rates averages to $\pm$ 0.1.

Data source: Centers for Disease Control and Prevention, National Center for Health Statistics. Underlying Cause of Death

1999-2016 on CDC WONDER Online Database, released December 2017. Data are from the Multiple Cause of Death Files, 1999-2016, as compiled from data provided by the 57 vital statistics jurisdictions through the Vital Statistics Cooperative Program. Accessed at http://wonder.cdc.gov/ucd-icd10.html on Mar 29, 2018 5:50:58 PM.

Rates are per 100,000 and age-adjusted to the 2000 U.S. Standard Population (19 age groups - Census P25-1130). Alaska deaths are for Alaska residents only.

Alaska trend was tested using Joinpoint software. Annual Percent Change was -1.43 (p<.05).

Supporting table for Figure 8: Diabetes-related death rates among adults
Alaska and U.S., 1999-2016, age-adjusted, underlying cause only

| Year | Alaska | | | Year | U.S. | % Difference (AK from U.S.) | + AK higher than U.S. − AK lower than U.S. Blank: no significant difference* |
	Annual Rate	Lower CI	Upper CI		Annual Rate		
1999	23.8	18.0	31.0	67	25.0	-5%	
2000	27.3	21.4	34.3	87	25.0	9%	
2001	22.8	17.7	28.8	80	25.4	-10%	
2002	22.0	17.2	27.7	86	25.6	-14%	
2003	27.7	21.9	33.6	102	25.5	9%	
2004	22.5	17.8	28.2	93	24.7	-9%	
2005	22.4	17.7	27.9	93	24.9	-10%	
2006	25.9	20.6	31.2	109	23.6	10%	
2007	24.1	19.0	29.1	105	22.8	6%	
2008	22.3	17.7	27.7	93	22.0	1%	
2009	18.1	14.1	22.7	84	21.0	-14%	
2010	19.6	15.4	24.5	86	20.8	-6%	
2011	20.5	16.3	24.7	107	21.6	-5%	
2012	18.8	15.0	22.7	107	21.2	-11%	
2013	20.1	16.1	24.1	112	21.2	-5%	
2014	19.4	15.5	23.2	113	20.9	-7%	
2015	23.9	19.7	28.1	142	21.3	12%	
2016	19.3	15.6	22.9	124	21.0	-8%	

Data source: Centers for Disease Control and Prevention, National Center for Health Statistics. Underlying Cause of Death

1999-2016 on CDC WONDER Online Database, released December, 2017. Data are from the Multiple Cause of Death Files, 1999-2016, as compiled from data provided by the 57 vital statistics jurisdictions through the Vital Statistics Cooperative Program. Accessed at http://wonder.cdc.gov/ucd-icd10.html on Mar 29, 2018 5:50:58 PM.

Rates are per 100,000 and age-adjusted to the 2000 U.S. Standard Population (19 age groups - Census P25-1130). Only Alaska residents are included for Alaska estimates.

Alaska trend was tested using Joinpoint software. Annual Percent Change was -1.43 (p<.05).

Figure 9: Diabetes-related death rates among adults, by gender
Alaska and U.S., 2012-2016, age-adjusted, underlying cause only

Supporting table for Figure 9: diabetes-related death rates among adults, by gender
Alaska and U.S., 2012-2016, age-adjusted, underlying cause only

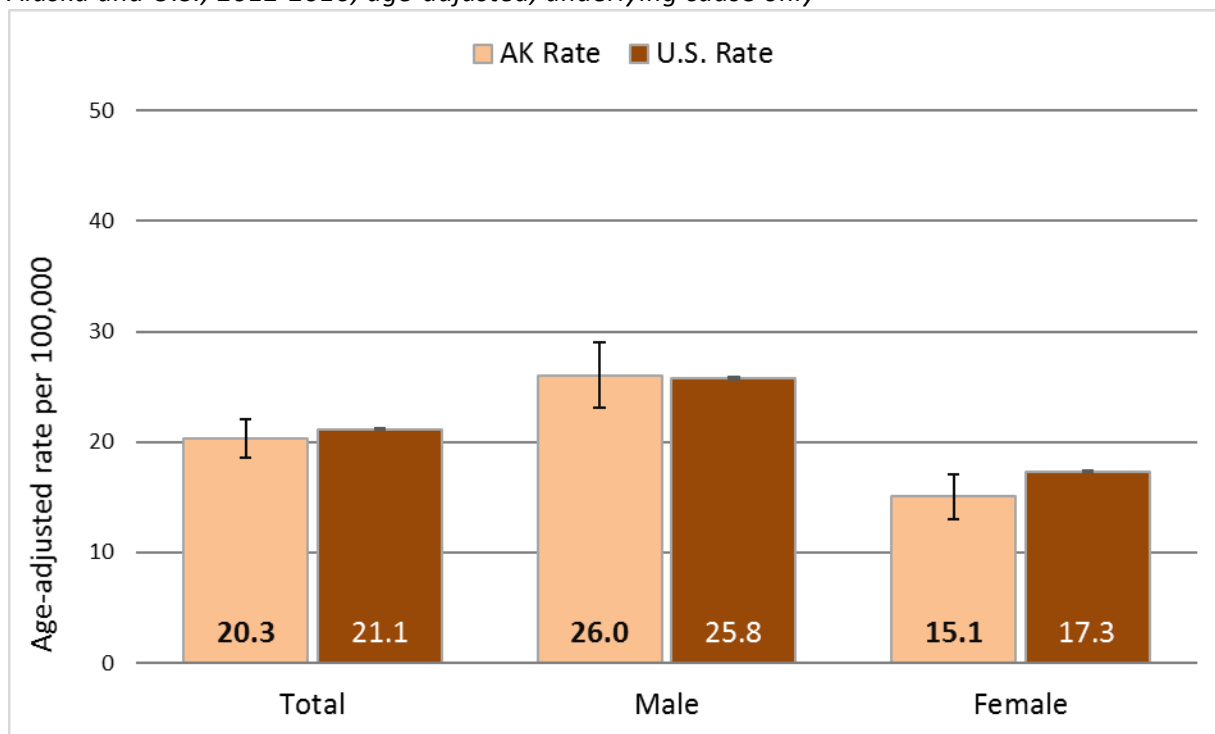|	Alaska			U.S.			
	Rate	Lower CI	Upper CI	Count	Rate	Lower CI	Upper CI
Total	**20.3**	**18.6**	**22.1**	**598**	**21.1**	**21.1**	**21.2**
Male*	26.0	23.1	29.0	376	25.8	25.7	25.9
Female[+]	15.1	13.0	17.1	222	17.3	17.3	17.4

Data source: Centers for Disease Control and Prevention, National Center for Health Statistics. Underlying Cause of Death 1999-2016 on CDC WONDER Online Database, released December, 2017. Data are from the Multiple Cause of Death Files, 1999-2016, as compiled from data provided by the 57 vital statistics jurisdictions through the Vital Statistics Cooperative Program. Accessed at http://wonder.cdc.gov/ucd-icd10.html on Apr 3, 2018

Rates are per 100,000 and age-adjusted to the 2000 U.S. Standard Population (19 age groups - Census P25-1130. Only Alaska residents are included for Alaska estimates.

* Within Alaska, diabetes-related death rates for men are significantly higher than for women; this is also true for the U.S.

[+] Diabetes-related death rates among women are lower for Alaska than for the U.S.

Figure 10: Diabetes-related death rates among adults, by race
Alaska and U.S., 2012-2016, age-adjusted, underlying cause only
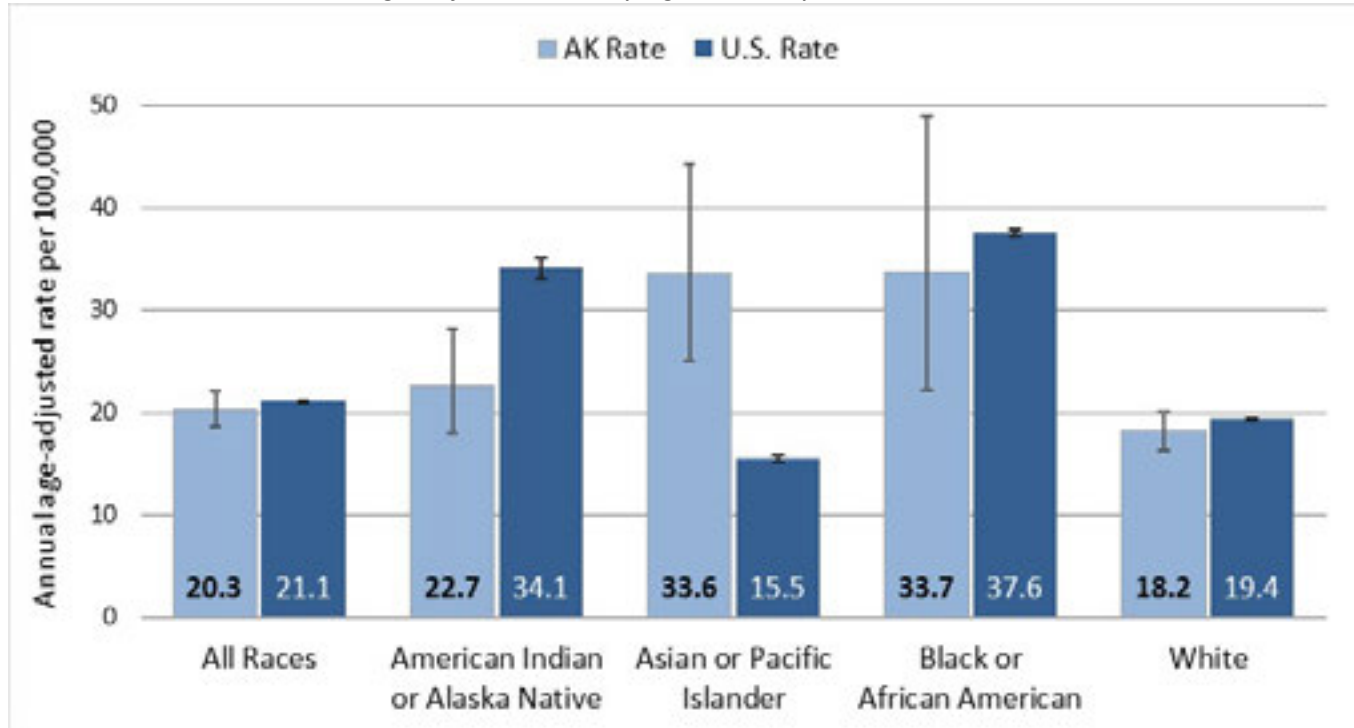
Supporting table for Figure 10: Diabetes-related death rates among adults, by race
Alaska and U.S., 2012-2016, age-adjusted, underlying cause only

	Alaska				U.S.		
	Rate	Lower CI	Upper CI	Count	Rate	Lower CI	Upper CI
All Races	**20.3**	**18.6**	**22.1**	**598**	**21.1**	**21.1**	**21.2**
American Indian or Alaska Native+	22.7	18.0	28.2	90	34.1	33.1	35.1
Asian or Pacific Islander*+	33.6	25.0	44.3	57	15.5	15.2	15.8
Black or African American*	33.7	22.2	49.0	32	37.6	37.3	37.9
White	18.2	16.3	20.1	419	19.4	19.3	19.5

Data source: Centers for Disease Control and Prevention, National Center for Health Statistics. Underlying Cause of Death 1999-2016 on CDC WONDER Online Database, released December, 2017. Data are from the Multiple Cause of Death Files, 1999-2016, as compiled from data provided by the 57 vital statistics jurisdictions through the Vital Statistics Cooperative Program. Accessed at http://wonder.cdc.gov/ucd-icd10.html on Apr 3, 2018

Rates are per 100,000 and age-adjusted to the 2000 U.S. Standard Population (19 age groups - Census P25-1130). Only Alaska residents are included for Alaska estimates.

* Within Alaska, death rates are higher for Asian or Pacific Islander and Black or African American in comparison to the state average and to Whites alone.

+ Death rates for American Indian or Alaska Native people in Alaska are lower than for the U.S.; rates for Asian or Pacific Islander people in Alaska are higher than for the U.S.

Figure 11: Diabetes-related death rates among adults, by Behavioral Health Systems Region

Alaska, 2007-2016, age-adjusted, underlying and contributing cause

Supporting table for Figure 11: Diabetes-related death rates among adults, by Behavioral Health Systems Region

Alaska, 2007-2016, age-adjusted, underlying and contributing cause

	Rate	Lower CI	Upper CI	Count
State of Alaska	**56.0**	**53.8**	**58.3**	**2,781**
Anchorage	61.0	57.3	64.7	1,200
Fairbanks*	46.3	40.3	52.4	264
Juneau	53.9	43.9	64.0	128
Kenai Peninsula*	42.6	36.9	48.3	240
Mat-Su	60.6	54.1	67.0	396
Northwest	54.9	39.6	70.3	60
Other Interior	60.4	47.9	72.9	109
SE-northern	66.9	55.7	78.0	148
SE-southern	57.2	45.2	69.3	95
Southwest	56.1	43.2	68.9	97
Y-K Delta*	30.4	19.5	41.3	36
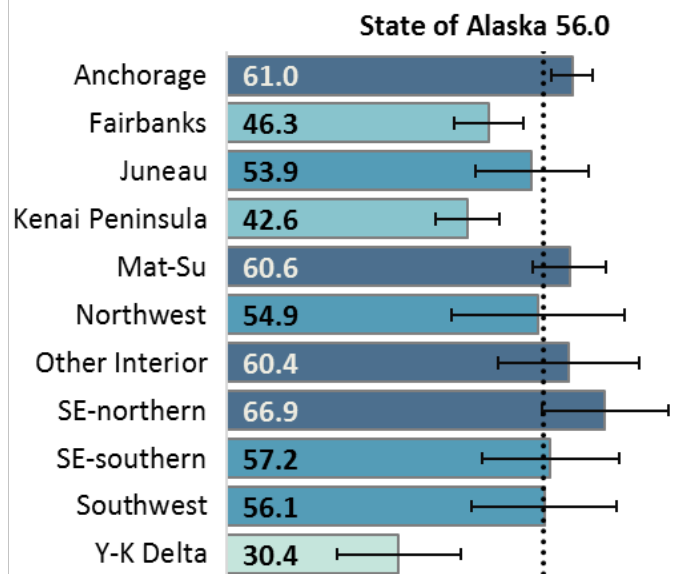
Data source: Alaska Division of Public Health, Health Analytics and Vital Records Section, Mortality Data. Underlying and contributing cause. Rates are per 100,000 and age-adjusted to the 2000 U.S. Standard Population (19 age groups - Census P25-1130). Only Alaska residents are included.

*Indicates significant difference between region and state overall.

Diabetes-related Hospitalizations

We examined diabetes-related hospitalization rates for Alaska for 2016, the most recent data available.[12] These datasets include both inpatient (admitted to the hospital) and outpatient (i.e., emergency department, outpatient surgery, outpatient observation, imaging labs, or other services) visits. "Diabetes-related" visits could list diabetes as the primary reason for the visit, or a contributing or complicating factor that was not the primary reason for the visit (i.e., "secondary").

Although only about 1% of diabetes-related hospital visits were inpatient visits where diabetes was the primary cause (637 total visits), diabetes contributed to the need for hospital treatment in 70,487 total visits during 2016 (see Table 2). Of the diabetes-related inpatient visits (13% of total diabetes-related visits), only 7% indicated diabetes as the primary cause, in comparison to 33% of the outpatient visits.

Rates of diabetes-related hospitalization were similar to diabetes prevalence among subgroups: higher for females than males and increasing with age. One exception is that among children (those under age 18) for both diabetes-related inpatient and outpatient visits, diabetes was more likely to be characterized as the primary reason for the visit than for other age groups (74% and 67%, respectively).

Total diabetes-related hospitalization rates were higher among Asian, Pacific Islander, Alaska Native, and Black/African American people in comparison to White and Hispanic people (see Table 3).

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[12] See description of hospitalization data in Appendix for additional detail.

Table 2: Number and rate of inpatient and outpatient hospital discharges for diabetes, by gender and age

Alaska, 2016

		Inpatient-Diabetes		Outpatient-Diabetes		Total
		Primary	Secondary	Primary	Secondary	
Total						
	Discharges	637	8,430	20,059	41,361	70,487
	Rate per 10,000	8.6	114.0	271.2	559.2	952.9
Male						
	Discharges	389	4,280	10,057	20,203	34,929
	Rate per 10,000	10.2	112.0	263.2	528.8	914.2
Female						
	Discharges	248	4,150	10,002	21,157	35,557
	Rate per 10,000	6.9	116.0	279.7	591.6	994.3
<18						
	Discharges	69	24	396	194	683
	Rate per 10,000	3.6	1.3	20.9	10.2	36.1
18-44						
	Discharges	228	745	3,196	5,819	9,988
	Rate per 10,000	8.3	27.0	115.7	210.6	361.5
45-64						
	Discharges	205	3,223	8,706	17,827	29,961
	Rate per 10,000	10.5	165.2	446.3	913.8	1535.8
65+						
	Discharges	135	4,438	7,761	17,520	29,854
	Rate per 10,000	17.1	562.1	982.9	2218.9	3781.0

Data source: Alaska Division of Public Health, Health Analytics and Vital Records Section, Health Facilities Data Reporting Inpatient and Outpatient Database 2016, v5.

Excludes gestational diabetes.

Only hospitalizations for Alaska residents are shown.

Rates are per 10,000 population in the state of Alaska.

"Secondary" are contributing or complicating factors that are not the primary reason for the visit.

Table 3: Number and rate of inpatient and outpatient hospital discharges for diabetes, by race and ethnicity

Alaska, 2016

		Inpatient-Diabetes		Outpatient-Diabetes		Total
		Primary	Secondary	Primary	Secondary	
White						
	Discharges	412	5,362	9,355	22,600	37,729
	Rate per 10,000	8.4	109.7	191.4	462.3	771.9
Black/African American						
	Discharges	50	401	684	2,232	3,367
	Rate per 10,000	18.2	146.2	249.3	813.6	1227.4
Alaska Native						
	Discharges	75	1,225	6,045	9,480	16,825
	Rate per 10,000	6.6	108.4	535.1	839.2	1489.4
Asian						
	Discharges	16	507	1,058	2,129	3,710
	Rate per 10,000	nr	515.8	1076.4	2166.0	3774.5
Pacific Islander						
	Discharges	24	319	424	1,617	2,384
	Rate per 10,000	24.4	324.5	431.4	1645.1	2425.5
Hispanic						
	Discharges	28	250	586	1,395	2,259
	Rate per 10,000	5.5	49.2	115.3	274.5	444.5

Data source: Alaska Division of Public Health, Health Analytics and Vital Records Section, Health Facilities Data Reporting Inpatient and Outpatient Database 2016, v5. Excludes gestational diabetes.

Only hospitalizations for Alaska residents are shown.

Categories are mutually exclusive: all race groups are non-Hispanic; Hispanic ethnicity includes people of all race groups.

Rates are per 10,000 population in the state of Alaska.

"Secondary" are contributing or complicating factors that are not the primary reason for the visit.

nr: rate not reported due to small numbers.

Economic Costs

Diabetes-related deaths and hospitalizations – as well as other outcomes associated with chronic disease – have economic costs to the public sector, as well as placing a burden on people with diabetes and their families. The CDC reports that after adjusting for age and gender, average medical expenditures among people with diagnosed diabetes are more than double the costs for people without diabetes.[13] To understand costs of providing healthcare services for people with diabetes in Alaska, a comprehensive study commissioned by the State of Alaska Division of Public Health assessed the economic costs to Medicaid for treating diabetes and other chronic conditions.[14]

The study reported that diabetes and other chronic conditions were more common among Medicaid-eligible adults in Alaska than non-Medicaid eligible adults. The prevalence of diabetes was 7.5% among Medicaid-eligible adults and 4.7% among other Alaska adults overall; and 27.8% among Medicaid-eligible adults ages 65 and older in comparison to 20.1% among non-eligible adults of the same age. Having diabetes was associated with other chronic conditions as well, including heart disease and obesity; prevalence of co-occurring conditions was higher among the Medicaid eligible population than the non-eligible population.

The study further described costs of providing healthcare to adults with diabetes among the 102,547 Alaska Medicaid-enrolled adults in FY2016 (54% of the total persons covered were adults in that year). Medicaid-paid healthcare costs were recorded for 5,400 adults with diabetes. The average cost for healthcare in FY2016 was nearly $36,000 per person with diabetes, in stark contrast to the average of about $7,700 spent per person without a chronic health condition in the same year. In total, more than $193 million in Medicaid costs were paid for people with diabetes in Alaska in that year. About $72 million of this funding was from Alaska's state general fund (37%), and the remaining costs were covered by federal funds. Notably, these costs included only those paid by Medicaid, and do not account for medical care received from outside the system, and also do not account for other important economic costs to individuals and their families (e.g., lost work or inability to maintain employment).

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[13] Centers for Disease Control and Prevention (CDC). *National Diabetes Statistics Report, 2017 Estimates of Diabetes and Its Burden in the United States.* August 8, 2017. https://www.cdc.gov/diabetes/pdfs/data/statistics/national-diabetes-statistics-report.pdf

[14] Helvoight TL, Lehndorff H, McMillan N. Evergreen Economics. *The Cost of Eight Chronic Conditions on Alaska's Medicaid Program.* October 18, 2017.
http://dhss.alaska.gov/dph/Chronic/Documents/Publications/2017_CostOfChronicConditions_EvergreenEconomics_web.pdf

Diabetes Control

Screening for Diabetes

The American Diabetes Association recommends screening and testing for type 2 diabetes or prediabetes among all adults ages 45 or older every three years at a minimum, adults of any age who are overweight or obese and have one or more additional risk factors for type 2 diabetes, and recently recommended consideration of testing for diabetes in children or adolescents who are overweight or obese.[15]

About half (52.0%) of Alaska adults without diabetes have been tested for diabetes within the past three years. Conservatively, at least 76% of Alaska adults who do not have diabetes met criteria for screening (i.e., people age 45 and older and people ages 18-44 who are overweight or obese) and should be screened.

Women were more likely than men to have been tested in the past three years (55.7% vs. 48.5%). Screening rates increased significantly by age: 42.3% of adults ages 18-44 had been screened in comparison to 68.3% of adults ages 65 and older. Black/African American adults and White adults were similarly likely to have been screened (57.1% and 54.9%, respectively); Alaska Native (45.4%), Hispanic (41.3%) and Asian (38.7%) adults were less likely to have been screened. People with fewer economic resources (low socioeconomic status or SES) were less likely than those of higher SES to have been screened (45.4% vs. 57.7%). (data not shown, see Appendix Table 2 for details).

Adults in Southeast (SE) Alaska – both northern and southern regions – were more likely to have been tested within the past three years than the state average (see Figure 12). Adults in the Northwest and Yukon-Kuskokwim (Y-K) regions were less likely than the state average to have been tested.

Other screenings. In addition to screening for diabetes, adults should receive regular screenings for high cholesterol and blood pressure; both are risk factors for developing diabetes, as well as for diabetes complications among those who already have diabetes. Appendix Table 2 provides the prevalence of current screenings for major Alaska population groups.

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[15] American Diabetes Association. *Classification and Diagnosis of Diabetes: Standards of Medical Care in Diabetes – 2018.* Diabetes Care. January 2018. Vol 41, Supplement 1: S13-S27.
http://care.diabetesjournals.org/content/diacare/suppl/2017/12/08/41.Supplement_1.DC1/DC_41_S1_Combined.pdf

Figure 12: Meeting diabetes screening recommendations among adults, by Behavioral Health Systems Region

Percentage of all adults without diabetes who have been tested for diabetes in the past 3 years, Alaska, 2012-2016

Percentage of adults without diabetes who have been tested for diabetes in the past 3 years, by Behavioral Health Systems Region, Alaska, 2012-2016

	Prevalence	Lower CI	Upper CI
State of Alaska	**52.0%**	**51.1%**	**52.9%**
Anchorage	52.4%	50.7%	54.2%
Fairbanks	52.8%	50.8%	54.8%
Juneau	52.1%	49.0%	55.2%
Kenai Peninsula	54.2%	51.9%	56.5%
Mat-Su	53.5%	51.5%	55.6%
Northwest*	38.6%	34.8%	42.6%
Other Interior	51.0%	48.1%	53.9%
SE-northern*	57.1%	53.4%	60.7%
SE-southern*	57.4%	53.4%	61.2%
Southwest	51.0%	47.3%	54.7%
Y-K Delta*	33.1%	29.6%	36.9%
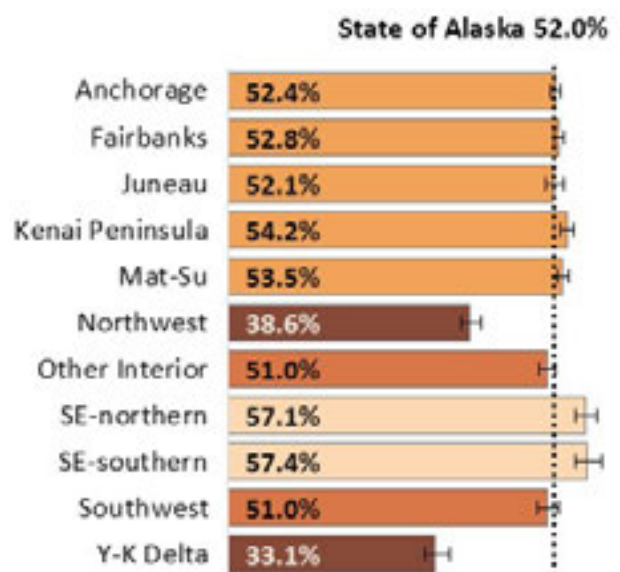
Data source: Alaska BRFSS Combined File. *Have you had a test for high blood sugar or diabetes within the past three years?*

*Indicates significant difference between region and state overall.

Effective Healthcare

Quality care and self-management practices for people with diabetes can effectively lower the risk of health complications.

Although recommendations for care can vary based on individual characteristics, specific guidelines for diabetes care include the following information from the Alaska BRFSS:

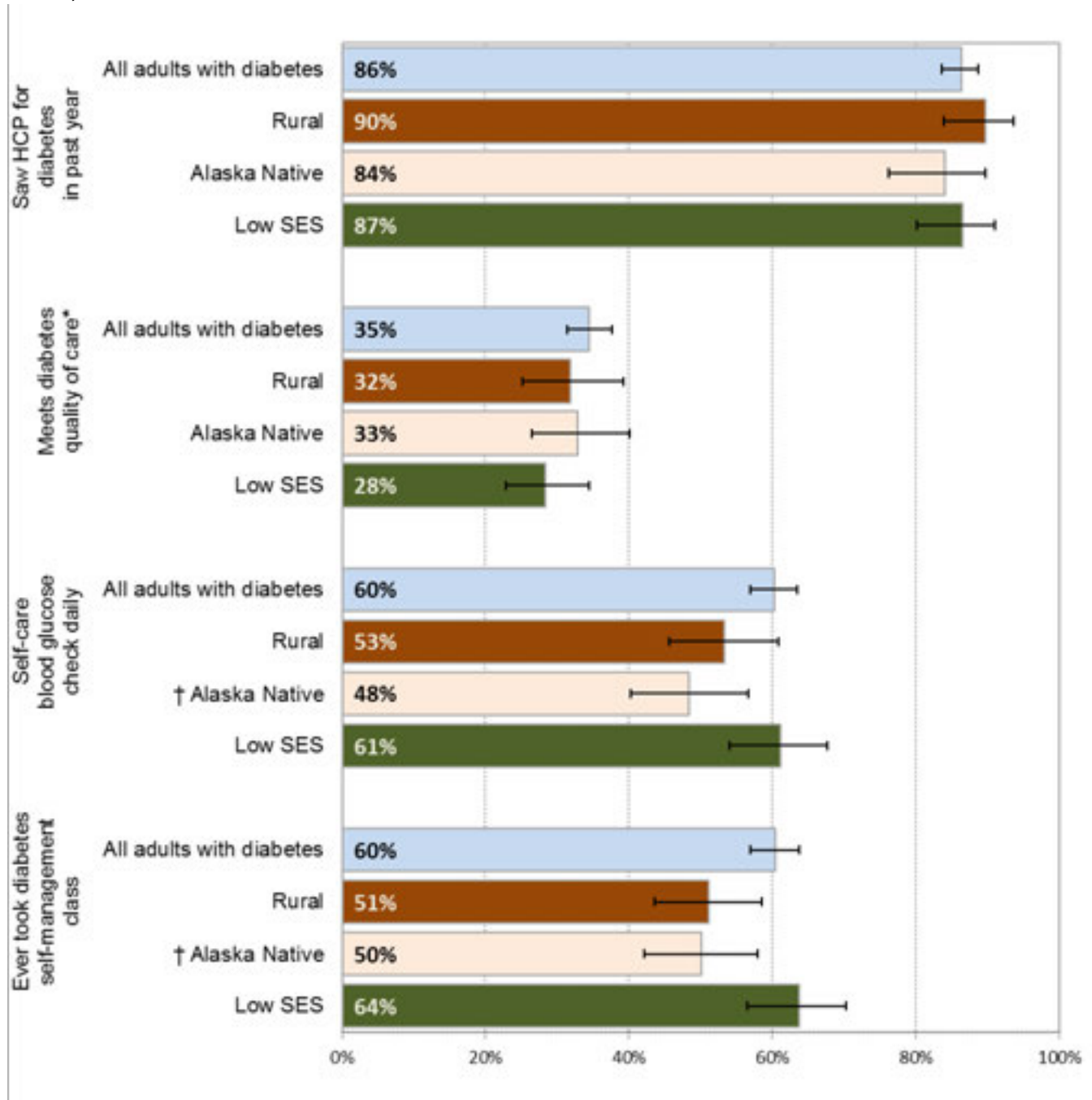- Seeing a healthcare provider (HCP) for diabetes-related preventive care at least once per year
- Working with a healthcare team to achieve high-quality diabetes care; that means having received all three clinical services below to achieve the "quality of care" standard:
  - an annual eye exam,
  - an annual foot exam, and
  - a hemoglobin A1C test at least twice per year
- Checking blood glucose levels daily at home
- Attending evidence-based diabetes self-management classes

We combined the five most recent years of data where these measures were collected to describe quality of diabetes care among people with diabetes.

Most Alaska adults with diabetes saw a healthcare provider for diabetes care in the past year (86%), and prevalence did not vary greatly among population subgroups (see Figure 13). However, only about one-third of people with diabetes met the quality of care standard. Alaska Native adults with diabetes were less likely to report checking their blood glucose daily in comparison to Whites, and also less likely to have ever taken a diabetes self-management class. Other groups were not significantly different than the state average.

Regional variation. There are not significant differences by region among people with diabetes for any quality of care measures (see Figures 14-17); however, the relatively small number of people with diabetes per region included in the survey makes it difficult to detect significant differences. Although not statistically significant from the state average, the prevalence of having attended a diabetes self-management class appears relatively lower for the Northwest, Yukon-Kuskokwim (Y-K) Delta, and Other Interior regions (see Figure 17).

Figure 13: Diabetes care indicators among adults, by priority population groups
Alaska, 2011-2014 combined

Saw HCP for diabetes in past year
- All adults with diabetes: 86%
- Rural: 90%
- Alaska Native: 84%
- Low SES: 87%

Meets diabetes quality of care*
- All adults with diabetes: 35%
- Rural: 32%
- Alaska Native: 33%
- Low SES: 28%

Self-care blood glucose check daily
- All adults with diabetes: 60%
- Rural: 53%
- † Alaska Native: 48%
- Low SES: 61%

Ever took diabetes self-management class
- All adults with diabetes: 60%
- Rural: 51%
- † Alaska Native: 50%
- Low SES: 64%

Data source: Alaska BRFSS Combined File, 2011-2014. Data shown in these charts are included in Appendix Table 4a and Table 4b.

† Alaska Native adults with diabetes were less likely than Whites to do daily self-checks and to have ever taken a self-management class.

*Meeting the Diabetes Quality of Care standard includes having had an annual eye exam and foot exam by a healthcare provider, and hemoglobin A1C tests taken at least twice in the past year.

Measures:

Seeing a healthcare provider (HCP) for diabetes: *About how many times in the past 12 months have you seen a doctor, nurse, or other health professional for your diabetes?*

[technical notes continue on the next page]

Diabetes Quality of Care standard:

- *When was the last time you had an eye exam in which the pupils were dilated? This would have made you temporarily sensitive to bright light.*
- *About how many times in the past 12 months has a health professional checked your feet for any sores or irritations.*
- *A test for "A one C" measures the average level of blood sugar over the past three months. About how many times in the past 12 months has a doctor, nurse, or other health professional checked you for "A one C"?*

Self-care blood glucose check: *About how often do you check your blood for glucose or sugar? Include times when checked by a family member or friend, but do NOT include times when checked by a health professional.*

Diabetes self-management class: *Have you ever taken a course or class in how to manage your diabetes yourself?*

Alaska Native group includes all who reported that as one of their race groups; other race groups include those who reported that race as their only race and did not report being Alaska Native or Hispanic. Pacific Islander/Other includes those who reported multiple race groups but not Alaska Native or Hispanic.

Low socio-economic status (SES) includes those who live in a household that is at <185% of the federal poverty level, or have completed less than a high school education.

Rural Alaska includes those living in Northern and Southwest Alaska, as defined by the sampling regions for Alaska BRFSS. This includes Northwest, Yukon-Kuskokwim (Y-K) Delta, and Southwest regions, as well as Denali Borough, and the Census Areas Yukon-Koyukuk and Southeast Fairbanks.

Figure 14: Diabetes care by a provider among adults with diabetes, by Behavioral Health Systems Region

Percentage of adults with diabetes who saw a healthcare provider for diabetes in the past year

Alaska, 2011-2014

Percentage of Alaska adults with diabetes who saw a healthcare provider for diabetes in the past year, by Behavioral Health Systems Region, Alaska, 2011-2014

	Prevalence	Lower CI	Upper CI
State of Alaska	**86.4%**	**83.7%**	**88.7%**
Anchorage	85.9%	80.6%	89.9%
Fairbanks	90.2%	85.1%	93.7%
Juneau	82.1%	70.5%	89.8%
Kenai Peninsula	88.1%	82.4%	92.1%
Mat-Su	84.4%	78.3%	89.0%
Northwest	95.8%	88.6%	98.5%
Other Interior	81.7%	70.2%	89.4%
SE-northern	78.8%	61.5%	89.6%
SE-southern	89.9%	78.0%	95.7%
Southwest	90.8%	83.2%	95.2%
Y-K Delta	90.2%	77.4%	96.1%

Data source: Alaska BRFSS Standard File.

^Estimates flagged for potential unreliability (small numbers or extremely high prevalence)

No significant difference between any region and the state overall.

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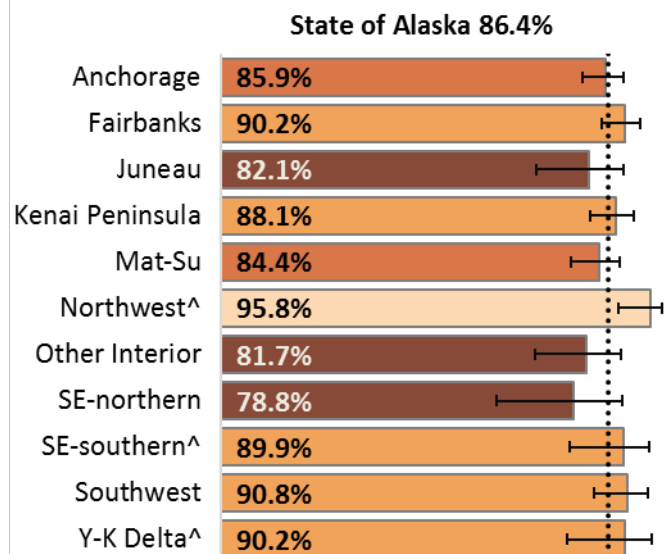***Figure 15: Receiving quality diabetes care among adults with diabetes, by Behavioral Health Systems Region***

Percentage of adults with diabetes who receive care meeting the Diabetes Quality of Care standard[+]

Alaska, 2011-2014

Percentage of Alaska adults with diabetes who meet the Diabetes Quality of Care standard[+],

by Behavioral Health Systems Region, Alaska, 2011-2014

	Prevalence	Lower CI	Upper CI
State of Alaska	**34.5%**	**31.4%**	**37.7%**
Anchorage	33.2%	27.8%	39.1%
Fairbanks	31.6%	24.5%	39.8%
Juneau	34.8%	24.3%	46.9%
Kenai Peninsula	32.1%	25.5%	39.6%
Mat-Su	42.0%	34.1%	50.3%
Northwest	36.7%	20.9%	56.1%
Other Interior	25.2%	17.8%	34.3%
SE-northern	41.2%	28.9%	54.8%
SE-southern	37.2%	25.5%	50.7%
Southwest	41.6%	31.5%	52.3%
Y-K Delta	24.6%	13.6%	40.3%
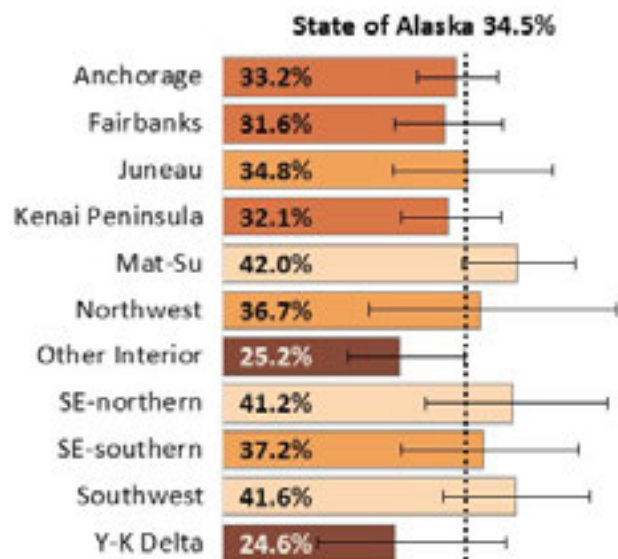
Data source: Alaska BRFSS Standard File.

[+]Meeting the Diabetes Quality of Care standard includes having had an annual foot exam and eye exam by a healthcare provider, and hemoglobin A1C tests at least twice in the past year.

No significant difference between any region and the state overall.

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Figure 16: Daily blood glucose checks among adults with diabetes, by Behavioral Health Systems Region

Percentage of adults with diabetes who check their blood glucose on a daily basis, Alaska, 2011-2014

Percentage of Alaska adults with diabetes who checked their blood glucose on a daily basis,
by Behavioral Health Systems Region, Alaska, 2011-2014

	Prevalence	Lower CI	Upper CI
State of Alaska	**60.3%**	**57.0%**	**63.5%**
Anchorage	62.8%	56.8%	68.3%
Fairbanks	56.0%	47.3%	64.4%
Juneau	65.3%	52.1%	76.5%
Kenai Peninsula	59.9%	52.3%	67.1%
Mat-Su	56.5%	48.5%	64.2%
Northwest	44.8%	29.1%	61.7%
Other Interior	61.7%	51.5%	71.0%
SE-northern	52.7%	39.7%	65.3%
SE-southern	75.1%	63.4%	84.0%
Southwest	56.2%	45.8%	66.1%
Y-K Delta	42.6%	26.0%	61.0%
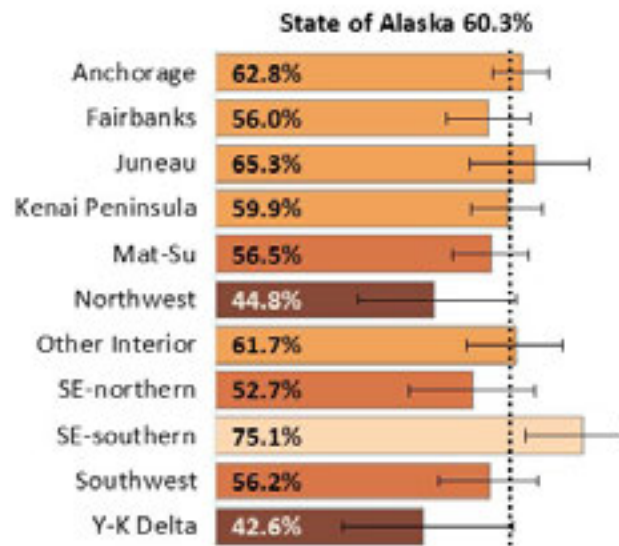
Data source: Alaska BRFSS Standard File.

No significant difference between any region and the state overall.

Figure 17: Diabetes self-management class participation among adults with diabetes, by Behavioral Health Systems Region

Percentage of adults with diabetes who have ever taken a class to manage their diabetes
Alaska, 2011-2014

Percentage of Alaska adults with diabetes who have ever taken a class to manage their diabetes,
by Behavioral Health Systems Region, Alaska, 2011-2014

	Prevalence	Lower CI	Upper CI
State of Alaska	**60.4%**	**57.0%**	**63.7%**
Anchorage	62.3%	56.0%	68.2%
Fairbanks	64.6%	56.7%	71.7%
Juneau	51.4%	38.6%	64.0%
Kenai Peninsula	59.7%	51.8%	67.1%
Mat-Su	63.1%	55.0%	70.5%
Northwest	42.0%	26.5%	59.2%
Other Interior	49.5%	39.6%	59.5%
SE-northern	59.2%	46.7%	70.7%
SE-southern	58.8%	44.9%	71.4%
Southwest	60.0%	49.7%	69.5%
Y-K Delta	42.3%	26.2%	60.3%

Data source: Alaska BRFSS Standard File.

No significant difference between any region and the state overall.
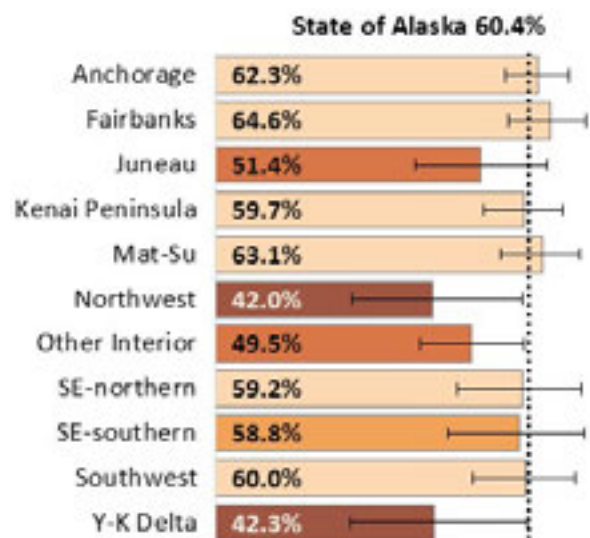
37

Risk Factors

Key risk factors for developing diabetes or its complications include being overweight or obese, drinking sugary drinks, not getting enough exercise, high blood pressure or cholesterol, and smoking cigarettes. Many adults in Alaska had one of these risk factors (see Figure 18), and more than half of adults in any of the major demographic groups examined for this report had two or more risk factors (see Figure 19).

Figure 18: Prevalence of selected risk factors for diabetes among adults
Alaska. 2011-2016
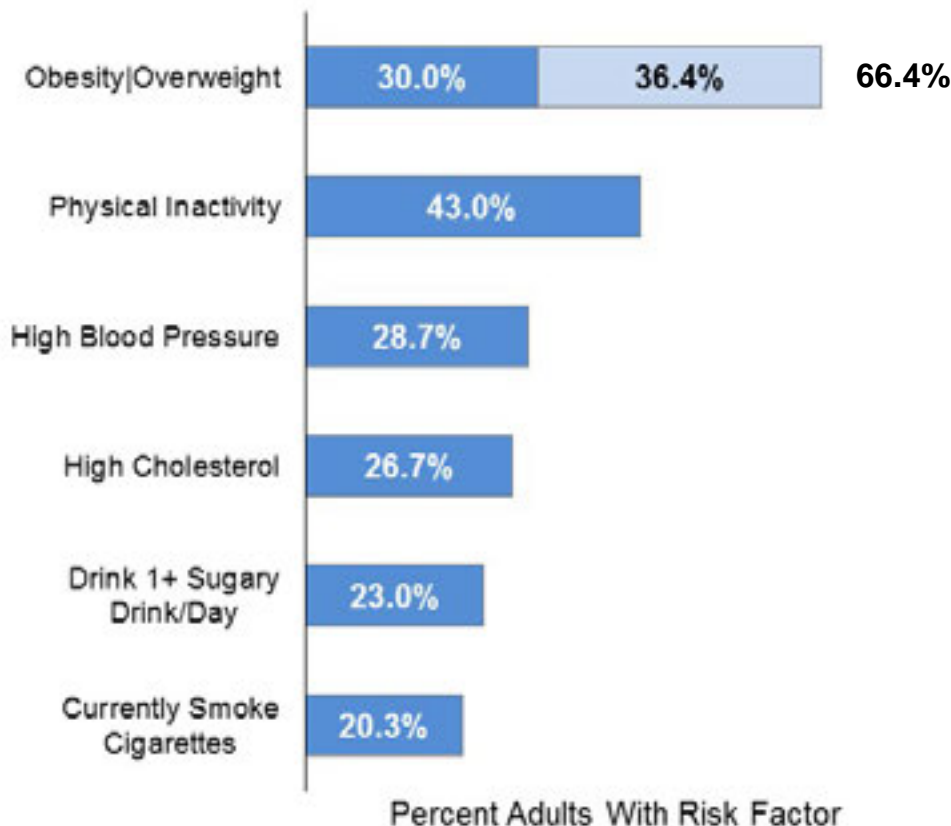
Data source: Alaska BRFSS Combined File, 2013-2016 for obesity, overweight and smoking; Alaska BRFSS Standard File, 2011, 2013, 2015 for physical inactivity, high cholesterol, and drinking one or more sugary drinks per day; Alaska BRFSS Standard File, 2011-2015 for high blood pressure.

Measure Definitions:

Obesity/Overweight: self-reported height and weight are used to calculate body mass index (BMI); BMI >=30 is obese, and BMI between 25.0-29.9 is overweight.

Physical inactivity: percent of adults not getting the equivalent of moderate-intensity physical activity for >=150 minutes per week.

High blood pressure, High cholesterol: percent of adults who were ever told by a healthcare professional that they have this condition (high blood pressure or high cholesterol)

Drink 1+ sugary drink/day: percent of adults who report drinking an average of one or more non-diet sodas or other sugary drinks per day in the past seven days.

Currently smoke cigarettes: percent of adults who have ever smoked 100 or more cigarettes and who report that they smoke every day or some days.

Figure 19: Prevalence of multiple risk factors for diabetes among adults, by demographic group
Alaska, 2011-2015
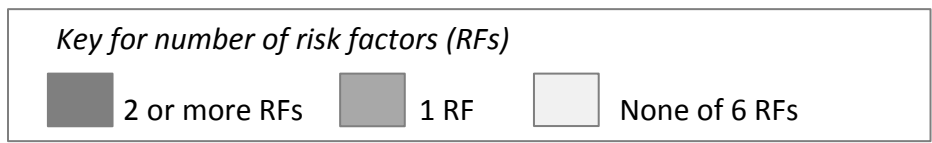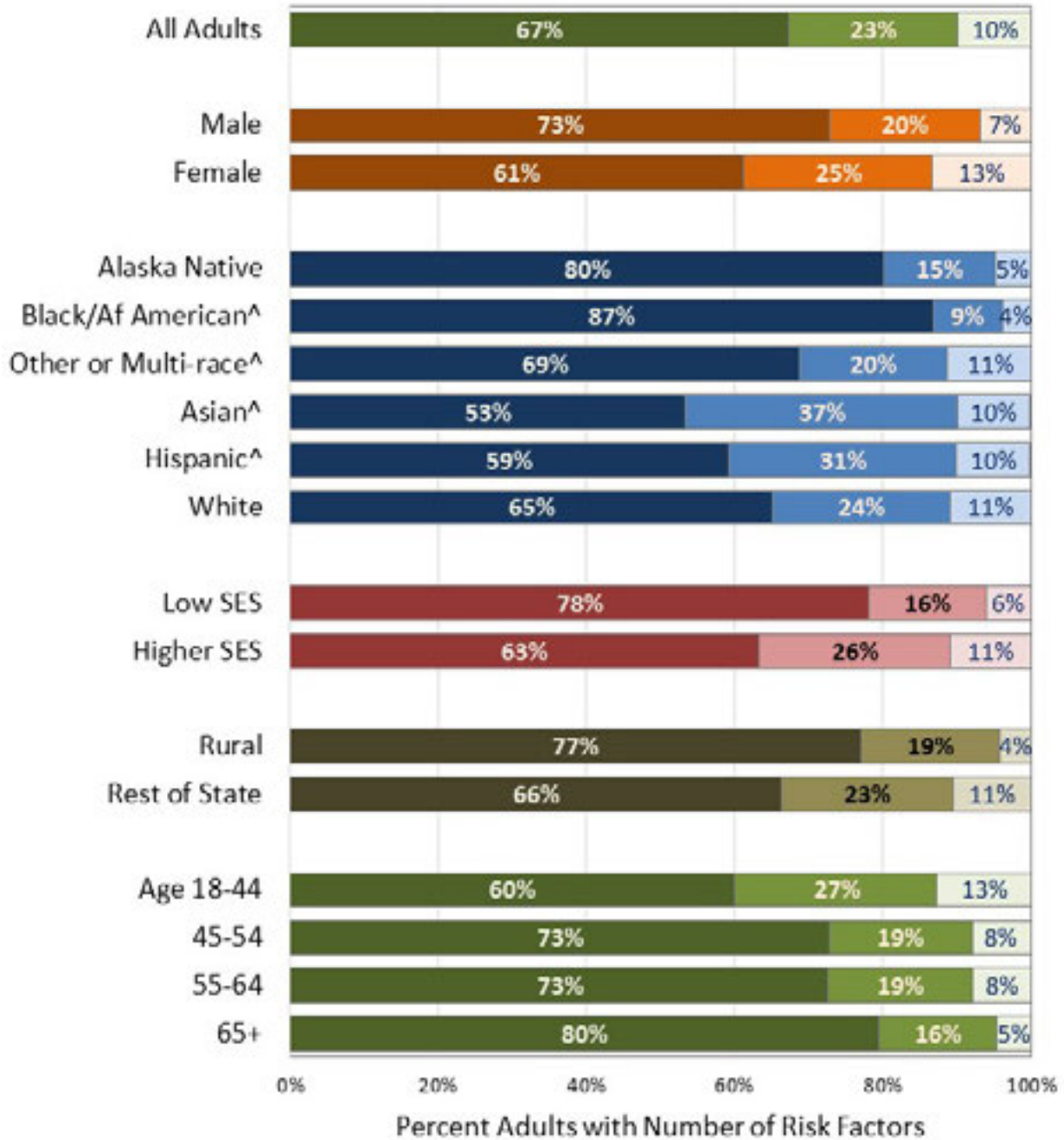
Data source: Alaska BRFSS Standard Data file, 2011, 2013, 2015. Supporting data for this figure are shown in Appendix Table 3.

Risk factors included in the count: Obesity or overweight, physical inactivity, ever told have high blood pressure, ever told have high cholesterol, drank one or more sugary drinks per day, and/or currently a smoker. [technical notes continue on next page]

Note: data may not add up to 100% due to rounding.

^ Indicates that the estimate is flagged for reliability.

Alaska Native group includes all who reported American Indian or Alaska Native as one of their race groups; other race groups include those who reported that race as their only race and did not report being Alaska Native or Hispanic. Other/multi-race includes those who reported multiple race groups but not Alaska Native or Hispanic.

Low socio-economic status (SES) includes those who live in a household that is at <185% of the federal poverty level, or have completed less than a high school education.

Rural Alaska includes those living in Northern and Southwest Alaska, as defined by the sampling regions for Alaska BRFSS. This includes Northwest, Yukon-Kuskokwim (Y-K) Delta, and Southwest regions, as well as Denali Borough, and the Census Areas Yukon-Koyukuk and Southeast Fairbanks.

Summary of population risk factor patterns

In summary, we provide a visual display of higher and lower risk factor prevalence by different population groups in Alaska: increasing intensity of red indicates relatively greater prevalence of risk factors, lighter shades indicate closer to "average" prevalence of risk, and increasing intensity of blue spotted patterns indicates relatively lower prevalence of risk factors. These can help to reveal patterns of risk across different population groups.

Figure 20 shows greater risk across multiple risk factors among men, older adults, and low SES populations. Figure 21 shows elevated risk for some factors among Alaska Native and Black/African American adults, and relatively lower risk among Asian, Hispanic and White adults. Finally, Figure 22 shows multiple increased risk factors by Behavioral Health Systems region, although patterns are generally mixed by region.

Figure 20: Summary of diabetes risk and risk factor status among adults, by gender, age, and socioeconomic status (SES)

Alaska, 2011-2015

Patterns for	Gender		Age				SES	
Individual Risk Factors	Male	Female	18-44	45-54	55-64	65+	Low SES	Higher
Obese (BMI 30.0 or higher)								
Overweight (BMI 25.0-29.9)								
Physical Activity <150 Min/Week								
1+ Sugary Beverage/Day								
Current Cigarette Smoker								
Hypertension (Lifetime)								
High Cholesterol (Lifetime)								
Diagnosed with Diabetes								

Key for patterns of risk summary above

Key for Patterns	Higher Risk					Lower Risk
Individual Risk Factors						
Obese (BMI 30.0 or higher)	>=40%	35.0-39.9	30.7-34.9	28.5-30.6	18.0-28.4	<18.0
Overweight (BMI 25.0-29.9)	>=43.0	40.0-42.9	37.9-39.9	34.0-37.9	20.0-33.9	<20.0
Physical Activity <150 Min/Week	>=53.0	48.0-52.9	45.1-47.9	40.0-45.0	25.0-39.9	<25.0
1+ Sugary Beverage/Day	>=40.0	35.0-39.9	32.1-34.9	27.0-32.0	20.0-26.9	<20.0
Current Cigarette Smoker	>=30.0	25.0-29.9	21.6-24.9	19.0-21.5	12.0-19.0	<12.0
Hypertension (Lifetime)	>=47.0	36.0-46.9	30.1-35.9	27.0-30.0	18.0-26.9	<18.0
High Cholesterol (Lifetime)	>=45.0	34.0-44.9	28.1-33.9	25.0-28.0	18.0-24.9	<18.0
Diagnosed with Diabetes	>=15%	10.0-14.9	7.9-9.9	6.7-7.9	4.0-6.6	<4.0

Data source: 2011-2015 Alaska BRFSS Standard File for physical activity, sugary drinks, hypertension, high cholesterol; 2012-2016 Alaska BRFSS Combined File for obesity, overweight, smoking, and diabetes.

Figure 21: Summary of diabetes risk and risk factor status among adults, by race and ethnicity

Patterns for Individual Risk Factors	Race and Ethnicity					
	Alaska Native	Black or African American	Asian	Other or Multi-race	Hispanic	White
Obese (BMI 30.0 or higher)						
Overweight (BMI 25.0-29.9)						
Physical Activity <150 Min/Week						
1+ Sugary Beverage/Day						
Current Cigarette Smoker						
Hypertension (Lifetime)						
High Cholesterol (Lifetime)						
Diagnosed with Diabetes						

Key for patterns of risk summary above

Key for Patterns	*Higher Risk*					*Lower Risk*
Individual Risk Factors						
Obese (BMI 30.0 or higher)	>=40%	35.0-39.9	30.7-34.9	28.5-30.6	18.0-28.4	<18.0
Overweight (BMI 25.0-29.9)	>=43.0	40.0-42.9	37.9-39.9	34.0-37.9	20.0-33.9	<20.0
Physical Activity <150 Min/Week	>=53.0	48.0-52.9	45.1-47.9	40.0-45.0	25.0-39.9	<25.0
1+ Sugary Beverage/Day	>=40.0	35.0-39.9	32.1-34.9	27.0-32.0	20.0-26.9	<20.0
Current Cigarette Smoker	>=30.0	25.0-29.9	21.6-24.9	19.0-21.5	12.0-19.0	<12.0
Hypertension (Lifetime)	>=47.0	36.0-46.9	30.1-35.9	27.0-30.0	18.0-26.9	<18.0
High Cholesterol (Lifetime)	>=45.0	34.0-44.9	28.1-33.9	25.0-28.0	18.0-24.9	<18.0
Diagnosed with Diabetes	>=15%	10.0-14.9	7.9-9.9	6.7-7.9	4.0-6.6	<4.0

Data source: 2011-2015 Alaska BRFSS Standard File for physical activity, sugary drinks, hypertension, high cholesterol; 2012-2016 Alaska BRFSS Combined File for obesity, overweight, smoking, and diabetes.

Figure 22: Summary of diabetes risk and risk factor status among adults by Behavioral Health Systems region

Alaska, 2011-2015

Patterns for Individual Risk Factors	Behavioral Health Systems Region										
	Anchorage	Fairbanks	Juneau	Kenai Peninsula	Mat-Su	Northwest	Other Interior	SE-northern	SE-southern	Southwest	Y-K Delta
Obese (BMI 30.0 or higher)											
Overweight (BMI 25.0-29.9)											
Physical Activity <150 Min/Week											
1+ Sugary Beverage/Day											
Current Cigarette Smoker											
Hypertension (Lifetime)											
High Cholesterol (Lifetime)											
Diagnosed with Diabetes											

Key for patterns of risk summary above

Key for Patterns	Higher Risk					Lower Risk
Individual Risk Factors						
Obese (BMI 30.0 or higher)	>=40%	35.0-39.9	30.7-34.9	28.5-30.6	18.0-28.4	<18.0
Overweight (BMI 25.0-29.9)	>=43.0	40.0-42.9	37.9-39.9	34.0-37.9	20.0-33.9	<20.0
Physical Activity <150 Min/Week	>=53.0	48.0-52.9	45.1-47.9	40.0-45.0	25.0-39.9	<25.0
1+ Sugary Beverage/Day	>=40.0	35.0-39.9	32.1-34.9	27.0-32.0	20.0-26.9	<20.0
Current Cigarette Smoker	>=30.0	25.0-29.9	21.6-24.9	19.0-21.5	12.0-19.0	<12.0
Hypertension (Lifetime)	>=47.0	36.0-46.9	30.1-35.9	27.0-30.0	18.0-26.9	<18.0
High Cholesterol (Lifetime)	>=45.0	34.0-44.9	28.1-33.9	25.0-28.0	18.0-24.9	<18.0
Diagnosed with Diabetes	>=15%	10.0-14.9	7.9-9.9	6.7-7.9	4.0-6.6	<4.0

Data source: 2011-2015 Alaska BRFSS Standard File for physical activity, sugary drinks, hypertension, high cholesterol; 2012-2016 Alaska BRFSS Combined File for obesity, overweight, smoking, and diabetes.

What can be done?

The State of Alaska and its partners are working to prevent and control diabetes in multiple ways.[16] Examples include:

- **Providing education and information to the Alaska public.** This includes campaigns to educate about risk factors and prevention of diabetes.
- **Promoting diabetes prevention programs (DPP) and diabetes self-management education and support (DSMES) programs**. The state of Alaska is working to increase access to and participation in DPPs, as evidence shows that DPPs can cut the risk of developing type 2 diabetes in people with prediabetes by over half.[17] The state supports training of facilitators and delivery of evidence-based self-management training for people with diabetes. These trainings build skills for people to practice self-care and improve the effectiveness of their clinical care. An economic evaluation of this program commissioned by the State of Alaska in 2014 found that attending diabetes self-management classes was associated with a more than 20% reduction in annual Medicaid spending relative to people who did not attend classes.[18]
- **Supporting healthcare systems to improve screening for type 2 diabetes and care for people with diabetes.** This includes collecting and disseminating clinical guidelines for care and sharing information about resources that providers can use with their patients.
- **Expanding access to resources.** Partners in Alaska have been working to expand insurance coverage for DPP, DSMES and other diabetes self-management programs.

Data Gaps

This report summarizes key data that are available to describe the burden of diabetes in Alaska, including among specific populations and communities. One important data gap is the prevalence of diabetes among children; currently, there is no information available about the percentage of Alaska's children who have prediabetes or diabetes, but development of type 2 diabetes in youth has been an issue of increasing national concern.[19] One critical risk factor for youth is obesity.

Although we lack prevalence information about diabetes in youth, Alaska's Student Weight Status Surveillance System (SWSSS) collects information about youth obesity from partner school districts that have contributed their data to help monitor obesity trends. Participating school districts provide the Department of Health and Social Services (DHSS) with de-identified student data (i.e., measured height and weight, age, and sex). DHSS conducts the analysis to generate body mass index (BMI), BMI percentile, and the associated weight status classifications of underweight, healthy weight, overweight

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[16] See Alaska Department of Health and Social Services, Division of Public Health, Diabetes Prevention and Control Program http://dhss.alaska.gov/dph/Chronic/Pages/Diabetes/default.aspx

[17] National Institutes of Health, National Institute of Diabetes and Digestive and Kidney Diseases, *Diabetes Prevention Program (DPP)* – website summarizing results from research. *https://www.niddk.nih.gov/about-niddk/research-areas/diabetes/diabetes-prevention-program-dpp* (last accessed 7/28/18)

[18] Helvoight TL, Lehndorff H, McMillan N. Evergreen Economics. *The Cost of Eight Chronic Conditions on Alaska's Medicaid Program.* October 18, 2017.

[19] Centers for Disease Control and Prevention (CDC). *Prevent Type 2 Diabetes in Kids.* *https://www.cdc.gov/features/prevent-diabetes-kids/index.html*

and obese. The percentage of K-8 students who are overweight and obese in participating districts ranged from 30.5 (Matanuska-Susitna) to 61.8 (Dillingham) in the 2016-17 school year.[20] Programs working to encourage healthy eating and physical activity among youth will also result in preventing type 2 diabetes.

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[20] Alaska Department of Health and Social Services, Division of Public Health, Obesity Prevention. http://dhss.alaska.gov/dph/InfoCenter/Pages/ia/swsss/swsss_health_profiles.aspx and http://dhss.alaska.gov/dph/Chronic/Pages/Obesity/weightstatus.aspx

Appendix

Data Tables

Appendix Table 1: Prevalence of diagnosed diabetes and prediabetes among adults

Alaska, 2012-2016

	Diabetes			Prediabetes			Combined[+] Diabetes/Prediabetes		
	%	Lower CI	Upper CI	%	Lower CI	Upper CI	%	Lower CI	Upper CI
All Adults	7.3%	6.9%	7.7%	8.5%	8.1%	9.0%	15.8%	15.4%	16.6%
Male	7.2%	6.6%	7.8%	6.4%	5.9%	7.0%	13.6%	13.0%	14.6%
Female	7.5%	6.9%	8.1%	10.7%	10.0%	11.4%	18.2%	17.5%	19.3%
Alaska Native	7.6%	6.7%	8.6%	11.2%	10.1%	12.4%	18.8%	17.5%	20.3%
Black/African American	15.8%	11.7%	20.9%	11.4%	8.1%	15.7%	27.2%	22.5%	33.7%
Other/Multi-race	6.6%	4.9%	8.8%	7.1%	5.2%	9.7%	13.7%	11.6%	17.8%
Asian	7.5%	5.3%	10.6%	9.4%	6.7%	13.0%	16.9%	13.5%	21.4%
Hispanic	9.1%	5.9%	13.9%	6.7%	4.4%	10.2%	15.8%	12.0%	21.5%
White	6.7%	6.3%	7.2%	7.9%	7.4%	8.4%	14.6%	14.2%	15.5%
Low SES	8.1%	7.2%	9.2%	10.0%	8.9%	11.1%	18.1%	16.9%	19.7%
Higher SES	5.6%	5.1%	6.2%	8.1%	7.5%	8.7%	13.7%	13.1%	14.7%
Rural	7.4%	6.5%	8.4%	8.8%	7.8%	10.0%	16.2%	15.0%	17.8%
Rest of State	7.3%	6.9%	7.8%	8.5%	8.0%	9.0%	15.8%	15.3%	16.6%
Age 18-44	2.0%	1.7%	2.4%	5.3%	4.8%	6.0%	7.3%	6.8%	8.2%
45-54	7.5%	6.6%	8.5%	10.3%	9.3%	11.4%	17.8%	16.6%	19.3%
55-64	13.3%	12.0%	14.6%	11.7%	10.6%	12.8%	25.0%	23.7%	26.7%
65+	19.3%	17.8%	20.8%	13.6%	12.3%	15.0%	32.9%	31.4%	35.0%

Data source: Alaska BRFSS Combined File, 2012-2016

[+] Combined diabetes/prediabetes prevalence is by direct addition of diabetes and prediabetes, to avoid inconsistency from missing data.

Definitions:

Alaska Native group includes all who reported American Indian or Alaska Native as one of their race groups; other race groups include those who reported that race as their only race and did not report being Alaska Native or Hispanic. Pacific Islander/Other includes those who reported multiple race groups but not Alaska Native or Hispanic.

Low socio-economic status (SES) includes those who live in a household that is at <185% of the federal poverty level, or have completed less than a high school education.

Rural Alaska includes those living in Northern and Southwest Alaska, as defined by the sampling regions for Alaska BRFSS. This includes Northwest, Yukon-Kuskokwim Delta, and Southwest regions, as well as Denali Borough, and the Census Areas Yukon-Koyukuk and Southeast Fairbanks.

Appendix Table 2: Prevalence of health screenings for chronic diseases among adults
Alaska, 2011-2016

	Hypertension Screening			Cholesterol Screening			Diabetes Screening		
	%	Lower CI	Upper CI	%	Lower CI	Upper CI	%	Lower CI	Upper CI
All Adults	**92.1%**	91.1%	93.0%	**83.6%**	82.3%	84.8%	**52.0%**	51.1%	52.9%
Male	**89.6%**	88.0%	91.1%	**79.3%**	77.4%	81.1%	**48.5%**	47.3%	49.7%
Female	**94.7%**	93.5%	95.7%	**89.8%**	88.2%	91.1%	**55.7%**	54.4%	56.9%
Alaska Native	**90.3%**	87.9%	92.3%	**80.0%**	77.1%	82.7%	**45.4%**	43.4%	47.3%
Black/African American	^ **95.0%**	89.1%	97.8%	^ **79.3%**	68.3%	87.2%	^ **57.1%**	50.1%	63.9%
Other/Multi-race	^ **88.0%**	80.2%	92.9%	^ **84.2%**	73.7%	91.0%	**47.4%**	42.9%	51.9%
Asian	^ **84.6%**	74.3%	91.2%	^ **88.5%**	80.1%	93.7%	^ **38.7%**	33.2%	44.4%
Hispanic	^ **95.3%**	80.0%	99.0%	†	†	†	^ **41.3%**	34.9%	47.9%
White	**93.3%**	92.3%	94.2%	**84.1%**	82.7%	85.5%	**54.9%**	53.9%	55.9%
Low SES	**86.0%**	83.1%	88.5%	**70.3%**	66.5%	73.9%	**45.4%**	43.4%	47.4%
Higher SES	**94.6%**	93.4%	95.5%	**85.5%**	83.8%	87.0%	**57.7%**	56.5%	58.9%
Rural Alaska	**89.0%**	86.0%	91.4%	**72.4%**	68.8%	75.7%	**43.0%**	40.9%	45.1%
Rest of State	**92.5%**	91.4%	93.4%	**84.9%**	83.5%	86.2%	**53.1%**	52.1%	54.0%
Age 18-44	**89.8%**	88.0%	91.3%	**67.5%**	62.5%	72.2%	**42.3%**	40.9%	43.6%
45-54	**92.3%**	89.8%	94.2%	**81.0%**	78.6%	83.3%	**57.2%**	55.4%	59.1%
55-64	**94.3%**	92.6%	95.6%	**87.1%**	85.2%	88.7%	**65.6%**	63.8%	67.3%
65+	**97.0%**	96.0%	97.7%	**93.8%**	92.5%	94.9%	**68.3%**	66.4%	70.1%

Data sources:

Hypertension screening within the past 2 years, Alaska BRFSS Standard File, 2014-2016

Cholesterol screening within the past 5 years, among men age 35+ and women age 45+, Alaska BRFSS Standard File, 2011, 2013, 2015

Diabetes screening within the past 3 years among adults without diabetes, Alaska BRFSS Combined File, 2012-2016

^ Indicates that the estimate is flagged for reliability.

† Estimate suppressed because number of respondents <50.

Definitions:

Alaska Native group includes all who reported American Indian or Alaska Native as one of their race groups; other race groups include those who reported that race as their only race and did not report being Alaska Native or Hispanic. Pacific Islander/Other includes those who reported multiple race groups but not Alaska Native or Hispanic.

Low socio-economic status (SES) includes those who live in a household that is at <185% of the federal poverty level, or have completed less than a high school education.

Rural Alaska includes those living in Northern and Southwest Alaska, as defined by the sampling regions for Alaska BRFSS. This includes Northwest, Yukon-Kuskokwim Delta, and Southwest regions, as well as Denali Borough, and the Census Areas Yukon-Koyukuk and Southeast Fairbanks.

Appendix Table 3: Prevalence of diabetes-related risk factors among adults

Alaska, 2011-2015

	None of 6 RFs	1 RF	2+ RFs
All Adults	9.9%	22.7%	67.4%
Male	6.9%	20.3%	72.8%
Female	13.3%	25.4%	61.3%
Alaska Native	4.8%	15.1%	80.1%
Black/African American^	3.9%	9.2%	86.9%
Other/Multi-race^	11.4%	20.0%	68.7%
Asian^	9.8%	36.8%	53.3%
Hispanic^	10.0%	30.7%	59.2%
White	10.9%	24.0%	65.1%
Low SES	6.2%	15.9%	78.0%
Higher SES	10.9%	25.9%	63.2%
Rural	4.3%	18.7%	77.0%
Rest of State	10.5%	23.1%	66.4%
Age 18-44	12.7%	27.2%	60.1%
45-54	8.0%	19.2%	72.8%
55-64	8.1%	19.3%	72.7%
65+	4.6%	15.9%	79.5%

Data source: Alaska BRFSS Standard File, 2011, 2013, 2015.

^ Indicates that the estimate is flagged for reliability.

Definitions:

Risk factors included in the count: Obesity or overweight, physical inactivity, ever told have high blood pressure, ever told have high cholesterol, drank 1 or more sugary drinks per day, and/or currently a smoker.

Alaska Native group includes all who reported American Indian or Alaska Native as one of their race groups; other race groups include those who reported that race as their only race and did not report being Alaska Native or Hispanic. Pacific Islander/Other includes those who reported multiple race groups but not Alaska Native or Hispanic.

Low socio-economic status (SES) includes those who live in a household that is at <185% of the federal poverty level, or have completed less than a high school education.

Rural Alaska includes those living in Northern and Southwest Alaska, as defined by the sampling regions for Alaska BRFSS. This includes Northwest, Yukon-Kuskokwim Delta, and Southwest regions, as well as Denali Borough, and the Census Areas Yukon-Koyukuk and Southeast Fairbanks.

Appendix Table 4a: Prevalence of diabetes care measures among adults with diabetes
Alaska, 2011-2014

	Diabetes HCP visit	Lower CI	Upper CI	Diabetes QOC	Lower CI	Upper CI
All Adults	86.4%	83.7%	88.7%	34.5%	31.4%	37.7%
Male	86.8%	83.2%	89.7%	32.7%	28.4%	37.2%
Female	86.0%	81.7%	89.4%	36.3%	31.9%	41.0%
Alaska Native	84.1%	76.2%	89.8%	32.9%	26.5%	40.1%
White Non-Hispanic	85.1%	81.7%	88.0%	36.5%	33.0%	40.1%
All Other Race/Ethnicity^	92.5%	84.3%	96.6%	28.4%	19.3%	39.6%
Low SES	86.5%	80.1%	91.1%	28.3%	22.8%	34.5%
Higher SES	89.6%	85.8%	92.5%	36.8%	31.6%	42.4%
Rural	89.8%	84.0%	93.7%	31.8%	25.1%	39.2%
Rest of State	86.0%	83.1%	88.5%	34.7%	31.4%	38.2%
Age 18-44	80.1%	69.1%	87.9%	25.3%	17.9%	34.3%
45-54	87.0%	80.5%	91.6%	32.4%	25.9%	39.5%
55-64	89.7%	86.3%	92.4%	35.9%	30.4%	41.9%
65+	86.2%	82.6%	89.1%	39.8%	34.7%	45.2%

Data source: Alaska BRFSS Combined file, 2011-2014

^ Indicates that the estimate is flagged for reliability. Race/ethnicity groups had to be combined due to small numbers.

Definitions:

Diabetes HCP Visit: had a health care provider visit for their diabetes care in the past 12 months

Diabetes QOC: meets the quality of care measure for diabetes, which includes having an annual foot exam and eye exam by a healthcare provider, and hemoglobin A1C tests at least twice a year.

Alaska Native group includes all who reported American Indian or Alaska Native as one of their race groups; White Non-Hispanic group includes those who reported that race as their only race and did not report being Alaska Native or Hispanic; all other race groups include single race, multiple race reported if not Alaska Native, and Hispanic.

Low socio-economic status (SES) includes those who live in a household that is at <185% of the federal poverty level, or have completed less than a high school education.

Rural Alaska includes those living in Northern and Southwest Alaska, as defined by the sampling regions for Alaska BRFSS. This includes Northwest, Yukon-Kuskokwim Delta, and Southwest regions, as well as Denali Borough, and the Census Areas Yukon-Koyukuk and Southeast Fairbanks.

Appendix Table 4b: Prevalence of diabetes care measures among adults with diabetes
Alaska, 2011-2014

	Daily Self-care	Lower CI	Upper CI	Diabetes Education	Lower CI	Upper CI
All Adults	60.3%	57.0%	63.5%	60.4%	57.0%	63.7%
Male	60.5%	55.9%	65.0%	60.5%	55.7%	65.1%
Female	60.0%	55.3%	64.5%	60.4%	55.6%	64.9%
Alaska Native	48.4%	40.3%	56.6%	50.1%	42.1%	58.0%
White Non-Hispanic	62.1%	58.5%	65.6%	63.7%	60.1%	67.2%
All Other Race/Ethnicity^	62.2%	51.5%	71.8%	55.7%	44.6%	66.2%
Low SES	61.1%	54.1%	67.7%	63.7%	56.5%	70.3%
Higher SES	59.4%	53.9%	64.6%	64.0%	58.4%	69.2%
Rural	53.3%	45.6%	60.8%	51.1%	43.6%	58.5%
Rest of State	60.9%	57.4%	64.4%	61.3%	57.7%	64.9%
Age 18-44	63.7%	53.8%	72.6%	66.3%	56.8%	74.6%
45-54	56.9%	49.1%	64.3%	60.2%	52.2%	67.6%
55-64	61.0%	55.3%	66.4%	60.9%	54.8%	66.7%
65+	59.8%	54.8%	64.7%	56.8%	51.6%	61.9%

Data source: Alaska BRFSS Combined file, 2011-2014

^ Indicates that the estimate is flagged for reliability. Race/ethnicity groups had to be combined due to small numbers.

Definitions:

Daily self-care: people with diabetes who monitor their blood glucose levels on a daily basis.

Diabetes education: have ever taken a class or course about how to manage their diabetes.

Alaska Native group includes all who reported American Indian or Alaska Native as one of their race groups; White Non-Hispanic group includes those who reported that race as their only race and did not report being Alaska Native or Hispanic; all other race groups include single race, multiple race reported if not Alaska Native, and Hispanic.

Low socio-economic status (SES) includes those who live in a household that is at <185% of the federal poverty level, or have completed less than a high school education.

Rural Alaska includes those living in Northern and Southwest Alaska, as defined by the sampling regions for Alaska BRFSS. This includes Northwest, Yukon-Kuskokwim Delta, and Southwest regions, as well as Denali Borough, and the Census Areas Yukon-Koyukuk and Southeast Fairbanks.

Data Sources

Death Data
Information on cause of death is taken from the death certificate. "Cause of death" is reported in two ways:

- Underlying (proximal) cause of death: The disease or injury that initiated the chain of events that led directly and inevitably to death.
- Contributing cause(s) of death: any conditions or injuries that initiated the events leading to death, but which are not themselves the immediate cause of death.

This report primarily uses underlying cause of death alone to describe statewide estimates, but underlying and contributing causes of death were combined and used for reporting regional estimates. This approach was used to provide the most results by region; using underlying cause of death only would have required suppression of many estimates due to small numbers. Including the contributing causes of death also highlights that disease burdens are worsened by additional factors.

Alaska statewide data (e.g., state rates, and rates by gender, age and race/ethnicity) and U.S. data were obtained from the Centers for Disease Control and Prevention (CDC), National Center for Health Statistics, Underlying Cause of Death 1999-2016 on CDC WONDER Online Database, released December, 2017. Data are from the Multiple Cause of Death Files, 1999-2016, as compiled from data provided by the 57 vital statistics jurisdictions through the Vital Statistics Cooperative Program. Data were accessed at http://wonder.cdc.gov/ucd-icd10.html .

For regional estimates, information on numbers and causes of death for Alaska residents was obtained directly from the Alaska Health Analytics and Vital Records Section, Division of Public Health. Only Alaska residents are included in the death data reports of Alaska-specific rates.

In some cases, there are minor discrepancies between annual statewide rates reported between the two systems; however, these are not meaningful differences in terms of understanding public health burden.

For more information on Alaska's death data,
visit: http://dhss.alaska.gov/dph/VitalStats/Pages/data/Deaths.aspx

Behavioral Risk Factor Surveillance System (BRFSS)
The BRFSS is an anonymous telephone survey conducted by the Alaska Division of Public Health in cooperation with the Centers for Disease Control and Prevention (CDC). It aims to estimate the prevalence of behavioral risk factors in the general adult population that are known to be associated with the leading causes of morbidity and death. The BRFSS has operated continuously in Alaska since 1991.

BRFSS data are weighted to adjust the distribution of the sample data so that it reflects the total population of the sampled area, and to compensate for the over-representation or under-representation of persons in various subgroups. Changes in both the weighting and sampling methods occurred between 2007 and 2011, including the expansion of the sampling frame to include cell phones in addition to landline phones. More information about the changes in BRFSS methods can be found in the January 2013 issue of
Chronicles: http://dhss.alaska.gov/dph/Chronic/Documents/Publications/assets/ChroniclesV5-1.pdf.

Alaska presently conducts two BRFSS surveys: the standard BRFSS and a separately funded supplemental BRFSS. Data can be reported based on different survey dataset combinations:

- Standard BRFSS
- Supplemental BRFSS
- Combined (standard + supplemental) BRFSS

Datasets are weighted (separately) for analysis of items based on whether they occur only in one or both survey versions. Whenever possible, the combined dataset was used to provide the estimates contained in this report. In cases where questions appeared on only one or another of the BRFSS surveys, that particular dataset was used.

For more information on the Alaska BRFSS,
visit *http://dhss.alaska.gov/dph/Chronic/Pages/brfss/default.aspx*

National Health Interview Survey (NHIS)

The National Health Interview Survey (NHIS) has been given in the U.S. since 1957 and is currently administered by the U.S. Census Bureau. NHIS uses household-based interviews to collect data on a variety of health topics, including healthcare access, health conditions and behaviors, and provides results used for tracking U.S. national health objectives.

For this report, NHIS data were downloaded from the Centers for Disease Control and Prevention (CDC) CDC Division of Diabetes Translation at www.cdc.gov/diabetes/data

Similar data are available through the Division for Heart Disease and Stroke Prevention at https://www.cdc.gov/dhdsp/maps/dtm/index.html

NHIS data are age-adjusted. Results are directly standardized to the age distribution of the 2000 U.S. Standard Population using the following age groups: 18-39, 40-59, 60+.

For more information on the NHIS, visit *https://www.cdc.gov/nchs/nhis/index.htm*

Hospitalization data

Inpatient and outpatient discharge data were obtained from the Alaska Health Facilities Data Reporting (HFDR) program. These facilities include private, municipal, state and some federal hospitals, including hospitals operated by Alaska Native organizations; military hospitals are not included.

Reporting of data by Alaska health facilities was mandated effective in December 2014 with reporting beginning in 2015; prior to that year this reporting was voluntary. Only data for 2016 were included in this report due to concerns about the impact of the transition from using International Classification of Diseases, 9th Revision, Clinical Modification (ICD-9-CM) for discharge coding to the 10th revision (ICD-10) between quarter 3 and quarter 4 of 2015. Such changes in coding systems could create increases or decreases in estimates that are not related to actual changes in patient presentation or treatment.

Rates are reported per 10,000 population, which is the reporting standard suggested by the HFDR program. These rates were presented without adjustment for factors such as age or gender. Population estimates for 2016 were used as denominators. Population estimates were obtained from the Alaska

Department of Labor and Workforce Development, Research and Data Analysis Section
(see http://live.laborstats.alaska.gov/pop/index.cfm accessed June 20, 2018).

Data are reported separately by type of encounter, based on the facility where treatment was given:

- Inpatient: acute medical/surgical unit, psychiatric unit, medical rehabilitation, alternate level of care (e.g., long-term care, hospice), alcohol or drug rehabilitation.
- Outpatient: emergency room, outpatient surgery, observation only.

Cases were identified using discharge diagnosis codes, and also reported separately by the position of the disease of interest within the discharge codes – as primary alone, secondary or both primary and secondary combined:

- Primary diagnosis: the specific condition is the first listed discharge code. This is usually the most serious and/or resource-intensive during the hospitalization or patient encounter.
- Secondary diagnoses: the discharge code for a specific condition is identified in any position from up to 19 diagnosis codes (except the first position code). There are up to 29 total discharge codes available, however we limited to 19 so that only conditions most relevant to the visit would be included.

Specific ICD-10 discharge codes used to identify cases for this report were:

- Diabetes cases were identified based on ICD-10 codes E10, E11.
- Gestational diabetes (O24) was not included in hospitalization rates.

For more information about the Alaska Health Facilities Data Reporting Program, visit
http://dhss.alaska.gov/dph/VitalStats/Pages/HFDR/default.aspx

National hospitalization data were not included in this report.

Definitions
Alaska Regions
Data are presented geographically in this report for Behavioral Health Systems Regions (BHSRs). Rates and counts are not shown for specific areas when there were fewer than 6 cases within the combined years. The following table includes a list of Borough/Census Areas included in each of Alaska's Behavioral Health Systems Regions, as well as their total population.

For some BRFSS indicators, results are presented for "rural residents" of Alaska. Rural Alaska includes Northern and Southwest Alaska, as defined by the sampling regions for the Alaska BRFSS. This includes Northwest, Yukon-Kuskokwim (Y-K) Delta, and Southwest regions, as well as Denali Borough, and the Census Areas of Yukon-Koyukuk and Southeast Fairbanks.

The following table provides an example of populations included in each BHSR for one year included in this report. Prior to 2010, the Southeast region was organized as one region; however, our analyses uses the current definitions.

Alaska Behavioral Health Systems Regions with 2014 Alaska Resident Population

Behavioral Health Systems Region	Included Boroughs/Census Areas	Population
State of Alaska		**737,046**
Anchorage	Anchorage Municipality	**300,357**
Fairbanks	Fairbanks North Star Borough	**99,371**
Interior	Denali Borough	1,903
	Southeast Fairbanks Census Area	6,978
	Valdez-Cordova Census Area	9,493
	Yukon-Koyukuk Census Area	5,563
	Interior Total	**23,937**
Juneau	Juneau City and Borough	**32,625**
Kenai Peninsula	Kenai Peninsula Borough	**57,638**
Mat-Su	Matanuska-Susitna Borough	**98,285**
Northwest	Nome Census Area	9,833
	North Slope Borough	9,713
	Northwest Arctic Borough	7,748
	Northwest Total	**27,294**
Southeast (SE)-northern	Haines Borough	2,566
	Hoonah-Angoon Census Area	2,091
	Petersburg Borough	3,184
	Sitka City and Borough	8,881
	Skagway Municipality	1,038
	Wrangell City and Borough	2,360
	Yakutat City and Borough	634
	SE-northern Total	**20,754**
Southeast (SE)-southern		
	Ketchikan Gateway Borough	13,781
	Prince of Wales-Hyder Census Area	6,384
	SE-southern Total	**20,165**
Southwest	Aleutians East Borough	3,317
	Aleutians West Census Area	5,751
	Bristol Bay Borough	946
	Dillingham Census Area	4,994
	Kodiak Island Borough	14,007
	Lake and Peninsula Borough	1,629
	Southwest Total	**30,644**
Yukon-Kuskokwim (Y-K) Delta	Bethel Census Area	17,923
	Kusilvak Census Area	8,053
	Y-K Delta Total	**25,976**

Sources: Alaska Department of Labor and Workforce Development, Research and Analysis Section; U.S. Census Bureau; and National Center for Health Statistics.

Race

Throughout this report the term "Alaska Native" is used for hospital and BRFSS data to represent people who reported being or were identified as "Alaska Native/American Indian" (AIAN). We used the term AIAN for death data because this is a national standard dataset and comparisons were made to national AIAN groups.

For this report, Asian and Native Hawaiian/Other Pacific Islander groups were combined for the death data because this is how race is reported in this data system. We urge caution in interpreting findings, because Asian and Native Hawaiian/Pacific Islander groups are quite distinct from one another and often show very different risk factors and prevalence of health indicators. Until recent years, they have often been combined in population and other datasets, and some data systems continue to use these prior groupings. For BRFSS data, Native Hawaiian/Other Pacific Islander group are combined with "other" due to small numbers of participants; there were sufficient number of participants for most measures so that results for Asian people were reported alone.

For death data, information included on the death certificate about the race and Hispanic ethnicity of the decedent is reported on the death certificate as provided by an informant, often the surviving next of kin, or, in the absence of an informant, on the basis of observation. Race and ethnicity information from the census (e.g., counts of people in different groups) is by self-report. To the extent that race and Hispanic origin are inconsistent between these two data sources, death rates by race will be biased. Studies have shown that persons self-reported as American Indian, Asian, or Hispanic on census and survey records may sometimes be reported as white or non-Hispanic on the death certificate, resulting in an underestimation of deaths and death rates for the American Indian, Asian, and Hispanic groups. Bias also results from undercounts of some population groups in the census, particularly young black males, young white males, and elderly persons, resulting in an overestimation of death rates.[21] In this report, death data are presented only for race, and not for Hispanic ethnicity.

For hospitalization data, a single race and separate Hispanic ethnicity are included in the record. It is not clear how these are assigned by hospitals. An "other" category may be used to describe people who identify as more than one race, or individuals may select the race with which they most strongly identify. We did not report data for the "other" group, because it was unclear who was included.

For BRFSS, survey participants self-report their race and Hispanic ethnicity in two separate questions, and they can indicate that they identify with multiple race groups. BRFSS respondents were identified as Alaska Native people if they reported this as one of their race groups, regardless of whether they reported being Hispanic. People who said they were Hispanic ethnicity, but not Alaska Native, were classified as Hispanic regardless of their race. Other race groups (Asian, Black, White) include survey respondents who reported that race as their only race group and also said that they were not Hispanic. The "other" group includes people who reported being Pacific Islander/Native Hawaiian, or multiple race groups but not Alaska Native or Hispanic. Numbers of respondents were too small to report Pacific Islander/Native Hawaiian alone.

"Low SES" Alaskans

Having fewer financial resources, including lower household income and less formal education, is associated with poorer health outcomes. This is sometimes called low socio-economic status (SES). In this report, some BRFSS indicators are shown for "Low SES" populations. This means people who live

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[21] Centers for Disease Control and Prevention (CDC), Underlying cause of death 1999-2016, dataset documentation. https://wonder.cdc.gov/wonder/help/ucd.html#

in a household that is at less than 185% (< 185%) of the federally-determined poverty level (annual thresholds are based on combined household income and number of people living in the household) <u>or</u> who have completed less than a high school education.

Analysis and reporting approaches

Notes on data display

Throughout this report, visual cues are used to help the reader understand what types of data are being presented:

- Data shown on a vertical axis (i.e., column charts) included both Alaska statewide and U.S. data.
- Trend line charts are also used for Alaska statewide data, and include U.S. data when available.
- Data shown on a horizontal axis (i.e., bar charts) are for Alaska alone, including contrasting sub-groups within the state.
- All regional data are presented both with a map to provide geospatial context and a bar chart; colors were assigned by region to provide visual cues about relative rates, but different shades should not be interpreted as statistically significant differences.
- To summarize data across groups and regions, a color block "patchwork" table is included near the end of this report. Different colors were used to provide visual cues about relative rates, and patterns of risks across groups, but should not be interpreted as statistically significant differences.

Small numbers and other limitations

The following are systematic limitations of our datasets, analysis and reporting.

Small numbers and data suppression

The State of Alaska has guidelines for suppressing data based on small numbers, both because rates based on these numbers can be unreliable, and also to prevent the identification of individuals within the data.

In this report, death and hospitalization counts based on fewer than 6 occurrences are not reported. For both of these data sources, rates based on fewer than 20 occurrences are not reported, although the counts (n>5) are reported.

To maximize reportable data for regional comparisons, the rate for both underlying and contributing cause of death are combined, to generate larger and more reportable numbers.

BRFSS information is suppressed or flagged based on statistical guidelines developed by Alaska's Division of Public Health in the Department of Health and Social Services, which are based upon the national Joint Policy of Variance Estimation and Statistical Reporting Standards for the National Health and Nutrition Examination Survey (NHANES-III) and the Continuing Survey of Food Intake by Individuals (CSFII) Reports. An asterisk is used to indicate that the estimate may lack statistical precision. Estimates are suppressed if the unweighted sample size for the denominator (N) is less than 50, or if the numerator (n) is less than 5. In addition, estimates may be reported but flagged with an asterisk if there is inadequate sample size for normal approximation, or for uncommon or very common event. Finally, if the coefficient of variation is greater than 30%, the estimate is also considered imprecise and is flagged.

Population estimates and effect on rates

Death and hospitalization data are shown as rates, i.e., in terms of cases per population totals. For years when the U.S. census is taken (e.g., 2000, 2010) total population counts are based on what was actually measured during that year. For non-census years (i.e., years other than 2010 and 2000), state and borough/census area population figures are estimates. Because rates are calculated using the population data as a denominator, any errors in the population estimates will impact the rates.

Age-adjusted Rates

A "crude" rate is calculated by taking the number of cases for a given population and dividing it by the total number of people in that population per a specific time period. Since this number would be a very small decimal, it is multiplied by 100,000 and is thus expressed as "per 100,000 persons". However, death rates in this report are calculated using the direct method and age-adjusted to the standard 2000 U.S. population; they are expressed as an annual number of cases per 100,000 persons, using the 19-age group Census P25-1130 data file. National prevalence rates from the NHIS, and Alaska prevalence rates used for comparing trends to the U.S., are directly standardized to the age distribution of the 2000 U.S. Standard Population (except where stratified by age) using the following age groups: 18-39, 40-59, 60+.

Age adjustment (sometimes called age standardization) is a statistical process that allows communities and states with different age structures to be compared. Age adjustment removes the influence of the differences in age distributions that occur from one population to another. Since the risk of developing chronic disease (e.g., diabetes, heart disease) is strongly associated with age, a geographic area with a high proportion of elderly residents could not be accurately compared with a younger-age populated area unless rates were adjusted to a standard reference population – the older community group would always naturally have a higher rate even if the two communities had the same risk.

Age adjustment is an internationally approved statistical method to remove this effect – sometimes called "confounding" – caused by different age distributions. Effectively, rates for a specific age group in the population of interest are multiplied by the number of people in the same age group in a standard population (in this case, the U.S. 2000 population).

Rates shown for combined years of data are average annual age-adjusted rates for the years of data indicated.

Confidence Intervals

The "margin of error" is a common term for the "plus or minus" value around a point estimate, which in total represents the confidence interval. The confidence interval helps to understand the size of uncertainty of the "true value" in a population. Readers are advised to consider the precision of point estimates.

Our report uses 95% confidence intervals. If there is no bias in the data collection system, there is a 95% chance (95 times out of 100 times) that the confidence interval around an estimate will include the true value.

In many of the tables, we report the 95% confidence intervals as well as the estimates and denominators. In the bar graphs, the error bars (lines with a "T" at either end) reflect the confidence intervals and show the range of where the true population estimate is expected to be, at the 95% confidence level.

Narrower confidence intervals indicate more precision in the presented estimates. The width of the confidence interval is dependent upon the size of the population at risk and the number of reported cases (presence of chronic disease or a risk factor, counts of deaths or hospitalizations). Generally, large populations with large number of cases will result in rates with narrower confidence intervals. Because U.S. rates are based on very large populations and number of cases, their confidence intervals are not stated in this report and are usually about $\pm$ 0.1 of the rate. Rural areas with sparse populations tend to have large confidence intervals.

Statistically Significant Differences
In this report, we indicate "significant" differences between groups when we have used statistically-based approaches and found that the differences measured between groups are unlikely to be due to variability in estimates or chance. Non-significant differences are typically not described in text as being "different" (e.g., higher or lower than other groups).

We used chi-square tests in our comparisons between groups of Alaskans. Chi-square tests are tests of association between group and outcome variables (for example, smoking [yes, no] and gender [male, female]). For trend analyses, we used logistic regression models that tested for a statistically significant linear change over time. P-values less than 0.05 indicate that a difference seen between percentages or across years is statistically significant at the 95% confidence level.

Confidence intervals are also used as another way to test statistical significance. Generally, if the confidence intervals of two different rates overlap, we cannot be certain that there is a true difference between them. However, if the confidence intervals do not overlap, then we believe the true values of results for the two groups are different.

Trend Analysis
Trends for Alaska's age-adjusted death and prevalence rates were assessed using the National Cancer Institute's (NCI) Joinpoint Regression Program, Version 4.3.1.0 (April 2016, NCI Statistical Research and Applications Branch; software available at https://surveillance.cancer.gov/joinpoint/). Joinpoint is a national standard for analysis of population-based cancer statistical trends in cancer surveillance, and can also be applied to other health outcomes.

Based on annual prevalence and standard errors, the software identifies "joinpoints" (points of inflection where trends have significantly changed). The program starts with the minimum number of joinpoints (e.g., 0 joinpoints, or a straight line), and tests whether more joinpoints are statistically significant and improve the fit of data (up to the maximum allowed number; 3 for this report).

For each joinpoint time segment, the estimated annual percentage change (APC) was calculated by fitting a least squares regression line to the natural logarithm of the rates. When the APC is statistically significant as different from zero (i.e., significantly different from a flat line), it is listed together with the p-value for that trend. This APC can be interpreted as the average percent increase or decrease in incidence during that period.