# APPENDIX V

## Health Impact Assessment

ALASKA LNG

# Health Impact Assessment

**November 1, 2018**

**AKLNG-5000-HSE-RTA-DOC-00550**

**Alaska LNG**
3201 C Street, Suite 200
Anchorage, Alaska 99503
T: 907-330-6300
www.alaska-lng.com

- Page Intentionally Left Blank -

## REVISION HISTORY

| Rev | Date | Description | Originator | Reviewer | Approver |
|---|---|---|---|---|---|
| 0 | 11/1/2018 | For Initial Use | D. Moss (exp) | C. Humphrey (exp) | L. Haas |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| **Approver Signature*** |  | | | | |

*This signature approves the most recent version of this document.

## MODIFICATION HISTORY

| Rev | Section | Modification |
|---|---|---|
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

- Page Intentionally Left Blank -

# TABLE OF CONTENTS

**List of Tables**

**List of Figures**

# ACRONYMS AND ABBREVIATIONS

ABHP .....Alaska Bureau of Highway Patrol
ABVS.....Alaska Bureau of Vital Statistics
ACS .....U.S. Census, American Community Survey
ADEC.....Alaska Department of Environmental Conservation
ADF&G.....Alaska Department of Fish and Game
ADHSS.....Alaska Department of Health and Social Services
ADM .....average daily membership
ADNR.....Alaska Department of Natural Resources
ADOT&PF .....Alaska Department of Transportation and Public Facilities
AGDC.....Alaska Gasline Development Corporation
AIDS.....acquired immune deficiency syndrome
AK-IBIS.....Alaska Indicator-Based Information System
ANTHC.....Alaska Native Tribal Health Consortium
ANVSA .....Alaska Native Village Statistical Area
AOI .....area of interest
APNCU.....Adequate Prenatal Care Utilization Index
ASAP.....Alaska Stand Alone Pipeline
AST .....Alaska State Troopers
ATR.....Alaska Trauma Registry
ATSDR.....Agency for Toxic Substances and Disease Registry
BACT.....best available control technology
BMI.....body mass index
BMP.....best management practices
BLM .....Bureau of Land Management
BRFSS.....Behavioral Risk Factor Surveillance System
CDC.....U.S. Centers for Disease Control and Prevention
CDP.....census designated place
CHD .....coronary heart disease
CLRD.....chronic lower respiratory disease
CO.....carbon monoxide
COPD .....chronic obstructive pulmonary disease
CS .....congenital syphilis
CT .....chlamydia trachomatis
DB.....Denali Borough
DPH .....Section of Chronic Disease Prevention and Health Promotion
DRIT.....direct rapid immunohistochemical test
EPA .....Environmental Protection Agency
FAS .....Fetal Alcohol Syndrome
FASD .....Fetal Alcohol Spectrum Disorders

FERC .....U.S. Department of Energy, Federal Energy Regulatory Commission
FNSB .....Fairbanks North Star Borough
GC.....gonococcal infection
GTP .....Gas Treatment Plant
HA2020.....Healthy Alaskans 2020
HCV.....hepatitis C virus
HEC.....Health Effects Categories
HIA.....health impact assessment
Hib .....Haemophilus influenzae type b
HIV.....human immunodeficiency virus
ICD .....International Classification of Diseases
IFC .....International Finance Corporation
IPIECA .....International Petroleum Industry Environmental and Conservation Association
KPB .....Kenai Peninsula Borough
Mainline .....an approximately 800-mile-long, large-diameter gas pipeline
Mat-Su.....Matanuska-Susitna
MSB .....Matanuska-Susitna Borough
MSM.....men who have sex with men
NEPA.....National Environmental Policy Act of 1969, as Amended
NGL.....natural gas liquid
NIH .....National Institute of Health
NOx .....nitrogen oxides
NSB.....North Slope Borough
OCS.....Office of Children's Services
OPR.....opioid pain reliever
PAC.....potentially affected communities
PBTL.....Prudhoe Bay Transmission Line
PID .....pelvic inflammatory disease
ppm .....parts per million
Project.....Alaska LNG Project
PSP .....paralytic shellfish poisoning
PTTL.....Point Thomson Transmission Line
ROW .....right-of-way
SEIS.....supplemental environmental impact statement
SDH.....social determinants of health
$SO_2$.....sulfur dioxide
SOE .....Section of Epidemiology
SPCS.....State Pipeline Coordinator's Section
SSA .....socioeconomic study area
STI.....sexually transmitted infections
TB .....tuberculosis

U.S. .....United States
USACE.....U.S. Army Corps of Engineers
USDA .....U.S. Department of Agriculture
USDHHS.....U.S. Department of Health and Human Services
VOC .....volatile organic compound
VPSO.....Village Public Safety Officers
WHO.....World Health Organization
YRBS .....Alaska Youth Risk Behavior Survey

- Page Intentionally Left Blank -

# 1. INTRODUCTION

This Health Impact Assessment (HIA) was prepared by the Alaska Gasline Development Corporation (AGDC) for the Alaska LNG Project (Project) and is intended as supplemental information to Section 5.4.2.10, Environmental Justice and Public Health, of Resource Report No. 5 (Socioeconomics) in the Environmental Report of the Federal Energy Regulatory Commission (FERC) Application. The HIA was requested by FERC in response to their February 15, 2018 Environmental Data Request No. 287. The HIA includes baseline health data provided by the Alaska Department of Health and Social Services (ADHSS) and its contractor NewFields, LLC, as well as an assessment completed by AGDC and follows the 2015 Technical Guidance for HIA in Alaska (ADHSS, 2015a). AGDC updated the baseline health data as possible using sources from ADHSS, the Center for Disease Control and Prevention (CDC), the Alaska Native Epidemiology Center, and others.

## 1.1. HIA Overview

In summary, the HIA provides information to decision-makers about potential positive and negative human health impacts related to the proposed Project. The HIA relies on a number of inputs (interdependencies) from other Project studies. These interdependencies, along with key performance indicators relied upon, are outlined in the following subsections. The HIA has been prepared utilizing existing baseline health data as well as available information within the Project Resource Reports and from comments and issues raised during meetings with the federal, state, and local government, the public during scoping meetings, and other stakeholders.

## 1.2. HIA Framework and Methodology

### 1.2.1. HIA Definition

The HIA is a combination of procedures, methods, and tools by which a policy, program, or project may be judged as to its potential effects on the health of a population, and the distribution of those effects within the population.

### 1.2.2. HIA Methods

As presented in the 2015 Alaska Technical Guidance for HIA in Alaska, the HIA methods include:

- Engaging relevant stakeholders;
- Reviewing Project specifics;
- Reviewing physical and general environmental setting of the Project;
- Identifying Potentially Affected Community (PACs);
- Analyzing of sufficiency of baseline health information;
- Selecting key health impacts using both a set of defined health effects categories (HECs) and input from stakeholder meetings;

- Conducting a qualitative impact rating and ranking analysis, consistent with standard National Environmental Policy Act (NEPA) approaches/methodologies; and
- Proposing a series of mitigation recommendations for potential impacts.

### 1.2.3. HIA Screening

The screening phase of the HIA determined that a comprehensive HIA was appropriate for the Alaska LNG Project. The hallmark of a comprehensive HIA is the collection of data to address gaps identified. This analysis included a review of the Project plan for factors that are known to influence human health. Project characteristics that indicated an in-depth comprehensive analysis was necessary include:

- Prominent new linear features, including transport features;
- Large footprint facilities (such as the Liquefaction Facility);
- Large project in rural settings;
- Construction related influx;
- Environmental concerns:
  - Potential for hazardous materials exposure;
  - Air quality; and
  - Water resources (quality, quantity, access);
- Subsistence resources, harvest and practices;
- Social issues, such as:
  - Worker influx and
  - Resettlement/relocation;
- Economic concerns; and
- Equity concerns.

Screening decisions are based on the best available knowledge about the Project and the best available information on human health in the potentially affected areas.

### 1.2.4. HIA Scope

An HIA to support a NEPA evaluation is not mandatory in Alaska; however, the 2015 Technical Guidance for HIA in Alaska was used as a primary resource for the public health evaluation of the Project required under NEPA. The 2015 Technical Guidance for HIA in Alaska methodology provides a comprehensive overview of health categories that are generally applicable to the evaluation of impacts related to the proposed Project.

This report does not address classic occupational health concerns (e.g., physical hazards or environmental hazards encountered while working), which are referred to as “inside the fence.” Those concerns are

addressed by federal and Alaska health and safety legal requirements. However, "cross-over" issues (e.g., health issues that arise as workers interact with local communities) are analyzed within this HIA.

This HIA reviews the proposed Project based on the following information:

- Existing most recent baseline health data for Alaska (2017);
- Project Resource Reports;
- Comments and issues raised during public consultations meetings, affected community meetings, and external stakeholder groups and held by the Project; and
- General parameters developed by the 2015 Alaska Technical Guidance for HIA in Alaska.

### 1.2.5. Health Effects Categories

The HECs, shown in Table 1, were developed by ADHSS to identify the full spectrum of possible health impacts related to various projects. The HECs were developed as a basis for systematic evaluation of the potential for project-related impacts (i.e., positive, negative, or neutral).

**Table 1. Health Effects Categories**

| Health Effects Category | Pathway Description |
|---|---|
| Social Determinants of Health (SDH) | • The SDH are the conditions in which people are born, grow, live, work, and age. These circumstances are shaped by the distribution of money, power, access, and resources at global, national, state, regional, and local levels. The SDH are mostly responsible for health inequities—the unfair and avoidable differences in health status seen within the State.<br>• This category reviews outcomes and determinants related to mental health, maternal and child health, substance use, social exclusion, psychosocial distress, historical trauma, family dynamics, economic status, educational status, social support systems, and employment status. |
| Accidents and Injuries | • This category contains health outcomes and determinants related to accidents and injuries.<br>• The key outcomes considered are increases and decreases in intentional and unintentional injuries with fatal and nonfatal results. The key determinants in this category include items such as the presence of law enforcement, traffic patterns, alcohol involvement, distance, and access to emergency services, and the presence of prevention programs. |
| Exposure to Potentially Hazardous Materials | • This category contains health outcomes and determinants that may arise from exposure to hazardous materials.<br>• The key health outcomes considered are increases and decreases in documented illnesses or exacerbation of illnesses commonly associated with pollutants of potential concern. These may be mediated through inhalation, ingestion, or physical contact. |
| Food, Nutrition, and Subsistence Activity | • This category includes health outcomes and determinants related to food security, dietary choices, and the consumption of subsistence foods.<br>• The key health outcomes considered are nutrient levels, malnutrition or improvements in nutrient intake, and the subsequent increases or decreases in |

| Health Effects Category | Pathway Description |
|---|---|
| | related diseases. The key determinants include diet composition, food security, and the consumption of subsistence foods. |
| Infectious Disease | • This category includes health outcomes and determinants that result from infectious diseases.<br>• The key health outcomes include rates of increase or decrease for a range of infectious diseases, such as sexually transmitted infections (STI), respiratory illness, or skin infections. Important health determinants may include immunization rates, and the presence of infectious disease prevention efforts. |
| Water and Sanitation | • This category includes changes to access, quantity, and quality of water supplies.<br>• Key determinants reviewed may include distance to clean water, water fluoridation, indoor plumbing, water treatment facilities, adequate volume of water resources, and the existence of community facilities, such as self-service laundry or community shower facilities, etc. |
| Non-communicable and Chronic Diseases | • This category includes health outcomes and determinants related to chronic disease.<br>• Important outcomes include increases or decreases in mortality and morbidity rates of cancer, cardiovascular and cerebrovascular diseases, diabetes, respiratory diseases, and mental health disorders. Key determinants for chronic diseases may include smoking rates, rates of alcohol and drug abuse, physical activity levels, presence of recreation centers, as well as cancer screening rates. |
| Health Services Infrastructure and Capacity | • This category considers health outcomes and determinants related to health care access and health care infrastructure.<br>• Important outcomes include the increase or decrease in the number of medical evacuations, clinics or hospital visit trends, health expenditures, and medication usage. Health determinants may include distance to health facilities, medevac facilities/aircraft, the presence of community health staff, and the frequency of physician visits to the area. |

Source: ADHSS, 2015a

# 2. POTENTIALLY AFFECTED COMMUNITIES

## 2.1. Introduction and Background

The Project background and description is provided in Resource Report No. 5, Section 5.1. The socioeconomic study area (SSA) including the area of interest (AOI) and the State of Alaska as a whole are provided in Section 5.2 of Resource Report No. 5. Resource Report No. 1 provides more detailed information regarding Project location, access, and construction schedule.

The Project AOI for the purposes of the HIA analysis is described in Section 5.2.2 of Resource Report No. 5 and includes boroughs and census areas in which Project facilities and major Project transportation routes are located. As shown in Figure 1.1-1 of Resource Report No. 1, the Liquefaction Facility would be located in the Kenai Peninsula Borough (KPB); the Mainline would traverse the KPB, Matanuska-Susitna Borough (MSB), Denali Borough, Fairbanks North Star Borough (FNSB), Yukon-Koyukuk Census Area, and North Slope Borough (NSB); and the Gas Treatment Plant (GTP), Prudhoe Bay Transmission Line (PBTL), and Point Thomsen Transmission Line (PTTL) would be located in the NSB.

A potentially affected community (PAC) is defined as an area, community, or village where Project-related health impacts may reasonably be expected to occur. While the HIA recognizes the social, economic, and cultural importance of all communities in the Project Area, experience with HIA consistently demonstrates that the health-specific PAC footprint does not necessarily match the environmental, economic, and social PAC footprints. There are subtle but critical disciplinary differences that produce variations in the delineation of the PACs. Relevant Resource Reports were reviewed, and communities were analyzed using elements of the HECs and include:

- Anticipated employment;
- Proximity to Project facilities and/or effects;
- Subsistence impacts;
- Exposure to outside workforce;
- Proximity to worker housing;
- Transportation corridors; and
- Port facilities.

The Project AOI was used as a basis for the health-related PAC analysis and other communities were identified as health PACs after evaluation of relevant Resource Reports. These communities are listed in Table 2. The AOI, together with the State of Alaska as a whole, constitute the SSA, as well as the health study area.

- Page Intentionally Left Blank -

**Table 2. Alaska Boroughs, Census Areas, Cities, Census Designated Places, and Alaska Native Village Statistical Areas in the Area of Interest (AOI)**

| Census Area | Project Facility in the Area | Transportation Corridor | Logistical and Supply Center | Growth-Related Effects | Subsistence & TLK Study Area |
|---|---|---|---|---|---|
| **North Slope Borough** | Mainline/GTP/PTTL/PBTL | | | X | |
| Prudhoe Bay/Deadhorse | Mainline/GTP/PTTL/PBTL | Dalton Hwy/primary port/airport | X | | X |
| Barrow | | | | | X |
| Nuiqsut | | | | | X |
| Kaktovik | | | | | X |
| Anaktuvuk Pass | | | | | X |
| **Yukon-Koyukuk Census Area** | Mainline | | | | |
| Bettles | | Dalton Hwy | | | X |
| Coldfoot | | Dalton Hwy/airport | | | X |
| Evansville/Evansville ANVSA | | Dalton Hwy | | | X |
| Livengood | | Dalton Hwy/airport | | | X |
| Manley Hot Springs | | Dalton Hwy | | | X |
| Minto | | Dalton Hwy | | | X |
| Nenana | Mainline | Parks Hwy/airport | | | X |
| Wiseman | Mainline | Dalton Hwy | | | X |
| Alatna | | | | | X |
| Allakaket | | | | | X |
| Stevens Village | | | | | X |
| Beaver | | | | | X |
| Rampart | | | | | X |
| Tanana | | | | | X |
| Four Mile Road | | | | | X |
| **Fairbanks North Star Borough** | Mainline | | | X | |
| Fairbanks | | Richardson Hwy/Parks Hwy/Steese Hwy/airport/railway | X | | |
| **Denali Borough** | Mainline | | | | |
| Anderson | | Parks Hwy | | | X |
| Cantwell | | Parks Hwy/airport | | | X |

| Census Area | Project Facility in the Area | Transportation Corridor | Logistical and Supply Center | Growth-Related Effects | Subsistence & TLK Study Area |
|---|---|---|---|---|---|
| Healy | Mainline | Parks Hwy/airport | | | X |
| McKinley Park | Mainline | Parks Hwy | | | X |
| Ferry | | | | | X |
| **Matanuska-Susitna Borough** | Mainline | | | X | |
| Big Lake | Mainline | Parks Hwy | | | |
| Houston | Mainline | Parks Hwy | | | X |
| Knik-Fairview | | Knik–Goose Bay Rd | | | X |
| Palmer | | Parks Hwy | | | |
| Point MacKenzie | Mainline | Knik–Goose Bay Road/secondary port/railway | | | |
| Skwentna | Mainline | | | | |
| Talkeetna | Mainline | Parks Hwy/airport | | | X |
| Trapper Creek | Mainline | Parks Hwy | | | X |
| Wasilla | Mainline | Parks Hwy | | | X |
| Willow | Mainline | Parks Hwy/airport | | | X |
| Chase | | | | | X |
| Petersville | | | | | X |
| Susitna North | | | | | X |
| Lakes | | | | | X |
| Meadow Lakes | | | | | X |
| Point MacKenzie | | | | | X |
| Tanaina | | | | | X |
| Wasilla | | | | | X |
| Buffalo Soapstone | | | | | X |
| Butte | | | | | X |
| Farm Loop | | | | | X |
| Knik River | | | | | X |
| Lazy Mountain | | | | | X |
| Palmer | | | | | X |
| Sutton Alpine | | | | | X |
| Chickaloon | | | | | X |
| Glacier View | | | | | X |

| Census Area | Project Facility in the Area | Transportation Corridor | Logistical and Supply Center | Growth-Related Effects | Subsistence & TLK Study Area |
|---|---|---|---|---|---|
| Skwentna | | | | | X |
| Alexander Creek | | | | | X |
| **Kenai Peninsula Borough** | Mainline | | | X | |
| Anchor Point | | Sterling Hwy | | | X |
| Beluga | | Road to Tyonek/airport/ primary barge landing | | | X |
| Clam Gulch | | Sterling Hwy | | | |
| Cohoe | Liquefaction Facility | Sterling Hwy | | | |
| Cooper Landing | | Sterling Hwy | | | X |
| Happy Valley | | Sterling Hwy | | | |
| Homer | | Sterling Hwy/secondary port | | | X |
| Kalifornsky | Liquefaction Facility | Sterling Hwy | | | |
| Kasilof | Liquefaction Facility | Sterling Hwy | | | |
| Kenai | Liquefaction Facility | Airport | | | X |
| Moose Pass | | Seward Hwy | | | |
| Nikiski | Liquefaction Facility | Primary port | X | | X |
| Ninilchik/Ninilchik ANVSA | | Sterling Hwy | | | X |
| Salamatof | Liquefaction Facility | | | | X |
| Seward | | Seward Hwy/ primary port/railway/airport | | | |
| Soldotna | Liquefaction Facility | Sterling Hwy | | | X |
| Sterling | Liquefaction Facility | Sterling Hwy | | | |
| Tyonek | Mainline | | | | X |
| Hope | | | | | X |
| Sunrise | | | | | X |
| Nikolaevsk | | | | | X |
| Fritz Creek | | | | | X |
| Seldovia | | | | | X |
| Port Graham | | | | | X |
| Nanwalek | | | | | |
| **Municipality of Anchorage** | | | | X | |

| Census Area | Project Facility in the Area | Transportation Corridor | Logistical and Supply Center | Growth-Related Effects | Subsistence & TLK Study Area |
|---|---|---|---|---|---|
| Anchorage | | Glenn Hwy/Seward Hwy/primary port/airport/railway | X | | X |
| Eklutna ANVSA | | Glenn Hwy | | | |
| **Southeast Fairbanks Census Area** | | | | | |
| Big Delta | | Richardson Hwy | | | |
| Delta Junction | | Richardson Hwy | | | |
| Dot Lake/Dot Lake ANVSA | | Alaska Hwy | | | |
| Dry Creek | | Alaska Hwy | | | |
| Tanacross | | Alaska Hwy | | | |
| Tok | | Alaska Hwy | | | |
| Tetlin | | Alaska Hwy | | | |
| Northway Junction | | Alaska Hwy | | | |
| Northway | | Alaska Hwy | | | |
| Alcan Border | | Alaska Hwy | | | |
| **Municipality of Skagway Borough** | | Klondike Hwy/Alaska Hwy/secondary port | | | |
| **Valdez-Cordova Census Area** | | | | | |
| Chistochina | | Tok Cutoff | | | |
| Copper Center/Copper Center ANVSA | | Richardson Hwy | | | |
| Gakona | | Richardson Hwy | | | |
| Gakona ANVSA | | Richardson Hwy | | | |
| Glennallen | | Richardson Hwy | | | X |
| Gulkana | | Richardson Hwy | | | |
| Gulkana ANVSA | | Richardson Hwy | | | |
| Mentasta Lake/Mentasta Lake ANVSA | | Tok Cutoff | | | |
| Paxson | | Richardson Hwy | | | |
| Slana | | Tok Cutoff | | | |
| Tazlina/Tazlina ANVSA | | Richardson Hwy | | | |
| Tonsina | | Richardson Hwy | | | |
| Valdez | | Richardson Hwy/secondary port/ airport | | | X |
| Whittier | | Primary port/railway | | | X |

| Census Area | Project Facility in the Area | Transportation Corridor | Logistical and Supply Center | Growth-Related Effects | Subsistence & TLK Study Area |
|---|---|---|---|---|---|
| Copper Center | | | | | X |
| Kenny Lake | | | | | X |
| **Other** | | | | | |
| Adak | | Secondary port | | | |
| Nome/Nome ANVSA | | Secondary port | | | |
| Unalaska | | Primary port/airport | | | |

_____

Notes:
A city/CDP and the corresponding ANVSA are listed separately only if the populations of the two geographical units differ.

- Page Intentionally Left Blank -

# 3. BASELINE HEALTH CONDITIONS

Baseline health conditions form a fundamental context for the overall HIA process. The baseline health summary creates a point of reference for the health status of a community prior to development of a proposed project and also describes an overall health profile for an area. The health profile can inform decision-makers about health vulnerabilities in a region as well as positive health traits present in a population. Decision-makers can use their knowledge about the features of a project and the health profile of a region to better consider health in their deliberations.

For Alaska, baseline health information resides in public health surveillance systems maintained by the CDC, the State of Alaska, the Alaska Native Tribal Health Consortium (ANTHC), and occasionally local borough and tribal entities.

Alaska public health agencies routinely report public health surveillance data at the statewide or regional level. These agencies do not report village or community-level data to avoid privacy violations (e.g., stigmatization) and problems with statistical analysis when case numbers are small. In general, the State of Alaska does not release disaggregated results for small numbers (e.g., <6). As a result, the information in the baseline summary, when developed for a number of parameters, represents entire boroughs and will not report community level data.

The seven Public Health Regions represent an internal reporting standard for the Alaska Division of Public Health. Alaska Public Health Regions are based broadly upon the Alaska Department of Labor and Workforce Development's six Economic Regions (Anchorage and Matanuska-Susitna [Mat-Su], Gulf Coast, Interior, Northern, Southeast, and Southwest), with the exception of MSB, which is reported separately from the Municipality of Anchorage (Behavioral Risk Factor Surveillance System [BRFSS], 2016).

The Alaska Native Epidemiology Center within the ANTHC have 12 tribal health regions. The boundaries of the tribal health regions do not always follow those of boroughs and census areas.

AGDC completed a review of the available relevant baseline health data and prepared and updated the information provided by ADHSS in cases where the data was available. Sources of baseline data included the following:

- Alaska Native Regional Health Status (ANTHC)
- National Patient Information Reporting System
- 2000 and 2010 United States (U.S.) Census
- 2016 5-year estimates from the American Community Survey of the U.S. Census Borough
- Alaska Bureau of Vital Statistics (ABVS)
- Alaska Department of Epidemiology
- Government Performance and Results Act
- Alaska Trauma Registry

- ANTHC Immunization Registry
- Alaska Area Diabetes Program
- ANTHC Department of Environmental Health and Engineering
- Alaska Native Tumor Registry
- County Health Rankings (University of Wisconsin)
- Alaska Division of Community and Regional Affairs: Alaska Community Database
- Alaska Department of Labor and Workforce Development
- Behavioral Risk Factor Surveillance System (BRFSS)
- Youth Behavioral Risk Factor Surveillance System
- Alaska Indicator-Based Information System (AK-IBIS)

The HIA team has also reviewed subject matter reports as well as findings from the scientific literature, nutritional surveys and field sampling data. The most recent Alaska Department of Fish and Game (ADF&G) survey results have been reviewed; ADF&G surveys included interviews with residents of the AOI, regarding their subsistence activity.

Of note, public health was addressed in the public and stakeholder meetings held during the subsistence and traditional knowledge study, Project open houses, state and local government meetings, and the FERC public scoping meetings held in 2015. Comments that were captured and health impacts discussed are provided in Resource Report No. 1, Appendix D.

Another key resource for the development of the HIA was the Healthy Alaskans 2020 report. This statewide report was developed by a coalition of public health groups led by the ADHSS and the ANTHC who are collaborating to improve health and reduce health disparities among Alaskans.

## 3.1. Health Effect Category 1: Social Determinants of Health

The World Health Organization (WHO) and the CDC define the social determinants of health as, “the circumstances in which people are born, grow up, live, work, and age, and the systems put in place to deal with illness” and asserts that “the social determinants of health are mostly responsible for health inequities—the unfair and avoidable differences in health status seen within and between countries” (WHO, 2008).

Both health outcomes data and health determinant data are used to establish baseline health status for the Social Determinants of Health HEC. An outcome is a health event that has actually occurred, while a determinant is a “setting” or context that strongly influences health status.

Of note, social determinants of health are real and important; however, it is extremely difficult to establish direct causality between a change in a social determinant and a particular health outcome. The language used to communicate impacts related to social determinants should reflect that SDH influence health in complex ways.

For outcomes (or endpoints), the HIA reports life expectancy, maternal and child health, suicide rates, and substance abuse rates as general indicators of physical and social well-being. For health determinants general demographics, family structure, economic status, and educational attainment are included. Regional parameters are compared to all Alaska Natives, all Alaskans and occasionally to the U.S. population, where possible. See Section 5.3.1 of Resource Report No. 5 for demographics including population size and density, projections, age characteristics, and race and ethnicity of the PACs and Statewide.

### 3.1.1. Social Determinants of Health and Psychosocial Issues

SDH and psychosocial issues are very important in Alaska, particularly for small, remote villages. HIA seeks to disentangle the determinants of health and identify the individual, social, environmental, and institutional factors that produce direct, indirect, or cumulative health impacts. This exercise is complex because many individual and institutional factors interact with each other.

- Individual factors include genetic, biological, lifestyle or behaviors, and specific circumstances. Examples of individual determinants include gender, age, dietary intake, exercise, alcohol and tobacco use, educational attainment, and employment.
- Institutional factors include the capacity, capability, and coverage of public sector services, such as health, schools, transportation, and communications.

The HIA considers psychosocial issues. Subsistence-based rural populations can suffer significant anxiety/stress associated with perceived changes in their autonomy, traditional lifestyle, and cultural stability. This reaction, however, is not necessarily uniform across the community, as there may be a generational split. Even though the generational divide may be unrelated to the Project, it may be accentuated by the Project. Important health outcomes including drug/alcohol usage, teen/unwed pregnancy, gender violence suicides, and depression are considered within this HEC.

#### 3.1.1.1. Demographics

See Section 5.3.1 of Resource Report No. 5 for demographics including population size and density, projections, age characteristics, and race and ethnicity of the PACs and statewide.

#### 3.1.1.2. Economic Indicators

See Section 5.3.2 of Resource Report No. 5 for economic data including employment, income, and labor force characteristics of the PACs.

#### 3.1.1.3. Life Expectancy

Life expectancy can give some general information about expected well-being for infants. Life expectancy is the number of years that infants born in a specific year can expect to live if they experience the same age-specific death rates for all persons who died during their birth year. In 2009, the average life expectancy for all Alaskan infants was 77.1 years compared to all U.S. infants at 78.1 years; data are not publicly available at the borough level (CDC, 2011).

#### 3.1.1.4. Maternal and Child Health

Maternal and child health outcomes (e.g., low birth-weight) can profoundly influence youth and adult health status and can suggest current or future challenges (or improvements) to human health. The HIA will report components of maternal and child health including initiation of prenatal care, teen-birth rates, low-birth weight, substance abuse during pregnancy, infant mortality child-abuse, and domestic violence.

The ADHSS completed the Alaska Vital Statistics 2015 Annual Report that summarizes data on births and deaths. The purpose of this report is to provide basic reference material and indicators for health and vital events in Alaska. The data is available at www.dhss.alaska.gov and the information summarized here is used to assess baseline conditions for public health in the State of Alaska (ADHSS, 2015b).

##### 3.1.1.4.1. Mother Medical Services Utilization

In 2015, the overall level of mothers receiving first trimester care increased from 74.7 to 76.8 percent (%). Asian/Pacific Islander mothers remain the least likely to initiate prenatal care during the first trimester of pregnancy.

The adequacy of prenatal care utilization index compares the number of prenatal visits with the expected number of visits for the period when care began and with the delivery date (see Appendix C). Since 2006, this index in Alaska has increased 1.4%. Since 2006, the percentage of births by Cesarean section has dropped slightly by 0.9%. African American mothers were most likely to have a Cesarean section birth, while American Indian/Alaska Native mothers were least likely (ADHSS, 2015b).

##### 3.1.1.4.2. Adequacy of Prenatal Care

Initiation of prenatal care during the first trimester is an important marker, as adequate prenatal care has been shown to increase the likelihood of a healthy pregnancy and reduce the likelihood of adverse birth outcomes (Krueger and Scholl, 2000) (Table 3). Prenatal care not only identifies women at risk for complications during delivery, but also enables screening and treatment of medical conditions that may arise during pregnancy. Some conditions, such as preeclampsia, hemorrhage, and intra-partum infection, may be life threatening to both the mother and developing fetus. Prenatal appointments further allow for interventions involving behavioral risk factors associated with poor birth outcomes, such as smoking (WHO, 2005; CDC, 2010).

The Adequate Prenatal Care Utilization Index (APNCU) is a measure that combines the initiation of prenatal care and the number of prenatal visits. A ratio of actual to recommended visits is calculated; if the ratio is 110% or greater, care is considered “adequate plus” prenatal care. If the ratio is greater than 80% but less than 110%, care is considered “adequate”. A ratio between 50 and 79% is considered “intermediate” and a ratio of less than 50% is considered “inadequate” (ADHSS, 2014). The categories of “adequate” and “adequate plus” were combined to create the category “adequate or better”.

In 2012, only approximately 40% of all pregnant women in the NSB Census Area and the Yukon-Koyukuk Census Area were documented on the birth certificate as having received adequate or better prenatal care (ABVS, 2014). This is considerably less than in the State of Alaska, where around 60% of all pregnant women reported experiencing adequate or better prenatal care. Of pregnant Alaska Native women, only

25% in Skagway-Hoonah-Angoon Census Area had received adequate or better prenatal care, compared to 52% of all Alaska Natives in 2012. In the NSB Census Area and Yukon-Koyukuk Census Area, 43.6% and 39.8% of pregnant Alaska Native women had received adequate or better prenatal care. These discrepancies indicate that fewer Alaska Native women within these regions were receiving proper prenatal care.

In 2013, just over half (54.5%) of mothers of Alaska Native infants had documented adequate prenatal care (AN EpiCenter, 2016). During 1991-2013, the proportion of mothers receiving documented adequate prenatal care among mothers of Alaska Native infants decreased to a low of 43.0% in 2008, but has been increasing since 2008 (Figure 1). During 2009-2013, the proportion of mothers receiving documented adequate prenatal care varied significantly by tribal health region, ranging from 30.7% to 80.5% (AN EpiCenter, 2016) (Figure 2). The Arctic North Slope had the lowest level of adequacy of prenatal care among the tribal health regions that may be potentially impacted by the project (e.g., containing PACs).

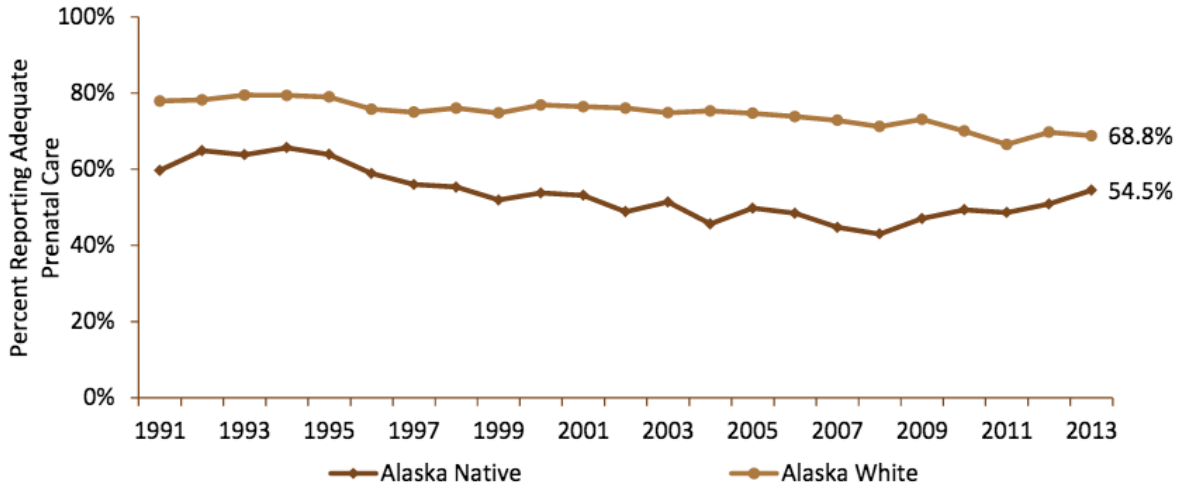
**Table 3. Adequacy of Prenatal Care for Females by Potentially Affected Census Area, Alaska 2012**

| Adequacy of Prenatal Care (APNCU Index) | All Races | | White | | Alaska Native | |
|---|---|---|---|---|---|---|
| | Births (No.) | Percent (%) | Births (No.) | Percent (%) | Births (No.) | Percent (%) |
| **North Slope Borough** | | | | | | |
| Adequate plus | 43 | 21.5 | 1 | 10.0 | 42 | 22.2 |
| Adequate | 49 | 24.5 | 2 | 20.0 | 46 | 24.3 |
| Intermediate | 63 | 31.5 | 3 | 30.0 | 60 | 31.7 |
| Inadequate | 45 | 22.5 | 4 | 40.0 | 41 | 21.7 |
| **Yukon-Koyukuk Census Area** | | | | | | |
| Adequate plus | 7 | 9.0 | 0 | 0.0 | 7 | 10.3 |
| Adequate | 24 | 30.8 | 3 | 33.3 | 21 | 30.9 |
| Intermediate | 24 | 30.8 | 3 | 33.3 | 21 | 30.9 |
| Inadequate | 23 | 29.5 | 3 | 33.3 | 19 | 27.9 |
| **Fairbanks North Star Borough** | | | | | | |
| Adequate plus | 296 | 21.5 | 235 | 23.2 | 25 | 13.0 |
| Adequate | 677 | 49.1 | 513 | 50.5 | 84 | 43.8 |
| Intermediate | 186 | 13.5 | 133 | 13.1 | 33 | 17.2 |
| Inadequate | 220 | 16.0 | 134 | 13.2 | 50 | 26.0 |
| **Denali Borough** | | | | | | |
| Adequate plus | 1 | 5.6 | ** | ** | ** | ** |
| Adequate | 8 | 44.4 | ** | ** | ** | ** |
| Intermediate | 2 | 11.1 | ** | ** | ** | ** |
| Inadequate | 7 | 38.9 | ** | ** | ** | ** |
| **Matanuska-Susitna Borough** | | | | | | |
| Adequate plus | 371 | 29.5 | 311 | 29.7 | 40 | 29.6 |
| Adequate | 534 | 42.4 | 447 | 42.7 | 52 | 38.5 |
| Intermediate | 184 | 14.6 | 153 | 14.6 | 20 | 14.8 |
| Inadequate | 170 | 13.5 | 137 | 13.1 | 23 | 17.0 |
| **Kenai Peninsula Borough** | | | | | | |

| Adequacy of Prenatal Care (APNCU Index) | All Races | | White | | Alaska Native | |
|---|---|---|---|---|---|---|
| | Births (No.) | Percent (%) | Births (No.) | Percent (%) | Births (No.) | Percent (%) |
| Adequate plus | 116 | 15.9 | 91 | 14.7 | 21 | 23.9 |
| Adequate | 299 | 41.0 | 256 | 41.4 | 31 | 35.2 |
| Intermediate | 208 | 28.5 | 179 | 28.9 | 23 | 26.1 |
| Inadequate | 107 | 14.7 | 93 | 15.0 | 13 | 14.8 |
| **Municipality of Anchorage** | | | | | | |
| Adequate plus | 1,008 | 24.5 | 585 | 23.3 | 208 | 34.8 |
| Adequate | 1,655 | 40.2 | 1,111 | 44.2 | 193 | 32.3 |
| Intermediate | 802 | 19.5 | 520 | 20.7 | 82 | 13.7 |
| Inadequate | 655 | 15.9 | 299 | 11.9 | 114 | 19.1 |
| **Southeast Fairbanks Census Area** | | | | | | |
| Adequate plus | 9 | 9.4 | 8 | 9.8 | 1 | 12.5 |
| Adequate | 30 | 31.3 | 27 | 32.9 | 1 | 12.5 |
| Intermediate | 24 | 25.0 | 19 | 23.2 | 2 | 25.0 |
| Inadequate | 33 | 34.4 | 28 | 34.1 | 4 | 50.0 |
| **Valdez-Cordova Census Area** | | | | | | |
| Adequate plus | 14 | 12.0 | 8 | 9.3 | 5 | 20.8 |
| Adequate | 42 | 35.9 | 29 | 33.7 | 12 | 50.0 |
| Intermediate | 33 | 28.2 | 26 | 30.2 | 4 | 16.7 |
| Inadequate | 28 | 23.9 | 23 | 26.7 | 3 | 12.5 |
| **Skagway-Hoonah-Angoon Census Area** | | | | | | |
| Adequate plus | 6 | 23.1 | 5 | 38.5 | 1 | 8.3 |
| Adequate | 8 | 30.8 | 5 | 38.5 | 2 | 16.7 |
| Intermediate | 5 | 19.2 | 1 | 7.7 | 4 | 33.3 |
| Inadequate | 7 | 26.9 | 2 | 15.4 | 5 | 41.7 |
| **State of Alaska** | | | | | | |
| Adequate plus | 2,360 | 23.1 | 1,423 | 23.3 | 619 | 23.4 |
| Adequate | 3,967 | 38.8 | 2,674 | 43.7 | 756 | 28.6 |
| Intermediate | 2,134 | 20.9 | 1,217 | 19.9 | 630 | 23.8 |
| Inadequate | 1,755 | 17.2 | 802 | 13.1 | 640 | 24.2 |

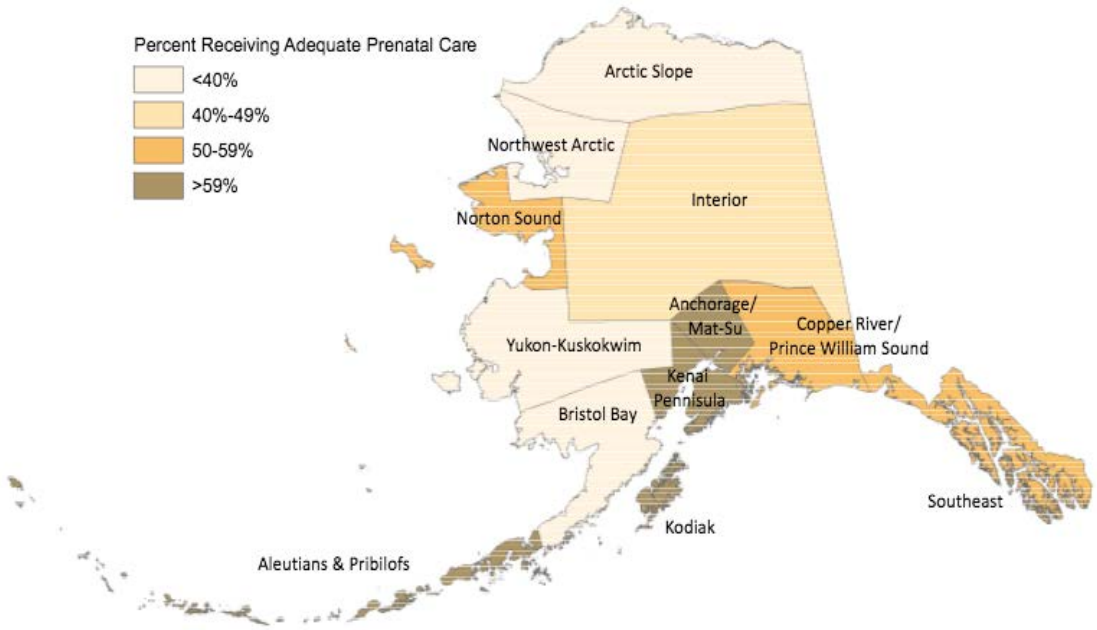
Source: ABVS, 2016
** Data suppressed for confidentiality concerns if total births, by race, is less than five.

**Figure 1. Adequate Prenatal Care by Alaska Native Status, 1991 – 2013**




Source: AN EpiCenter, 2016

**Figure 2. Adequate Prenatal Care by Tribal Health Region, 2009-2013**



Teen birth rates, defined as live births per 1,000 females ages 15–19 years, exert important influences on childhood development and female health. The children of teenage mothers are more likely to have lower school achievement and to drop out of high school, have more health problems, be incarcerated at some time during adolescence, give birth as a teenager (Venture et al., 2011). Teenage mothers are less likely to receive a high school diploma, which may negatively impact their future health (CDC, 2010). Teen birth rates by the potentially affected area is provided in Table 4, below.

**Table 4. Teen Birth Rates by Potentially Affected Area, Alaska 2012**

| Census Area | Percent of Total Births (%) to Alaska Native Mothers < 20 Years | Percent of Total Births (%) to All Mothers <20 Years |
|---|---|---|
| North Slope Borough Census Area | 10.1 | 9.3 |
| Yukon-Koyukuk Census Area | 8.7 | 7.5 |
| Fairbanks North Star Borough | 10.3 | 6.1 |
| Denali Borough | ** | 5.3 |
| Matanuska-Susitna Borough | 16.2 | 7.9 |
| Kenai Peninsula Borough | 10.0 | 6.0 |
| Municipality of Anchorage | 10.3 | 6.5 |
| Southeast Fairbanks Census Area | 25.0 | 8.1 |
| Skagway-Hoonah-Angoon Census Area | 23.1 | 11.1 |
| Valdez-Cordova Census Area | 0.0 | 3.2 |
| State of Alaska | 12.6 | 7.5 |

Source: ABVS, 2016
** Data suppressed for confidentiality concerns if total births, by race, is less than five.

#### 3.1.1.4.3. Birth Summary

The number of live births to Alaska residents has declined slightly over the previous year, decreasing 0.9%. However, the overall number of births has still risen 2.7% since 2006. Births to American Indian/Alaska Native mothers and white mothers continue to comprise the majority of Alaska's births.

Crude birth rates, which measure how many births occur per 1,000 population, have returned to a 10-year low of about 15 births per 1,000 population, the same rate as 2012. Fertility rates measures how many births occur per 1,000 female population between the ages 15 and 44. As this measure only takes into account the portion of the population that typically bears children, fertility rates are a more meaningful measure of birth patterns. The overall fertility rate of Alaska mothers has increased 0.1% since 2006 (ADHSS, 2015b).

#### 3.1.1.4.4. Births by Age Group

Fertility rates by age group, or age-specific fertility rates, vary substantially. Alaska mothers between the ages of 20 and 29 continue to have the highest fertility rates by age group. Since 2006, the overall teen mother (15–19) birth rate has declined 28.8%, with the black teen mother birth rate seeing the largest decrease.

As the two predominant races in Alaska, births to American Indian/Alaska Native and white teen mothers comprised the majority of teenaged births. American Indian/Alaska Native teen mother birth rates remain approximately three times higher than white teen mother birth rates. In 2015, the teen birth rate for American Indian/Alaska Native teens was 55 per 1,000 population, compared to 29 per 1,000 for white teens (ADHSS, 2015b).

#### 3.1.1.4.5. Preterm Birth

A preterm birth is one in which the delivery occurs before 37 weeks of gestation. Since 2006, this percentage has decreased 8%. White mothers continue to have the lowest overall preterm birth rate, while Asian/Pacific Islander mothers and American Indian/Alaska Native mothers have the highest (ADHSS, 2015b).

Low birth weight is considered an infant that weighs less than 2,500 grams (approximately 5.5 pounds). Since 2006, the overall percentage of low birth weight births has remained within a narrow range. In 2015, black mothers had the highest percentage of low weight births, at 8%. It is widely suspected that low birth weight infants (<5.5 pounds) experience a greater number of adverse health outcomes during development and adulthood. Combined with other parameters, birth weights can also help approximate baseline health conditions for a region. Typically, low birth weight is a result of poor delivery of nutrients and oxygen to the fetus, which, in turn, is directly related to the health of the mother. Low birth weight is associated with an increased risk of lifelong disability and a 20-fold increased risk of death (ABVS, 2016).**Error! Bookmark not defined.** Therefore, low birth weight is both an indicator of the health of the maternal population and a determinant of the health of the infant. Low birth weights by PACs is provided in Table 5, below.

**Table 5. Low Birth Weight Births by Potentially Affected Communities, Alaska 2012**

| Census Area | Percent of Total Low Birth Weight Births (%) to Alaska Native Mothers <20 Years | Percent of Total Low Birth Weight Births (%) to All Mothers <20 Years |
|---|---|---|
| North Slope Borough | 7.4 | 7.0 |
| Yukon-Koyukuk Census Area | 4.3 | 5.0 |
| Fairbanks North Star Borough | 6.9 | 5.2 |
| Denali Borough | 10.5 | ** |
| Matanuska-Susitna Borough | 6.5 | 10.1 |
| Kenai Peninsula Borough | 4.7 | 8.8 |
| Municipality of Anchorage | 7.4 | 5.9 |
| Southeast Fairbanks Census Area | 0.0 | 0.0 |
| Skagway-Hoonah-Angoon Census Area | 0.0 | 0.0 |
| Valdez-Cordova Census Area | 8.3 | 7.3 |
| State of Alaska | 6.8 | 5.6 |
| Source: ABVS, 2016<br>** Data suppressed for confidentiality concerns if total births, by race, is less than five. | | |

Substance use during pregnancy adversely affects birth outcomes and future health for individuals. Substance use during pregnancy refers to the consumption of alcohol, tobacco, and/or drugs during the partum period. Substance use is dangerous for both the mother and the fetus and can lead to premature detachment of the placenta, Sudden Infant Death Syndrome (SIDS), and developmental problems in childhood. Excessive alcohol use during pregnancy puts infants at risk for Fetal Alcohol Syndrome (FAS), the leading preventable cause of birth defects and mental retardation. Fetal Alcohol Spectrum Disorders (FASD) describe with a group of physical, mental, behavioral, or learning disabilities associated with maternal alcohol use during pregnancy. Approximately 1 in 10 infants diagnosed with FASD meet the case definition for the most severe form of the disorder, FAS, which produces typical facial features as well as growth and neurodevelopmental deficits from prenatal alcohol exposure (Community Anti-Drug Coalition of American, 2010).

Smoking during pregnancy is the single most significant contributor to low birth weight (CDC, 2004; Brook, 1989; Kramer, 1987). The NSB had the highest percent of mothers reporting smoking during pregnancy among all residents (48.0%) and Alaska Natives (55.0%) (ABVS, 2016) (Table 6). The Skagway-Hoonah-Angoon Census Area had the lowest percentage of Native Alaska women (15.4%) reporting smoking during pregnancy but the lowest reported rate occurred among all mothers residing in Southeast Fairbanks Census Area (7.1%). The percentage of women reporting drinking during pregnancy was much lower than reported rates of smoking statewide and across all regions. The highest reported levels of drinking during pregnancy occurred among Native Alaska woman living in the Municipality of Anchorage, whereas the highest percentage of all women reporting drinking during pregnancy resided in the Yukon-Koyukuk Census Area.

**Table 6. Infants Born to Mothers Reporting Substance Use during Pregnancy by Potentially Affected Communities Area, Alaska, 2012**

| Census Area | Percent of Alaska Native Mothers Reporting Smoking (%) during Pregnancy | Percent of all Mothers Reporting Smoking (%) during Pregnancy | Percent of Alaska Native Mothers Reporting Drinking (%) during Pregnancy | Percent of all Mothers Reporting Drinking (%) during Pregnancy |
|---|---|---|---|---|
| North Slope Borough | 55.0 | 48.0 | 0.7 | 0.6 |
| Yukon-Koyukuk Census Area | 29.0 | 25.0 | 5.9 | 5.1 |
| Fairbanks North Star Borough | 32.5 | 11.8 | 3.4 | 1.2 |
| Denali Borough | ** | 10.5 | ** | 0.0 |
| Matanuska-Susitna Borough | 27.7 | 13.9 | 4.1 | 2.6 |
| Kenai Peninsula Borough | 30.8 | 13.9 | 4.4 | 3.2 |
| Municipality of Anchorage | 31.1 | 9.3 | 6.2 | 3.1 |
| Southeast Fairbanks Census Area | 37.5 | 7.1 | 0.0 | 0.0 |
| Skagway-Hoonah-Angoon Census Area | 15.4 | 11.1 | 0.0 | 0.0 |

| Census Area | Percent of Alaska Native Mothers Reporting Smoking (%) during Pregnancy | Percent of all Mothers Reporting Smoking (%) during Pregnancy | Percent of Alaska Native Mothers Reporting Drinking (%) during Pregnancy | Percent of all Mothers Reporting Drinking (%) during Pregnancy |
|---|---|---|---|---|
| Valdez-Cordova Census Area | 20.8 | 11.3 | 0.0 | 2.5 |
| State of Alaska | 32.0 | 13.8 | 3.7 | 2.6 |
| Source: ABVS, 2016<br>**Data suppressed for confidentiality concerns if total births, by race, is less than five. | | | | |

#### 3.1.1.4.6. Fetal and Infant Mortality

Fetal and infant mortality is another health outcome that can be used to approximate baseline health conditions in a region. A fetal death is defined as death before the complete expulsion or extraction from its mother, irrespective of the duration of the pregnancy. The number of fetal deaths between 2013 and 2015 decreased to 184, down from 194 between 2012 and 2014. The fetal mortality rate is the number of fetal deaths, per 1,000 live births and fetal deaths. From 2013 to 2015, the fetal mortality rate averaged 5.4 deaths per 1,000 live births and fetal deaths.

Infant mortality is an important indicator for population health and is influenced by living conditions, food security, domestic conflict, socioeconomic wellbeing, and access to health services. This rate is often used as an indicator to measure the health and well-being of a nation, because factors affecting the health of entire populations can also impact the mortality rate of infants (CDC, 2014). Infant mortality can be separated into neonatal deaths, which occur during the first 28 days of life, and post-neonatal deaths, which occur from the 28th day to 1 year of life. Whereas neonatal deaths are associated with the quality of prenatal and perinatal health care, post-neonatal deaths are more closely associated with socioeconomic conditions (CDC, 2010).

During 1981 to 2013, infant mortality declined among Alaska Native, Alaska White and U.S. White population (Figure 3) (AN EpiCenter, 2016). During this time period, the Alaska Native infant mortality rate declined 49.4%, a significant decrease (p<001). During 2009 to 2013, rates of infant mortality varied by tribal health region, ranging from 2.6 to 10.9 per 1,000 live births (Figure 4) (AN EpiCenter, 2016).

The number of infant deaths between 2013 and 2015 increased to 219, up from 201 between 2012 and 2014. The infant mortality rate is the number of infant deaths per 1,000 live births for a given calendar year. From 2013 to 2015, the infant mortality rate averaged 6.4 deaths per 1,000 live births (ADHSS, 2015b).

#### 3.1.1.4.7. Neonatal Infant Deaths

Neonatal deaths are deaths of infants under 28 days of age. These deaths are frequently associated with circumstances related to pregnancy and delivery. The number of neonatal infant deaths increased from 34 in 2014, to 44 in 2015.

The neonatal infant mortality rate is the number of neonatal infant deaths, per 1,000 live births for a given calendar year. From 2013 to 2015, the neonatal infant mortality rate averaged 3.2 deaths per 1,000 live births. During this period, American Indian/Alaska Native infants were more than twice as likely to die during the neonatal period than white infants.

In 2015, congenital malformations, deformations, and chromosomal abnormalities were the leading causes of neonatal death (ADHSS, 2015b).

#### 3.1.1.4.8. Postneonatal Infant Deaths

Postneonatal deaths are deaths of infants between 28 and 364 days of age. These deaths are frequently associated with living conditions. The number of postneonatal deaths decreased from 41 in 2014, to 35 in 2015.

The postneonatal infant mortality rate is the number of postneonatal infant deaths, per 1,000 live births for a given calendar year. From 2013 to 2015, the postneonatal infant mortality rate averaged 3.3 deaths per 1,000 live births. During this period, American Indian/Alaska Native infants were more than three times as likely to die during the postneonatal period than white infants.

In 2015, SIDS and unintentional injuries were the leading causes of postneonatal death (ADHSS, 2015b).

Infant deaths and mortality rates by PAC for Alaska and the U.S. are provided in Table 7.

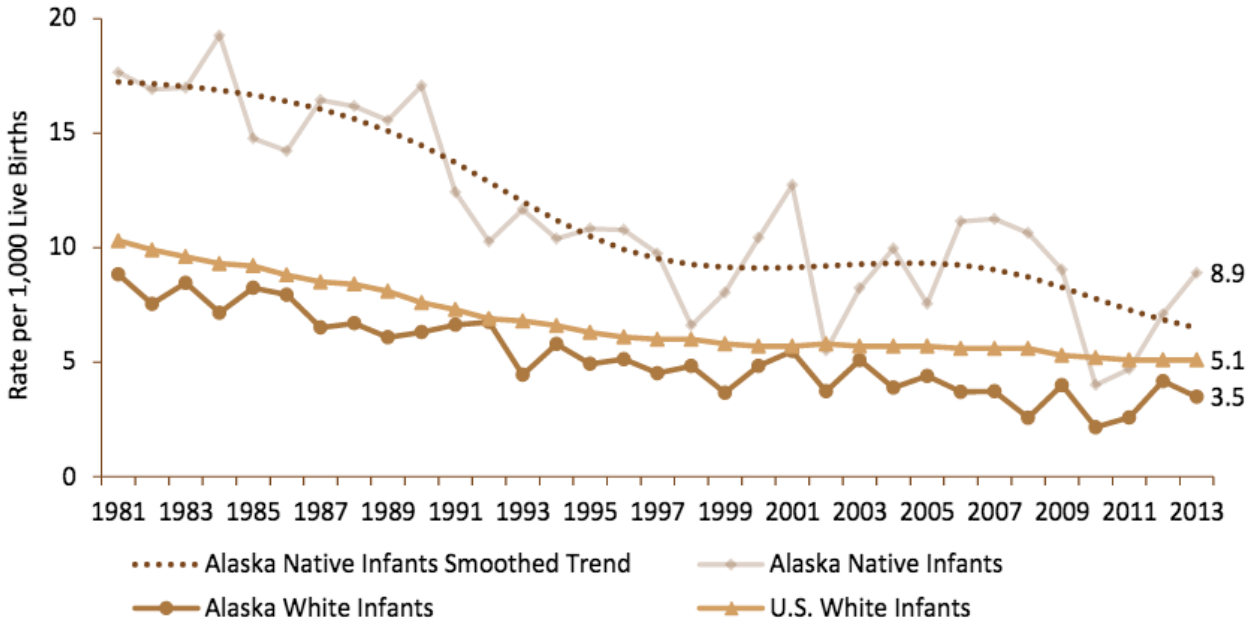
**Table 7. Infant Deaths and Infant Mortality Rates by Potentially Affected Area, Alaska, and the U.S.**

| Census Area | Neonatal (Infants less than 28 Days of Age) | | Postneonatal (Infants 28 Days to 1 Year of Age) | | Infant Mortality Rate |
|---|---|---|---|---|---|
| | Number of Deaths | Rate per 1,000 Live Births | Number of Deaths | Rate per 1,000 Live Births | Rate per 1,000 Live Births |
| North Slope Borough (2008-2012) | 3 | ** | 3 | ** | 6.8* |
| Yukon-Koyukuk Census Area (2008-2012) | 0 | 0.0 | 4 | ** | ** |
| Fairbanks North Star Borough (2010-2012) | 14 | 2.8* | 5 | ** | 3.8* |
| Denali Borough (2008-2012) | 1 | ** | 0 | 0.0 | ** |
| Matanuska-Susitna Borough (2010-2012) | 9 | 2.2* | 7 | 1.7* | 4.0* |
| Kenai Peninsula Borough (2010-2012) | 4 | ** | 3 | ** | 3.2* |
| Municipality of Anchorage (2012) | 11 | 2.4* | 12 | 2.6* | 5.0 |
| Southeast Fairbanks Census Area (2008-2012) | 2 | ** | 0 | 0.0 | ** |
| Skagway-Hoonah-Angoon Census Area (2008-2012) | 0 | 0.0 | 0 | 0.0 | 0.0 |
| Valdez-Cordova Census Area (2008-2012) | 1 | ** | 1 | ** | ** |

| Census Area | Neonatal (Infants less than 28 Days of Age) | | Postneonatal (Infants 28 Days to 1 Year of Age) | | Infant Mortality Rate |
|---|---|---|---|---|---|
| | Number of Deaths | Rate per 1,000 Live Births | Number of Deaths | Rate per 1,000 Live Births | Rate per 1,000 Live Births |
| State of Alaska (2012) | 36 | 3.2 | 25 | 2.2 | 5.5 |
| U.S. (2013) | 15,867 | 4.04 | 7,573 | 1.93 | 5.96 |

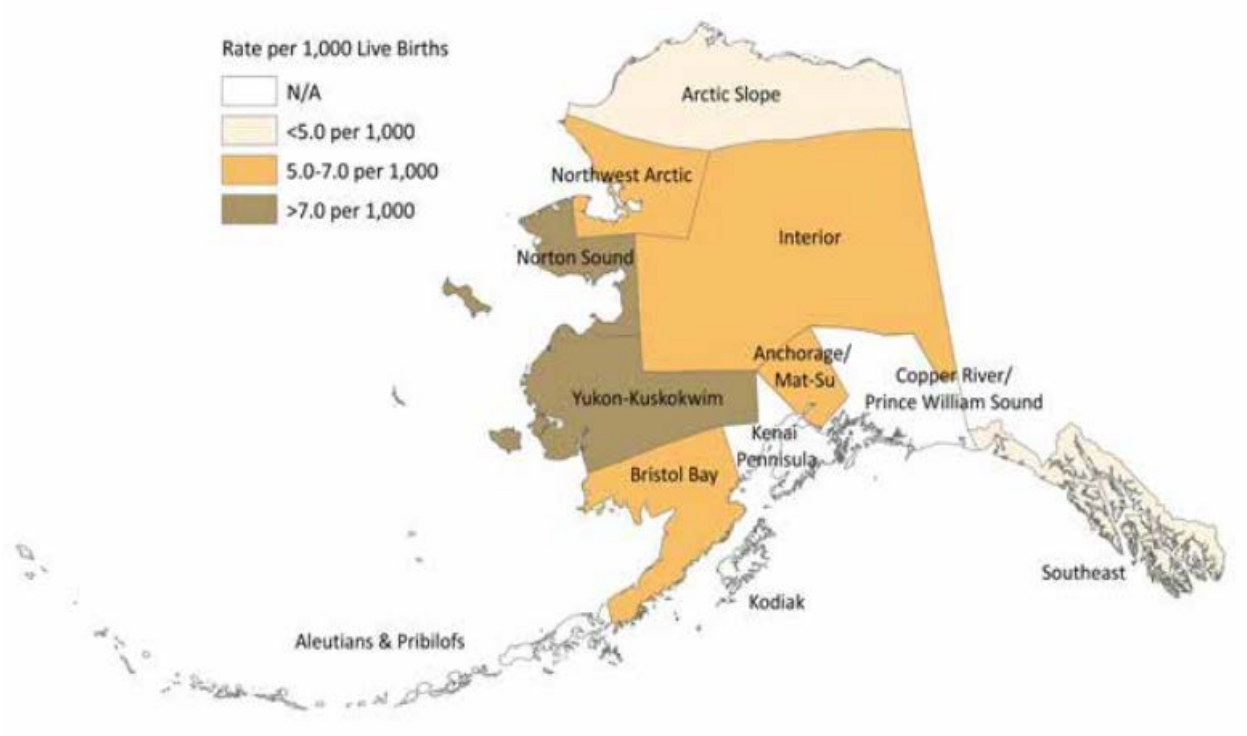
Source: ABVS, 2016; CDC, 2016
*Rates based on fewer than 20 occurrences are statistically unreliable and should be used with caution.
** Data suppressed for confidentiality concerns if total births, by race, is less than five.

**Figure 3. Infant Mortality Rate, 1981-2013**




Source: AN EpiCenter, 2016

**Figure 4. Alaska Native Infant Mortality Rates by Tribal Health Region, 2009-2013**




Source: AN EpiCenter, 2016

### 3.1.1.4.9. Child Mortality Summary

The under 5 mortality rate is the number of deaths that occur before age 5 (age 0–4), per 1,000 live births for a given calendar year. From 2013 to 2015, the under 5 mortality rate averaged 8.1 deaths per 1,000 live births. American Indian/Alaska Native children are nearly three times as likely to die before their fifth birthday than white children.

Mortality rates for children and teenagers age 5 to 19 are calculated on an age-specific basis. On average, from 2013 to 2015, approximately 17 Alaska children (age 5–14), and 71 teenagers (age 15–19) died per 100,000 population. American Indian/Native Alaska children (age 5–14) are three times as likely to die than white children, while American Indian/Native teenagers (age 15–19) are more than two and one-half times as likely to die than white teenagers (ADHSS, 2015b).

Child abuse is a major contributor to childhood morbidity and mortality. In addition to its direct impact on health, child abuse has been linked to long-term effects on cognitive development and on physical and mental health. Childhood physical abuse predicts a graded increase in depression, anxiety, and severe ill health, as well as multiple medical diagnoses and physical symptoms (Kramer, 1987; Chartier et al., 2007; Springer et al., 2007; U.S. Department of Health and Human Services [USDHHS], 2016). Child abuse and neglect are long-standing issues in Alaska, with rates historically significantly higher than in the U.S.

overall. A database maintained by ADHSS, Office of Children's Services (OCS) is used to monitor reports of child maltreatment.

Figure 5 demonstrates improvement in both the Alaska and U.S. rates (per 1,000 children) of substantiated child maltreatment between 2007 and 2011; however, the Alaska rate remained more than 50% higher than the U.S. rate (Healthy Alaskans 2020 [HA2020], 2014). OCS also provides services to families whose children have been determined to be unsafe or at high risk of maltreatment by their parent or caregiver.

**Figure 5. Child Maltreatment, All Alaskans and the U.S. (2007-2011)**


Source: HA2020, 2014

Child maltreatment data are not specifically aggregated by community or borough, instead, the Alaska OCS publishes statistics for each of five regions. OCS provides services to families whose children have been determined to be unsafe or at high risk of maltreatment by their parent or caregiver. Decisions regarding needed interventions with families are based on thorough information collection that guides the initial and ongoing assessment of safety and risk. OCS has experienced an increase in the number of children in care. Table 8 shows OCS' statistics on children in out-of-home care for one or more days during the calendar year.

**Table 8. Number of Children in Out-of-Home Care (Calendar Year)**

| Region | Reporting Period | | | | |
|---|---|---|---|---|---|
| | **2013** | **2014** | **2015** | **2016** | **2017** |
| **Anchorage** | 1,175 | 1,317 | 1,579 | 1,719 | 1,723 |
| **Northern Region** | 506 | 568 | 665 | 759 | 831 |
| **Southcentral Region** | 721 | 831 | 926 | 1,108 | 1,083 |
| **Western Region** | 235 | 273 | 280 | 285 | 299 |
| **Southeastern Region** | 249 | 256 | 266 | 267 | 273 |
| **Alaska Statewide (Total)** | 2,886 | 3,245 | 3,716 | 4,138 | 4,209 |
| **Source: ADHSS, OCS, 2018** | | | | | |

#### 3.1.1.4.10. Intimate Partner Violence

Intimate partner violence and sexual violence cause an array of direct physical and psychological injuries to victims. In one study, abuse was linked to numerous adverse medical effects including arthritis, chronic neck or back pain, migraine, STIs including human immunodeficiency virus (HIV)/acquired immune deficiency syndrome (AIDS), chronic pelvic pain, peptic ulcers, irritable bowel syndrome, and frequent indigestion, diarrhea, or constipation (Coker et al., 2000). Abuse of pregnant women can cause pregnancy complications, such as low weight gain, anemia, infection, and first and second trimester bleeding, as well as elevated rates of depression, suicide attempts, and substance abuse among mothers (The Family Violence Prevention Fund, 2004). Exposure to high levels of intimate partner violence has also been shown to have an association with IQ suppression in young children (Koenen et al., 2003).

The Alaska Victimization Survey is modeled after the National Intimate Partner and Sexual Violence Surveillance System. Statewide surveys were conducted in 2010 and 2015. Regional surveys were administered between 2011 and 2014 within Anchorage, Bristol Bay, Fairbanks, Juneau, Ketchikan, Kodiak, Matsu, Nome, Sitka, Yukon-Kuskokwim, North Slope, and Aleutians. The survey excluded non-English speaking women, women without phone access, and women not living in a residence. It is important to note, therefore, that estimates may be higher among women excluded from the survey. In addition, estimates may also be conservative due to the stigma of reporting victimization. Because these limitations may vary across regions, the validity of regional comparisons remains should be interpreted with caution. Table 9 illustrates past year and lifetime estimates of each form of intimate partner violence measured among women residing in those project regions included in the survey. Among project regions, FNSB had the lowest rates of physical violence and threats; rates were similar among other projects regions. Prevalence of sexual violence was similar among all regions and slightly below that of the state overall.

The most recent Alaska Victimization Survey (2015) conducted by the University of Alaska Anchorage Justice Center for the Council on Domestic Violence and Sexual Assault found that 21,401 adult women in Alaska experienced intimate partner violence, sexual violence, or both in the past year. Half of adult women in Alaska (more than 130,000) have experienced violence in their lifetime. There was, however, a decline in intimate partner and sexual violence in Alaska since 2010. In 2010, 12 in 100 women had experienced intimate partner violence, sexual violence, or both in Alaska during the previous year. By 2015, that number had dropped to 8 in 100. Overall, intimate partner violence decreased by 32% and sexual violence decreased by 33%. In 2015, 6,556 fewer women experienced intimate partner violence than in 2010. In 2015, 3,072 fewer women experienced sexual violence than in 2010.

**Table 9. Lifetime Estimates of Intimate Partner Violence and Sexual Violence among English-Speaking Adult Women by Region and Statewide (2010-2015)**

| Census Area | Lifetime | | Past Year | |
|---|---|---|---|---|
| | Percentage (%) | Number | Percentage (%) | Number |
| **Fairbanks North Star Borough (2011)** | | | | |
| Intimate Partner Violence[a] | 36.4% | 11,749 | 4.8% | 1,630 |
| Threats | 21.8% | 7,403 | 3.5% | 1,188 |
| Physical Violence | 34.3% | 11,647 | 4.6% | 1,562 |
| Sexual Violence[b] | 31.6% | 10,730 | 1.3% | 441 |
| Alcohol or Drug Involved Sexual Assault | 21.1% | 7,165 | 1.2% | 407 |
| Forcible Sexual Assault | 23.6% | 8,014 | 0.4% | 136 |
| **Matanuska-Susitna Borough (2013)** | | | | |
| Intimate Partner Violence[a] | 45.5% | 13,895 | 7.6% | 2,321 |
| Threats | 27.9% | 8,520 | 3.7% | 1,130 |
| Physical Violence | 44.9% | 13,712 | 7.2% | 2,199 |
| Sexual Violence[b] | 33.7% | 10,292 | 3.0% | 916 |
| Alcohol or Drug Involved Sexual Assault | 22.3% | 6,810 | 1.5% | 458 |
| Forcible Sexual Assault | 26.1% | 7,971 | 2.2% | 672 |
| **Municipality of Anchorage (2011)** | | | | |
| Intimate Partner Violence[a] | 42.2%<br>45,030<br>8.2%<br>8,750<br>45,030<br>8.2%<br>8,750 | 45,030 | 8.2% | 8,750 |
| Threats | 22.8% | 24,329 | 3.6% | 3,841 |
| Physical Violence | 41.6% | 44,390 | 8.1% | 8,643 |
| Sexual Violence[b] | 29.6% | 31,585 | 1.4% | 1,494 |
| Alcohol or Drug Involved Sexual Assault | 18.0% | 19,207 | 1.2% | 1,280 |
| Forcible Sexual Assault | 22.8% | 24,329 | 0.4% | 427 |
| **Kenai Peninsula Borough (2013)** | | | | |
| Intimate Partner Violence[a] | 43.0% | 8,561 | 4% | 796 |
| Threats | 26.3% | 5,236 | 1.5% | 299 |
| Physical Violence | 41.6% | 8,283 | 3.5% | 697 |
| Sexual Violence[b] | 30.1% | 5,993 | 2.2% | 438 |
| Alcohol or Drug Involved Sexual Assault | 18.8% | 3,743 | 1.4% | 279 |
| Forcible Sexual Assault | 22.8% | 4.539 | 1.4% | 279 |
| **Alaska Statewide (2013)** | | | | |
| | Lifetime | | Past Year | |
| | 2010 | 2015 | 2010 | 2015 |
| Intimate Partner Violence[a] | 47.6% | 40.4% | 9.4% | 6.4% |
| Threats | 31.0% | 25.6% | 5.8% | 3.0% |

| Census Area | Lifetime | | Past Year | |
|---|---|---|---|---|
| | Percentage (%) | Number | Percentage (%) | Number |
| Physical Violence | 44.8% | 39.6% | 8.6% | 5.9% |
| Sexual Violence[b] | 37.1% | 33.1% | 4.3% | 2.9% |
| Alcohol or Drug Involved Sexual Assault | 26.8% | 22.6% | 3.6% | 2.0% |
| Forcible Sexual Assault | 25.6% | 23.5% | 2.5% | 1.6% |

Source: Alaska Victimization Survey, 2010-2015

[a]Includes both threats of physical violence and physical violence by intimate partners.

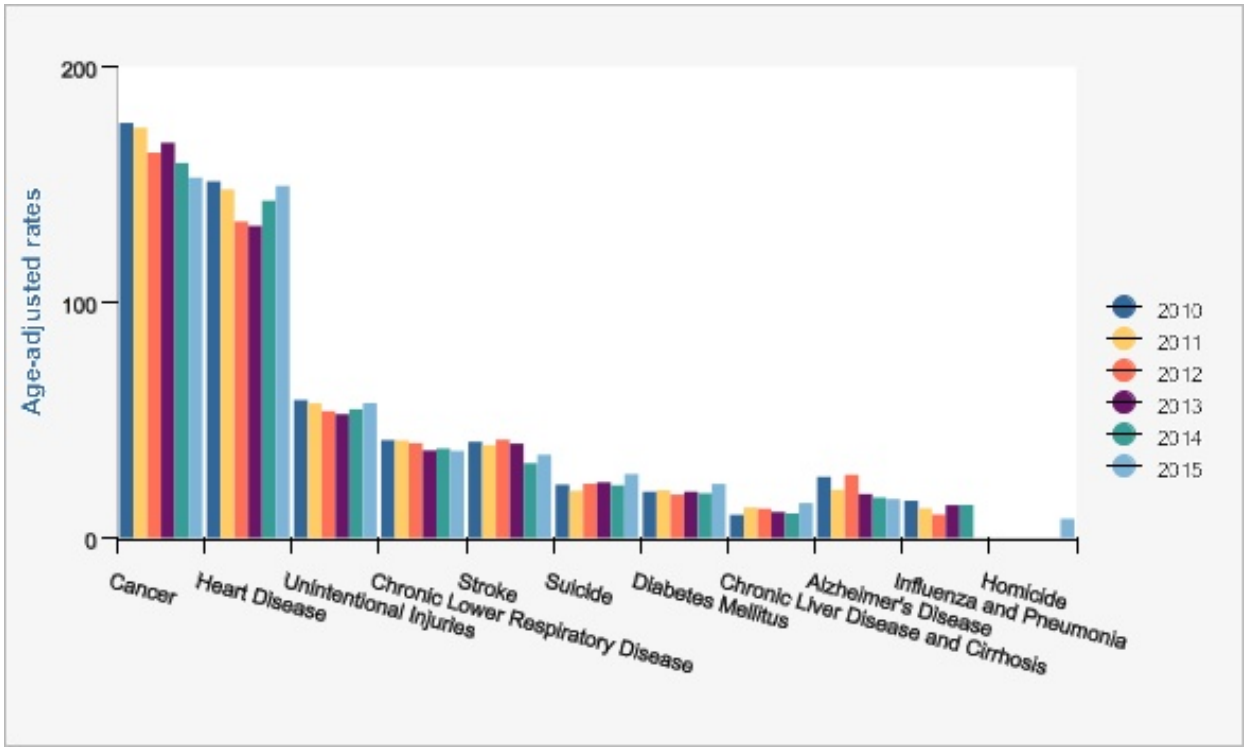
[b]Includes both alcohol or drug involved sexual assault and forcible sexual assault.

Note: This survey measured the number of victims, not the number of victimizations. In addition, not all forms of intimate partner violence or sexual violence were measured.

### 3.1.1.5. Leading and Select Causes of Death Summary

In 2015, the top 10 leading causes of death claimed the lives of 3,146 Alaskans, comprising 72.8% of all deaths. The top leading causes of death are shown in Figure 6, below. Cancer continues to be the number one leading cause of death in Alaska.

**Figure 6. Leading Causes of Death in for All Alaskans 2010–2015**




Source: Alaska Vital Statistics 2015 Annual Report (ADHSS, 2015b)

In 2015, assault (homicide) replaced influenza and pneumonia as the tenth leading cause of death. Years of potential life lost is defined as the difference between the assumed life span of a "typical" person, and the actual age of death. Assuming that a typical person's lifespan is 75 years, the top ten leading causes of death were responsible for a total 43,792 years of potential life lost in 2015.

In addition to the top ten leading causes of death, data on three select causes of death are also presented. Select causes are composite categories of special interest. Because these categories can contain deaths that may fall into more than one leading cause, they are not ranked (ADHSS, 2015b).

#### 3.1.1.5.1. Death Summary

In 2015, 4,324 Alaskans died. As the two most predominant races in Alaska, American Indian/Alaska Native and white Alaskans comprise the majority of deaths.

Crude death rates measure how many Alaskans died per 100,000 population. Since 2006, Alaska's crude death rates have increased 17.9%. Crude death rates for American Indian/Alaska Native people were 44.2% higher than for white people.

When comparing death rates between different populations, age-adjusted death rates should be used. This is because populations with a higher proportion of older people will tend to have higher crude death rates. In 2015, Alaska's age-adjusted death rate was 736 deaths per 100,000 U.S. year 2000 standard population. Age-adjusted rates for American Indian/Alaska Native people are about 79.6% higher than for white people (ADHSS, 2015b).

#### 3.1.1.5.2. Suicide

Suicide is an important health outcome that can function as one indicator for mental health wellness in a population. Mental illness and other life stressors are highly associated with suicide. The economic and human cost of suicidal behavior to individuals, families, communities, and society makes suicide a serious public health problem (HA2020, 2014). Timely access to mental health and substance use disorder treatment services are essential to preventing suicide. Many conditions and stressors may be related to suicide, including:

- Previous suicide attempt(s);
- History of depression or other mental illness;
- Alcohol or drug abuse;
- Family history of suicide or violence;
- Physical illness; and
- Local epidemics of suicide.

Alaska had the second highest age-adjusted suicide rate in the nation in 2013 at 23.1 per 100,000 population, the most recent year for which national data are currently available (AK-IBIS, 2016). During the 2005-2009 period, suicide was the leading cause of death among Alaskans aged 15-44 years and the sixth leading cause of death overall in Alaska (ABVS, 2016). Alaska's suicide rates are highest among males,

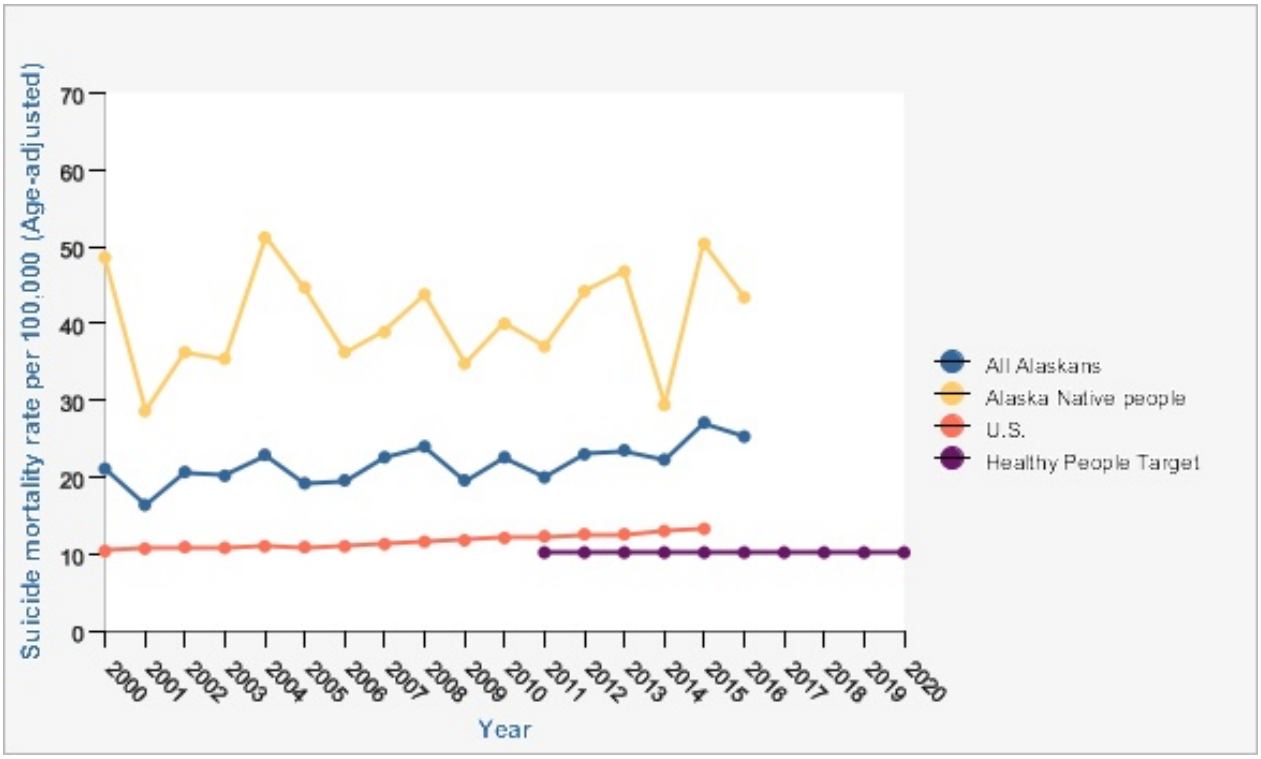
young adults, American Indian/Alaska Native people, and persons living the rural regions of the state (Figures 7 and 8). Between 2000 and 2014, males had a higher suicide rate in every age group (Figure 8).

Intentional self-harm, or suicide, is the fifth leading cause of death in Alaska. In 2015, suicide claimed the lives of 200 Alaskans. Firearms were the leading mechanism of death by suicide, making up 61% of all suicide deaths (98 males and 24 females).

Among the leading causes of death in Alaska, suicide ranked third in total years of potential life lost with 7,510 years lost. On average 37.5 years of life were lost prematurely for each suicide death.

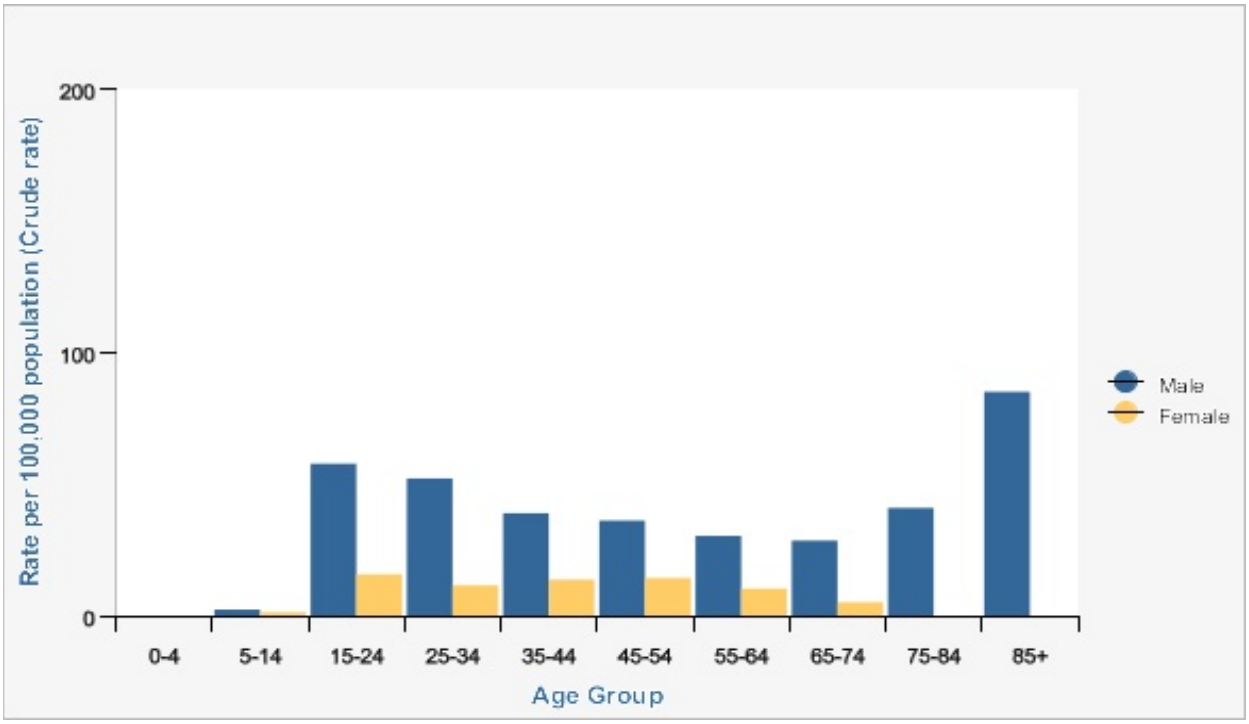
Since 2006, the crude death rate for suicides has increased 38.3%. During this same time period, the age-adjusted rate has increased 38.3% (ADHSS, 2015b).

**Figure 7. Suicide Mortality Rate per 100,000 Population, All Ages, All Alaskans, Alaska Natives, and U.S. (2000-2016)**




Source: AK-IBIS, 2016

**Figure 8. Suicide Mortality Rate per 100,000 Population, by Age Group and Sex, All Alaskans, (2002-2016 [15-Year Average])**




Source: AK-IBIS, 2016

Table 10 provides the 5-year (2012-2016) average suicide mortality rate per 100,000 population for all ages classified by Alaska Economic Region.

**Table 10. Suicide Mortality Rate per 100,000 Population, All Ages, by Alaska Economic Region, 2012-2016 (5-Year Average)**

| Economic Region | Suicide Mortality Rate per 100,000 (Age-adjusted) | Lower Limit | Upper Limit | Numerator | Denominator |
|---|---|---|---|---|---|
| **Anchorage** | 21.3 | 20.4 | 22.1 | 327 | 1,497,336 |
| **Gulf Coast** | 27.1 | 25.2 | 28.9 | 108 | 404,103 |
| **Interior** | 20.8 | 19.4 | 22.2 | 119 | 565,714 |
| **Northern** | 19.2 | 17.7 | 20.6 | 91 | 490,241 |
| **Mat-Su** | 45.2 | 41.0 | 49.4 | 64 | 138,014 |
| **Southeast** | 16.6 | 15.0 | 18.1 | 61 | 371,027 |
| **Southwest** | 49.9 | 46.3 | 53.5 | 109 | 211,294 |
| **Statewide** | 24.2 | 23.6 | 24.8 | 891 | 3,680,926 |
| **Source: AK-IBIS, 2016** | | | | | |

Among potentially affected areas (Table 11), Yukon-Koyukuk had the highest age-adjusted suicide rate at 72.3 per 100,000 population; however, this figure was derived from a sample size less than 20 and is,

therefore, not statistically robust (Table 11). KPB has the highest statistically reliable suicide rate at 27.3 per 100,000 population.

**Table 11. Suicide Rates by Potentially Affected Area and Alaska Statewide (2011-2013)**

| Borough/Census Area | Number of Deaths | Age-adjusted Rate per 100,000 Population[a] |
|---|---|---|
| **North Slope Borough Census Area** | 6 | 21.1* |
| **Yukon-Koyukuk Census Area** | 12 | 72.3* |
| **Fairbanks North Star Borough** | 57 | 19.2 |
| **Denali Borough** | 0 | 0.0 |
| **Matanuska-Susitna Borough** | 48 | 17.4 |
| **Kenai Peninsula Borough** | 47 | 27.3 |
| **Municipality of Anchorage** | 163 | 17.9 |
| **Southeast Fairbanks Census Area** | 3 | ** |
| **Skagway-Hoonah-Angoon Census Area** | 1 | ** |
| **Valdez-Cordova Census Area** | 7 | 27.9* |
| **State of Alaska** | 481 | 22.2 |
| **Source: ABVS, 2016**<br>**[a]Age-adjusted rates are per 100,000 U.S. year 2000 standard population.**<br>***Rates based on fewer than 20 occurrences are statistically unreliable and should be used with caution.**<br>****Rates based on fewer than 6 occurrences are not reported.** | | |

#### 3.1.1.5.3. Substance Abuse

The term "Substance Abuse" refers to the overindulgence in or dependence on an addictive substance, especially alcohol or drugs. In 2013, the American Psychiatric Association updated the Diagnostic and Statistical Manual of Mental Disorders (DSM-5), replacing the categories of substance abuse and substance dependence with a single category: substance use disorder. The symptoms associated with a substance use disorder fall into four major groupings: impaired control, social impairment, risk use, and pharmacological criteria (i.e., tolerance and withdrawal) (National Institute of Health [NIH], 2014).

Substance abuse can cause health problems and strongly influences many related health outcomes, such as accidents and injuries. Substance abuse includes illegal drugs (e.g., heroin, cocaine) alcohol addiction, and binge drinking.

According to the Alaska State Troopers 2015 Annual Drug Report:

> *The greatest contributing factor to violent crimes—including domestic violence and sexual assault—is drug and alcohol abuse. Property crimes, such as burglary and theft, often have a drug and alcohol abuse nexus. It is also widely recognized that many of the accidental deaths that occur in Alaska are related to alcohol use. This is especially true in the western regions of the state and is evident in the statistics entered into the Alaska State Trooper case management systems. Drugs and alcohol continue to be a factor in intimate partner violence and sexual assault in Alaska. According to the 2015 Alaska Victimization Survey conducted by the University of Alaska-Anchorage (UAA), for every 100 adult women in Alaska, an estimated 40 have experienced intimate partner violence,*

*33 have experience sexual violence, and 50 have experienced intimate partner violence, sexual violence, or both. The survey revealed 22.6% experienced at least one alcohol or drug involved sexual assault in their lifetime. 2.0% experienced at least one alcohol or drug involved sexual assault in the past year.*

*Additionally, according the UAA Justice Center's "Descriptive Analysis of Domestic Violence and Sexual Assault Incidents Closed by the Alaska State Troopers: 2008–2011" alcohol use by domestic violence suspects or victims was documented in 67.78% of domestic violence cases reported to the Alaska State Troopers from 2008 through 2011. Alcohol use by sexual assault suspects or victims was documented in 39.3% of sexual assault incidents reported to the Troopers during the same timeframe.*

*According to a July 2015 bulletin released by the Division of Public Health, State of Alaska Epidemiology, the rate of inpatient hospital discharges coded for heroin poisoning nearly doubled from 2.4 per 10,000 in 2008 to 4.7 per 10,000 population in 2012. Heroin-related inpatient and outpatient hospital costs exceeded $2 million. Heroin-associated deaths more than tripled from 2008 to 2013. During that timeframe, 72 people died with heroin use as the primary or a contributing cause of death. The number of Medicaid health care services payment requests for heroin poisoning increased almost ten-fold from 2004 to 2013. During the years 2009–2013, heroin-related admissions to publicly- funded substance use treatment centers nearly doubled, and the majority of patients admitted for heroin use treatment were aged 21–29 years. The number of treatment admissions for all patients reporting heroin as their primary substance of choice increased by 58% and the number of treatment admissions for patients aged 21–29 reporting heroin as their primary substance of choice increased by 74% (AST 2015).*

Substance abuse for adolescents is defined as having used alcohol, marijuana, or cocaine in the past 30 days. The Alaska Youth Risk Behavior Survey (YRBS) is part of an epidemiological surveillance system established by the CDC in 1990 to monitor the prevalence of health-risk behaviors among youth. The YRBS is a biennial, anonymous, and voluntary survey of students in grades 9–12 in public traditional high schools (excluding boarding, correspondence, home study, alternative, and correctional schools). The purpose of the YRBS is to help monitor the prevalence of behaviors that put Alaskan youth at risk for the most significant health and social problems that can occur during adolescence and adulthood. This anonymous survey examines a minimum of six categories of adolescent behavior:

1. Behaviors that result in unintentional and intentional injuries;
2. Tobacco use;
3. Alcohol and other drug use;
4. Sexual behaviors that can result in HIV infection, other STIs and unintended pregnancies;
5. Dietary behaviors; and
6. Physical activity.

Surveys have also been aggregated into six public health regions; however; because this collection of surveys is not conducted with the same scientific rigor as those producing the statewide estimates, the resulting rates are considered indicators of the existence of specific behaviors but not necessarily the precise prevalence estimates, limiting the utility of comparisons (Youth Behavioral Risk Factor Surveillance System, 2015). Consequently, results of these surveys will be discussed at the state level.

Alaska's pattern of substance use disorder generally follows national trends, with the following exceptions (Substance Abuse and Mental Health Services, 2015):

- Approximately 4 in 10 (42.4%) adolescents (aged 12-17) in Alaska in 2013-2014 perceived no great risk from smoking one or more packs of cigarettes a day, exceeding the national percentage (34.7%).
- Approximately 8 in 10 (82.9%) adolescents (aged 12-17) in Alaska in 2013-2014 perceived no great risk from smoking marijuana once a month, exceeding the national percentage (76.5%).

#### 3.1.1.5.4. Drug-Induced Deaths

Drug-induced mortality is a composite that includes deaths due to dependent and non-dependent use of drugs (legal and illegal use), and due to poisoning from medically prescribed, or other drugs. It excludes injury, homicides, other causes indirectly related to drug use, and newborn deaths due to the mother's drug use.

In 2015, drug-induced deaths claimed the lives of 126 Alaskans. Since 2006, the crude death rate for drug-induced deaths has increased 39%. During this same time period, the age-adjusted rate has increased 36.6%.

There were 4,301 years of potential life lost due to drug-induced deaths, with 34.1 years lost prematurely for each death, on average (ADHSS, 2015b).

#### 3.1.1.5.5. Alcohol-Induced Deaths

Alcohol-induced mortality is a composite that includes deaths due to alcohol psychoses, alcohol dependence syndrome, non-dependent abuse of alcohol, alcohol-induced chronic liver disease and cirrhosis, and alcohol poisoning. It does not include deaths due to traumatic injury such as motor vehicle accidents.

In 2015, alcohol-induced deaths claimed the lives of 160 Alaskans. Since 2006, the crude death rate for alcohol-induced deaths has increased 3.8%. During this same time period, the age-adjusted rate has decreased by 3.3%.

There were 3,740 years of potential life lost due to alcohol-induced deaths, with 23.4 years lost prematurely for each death, on average (ADHSS, 2015b).

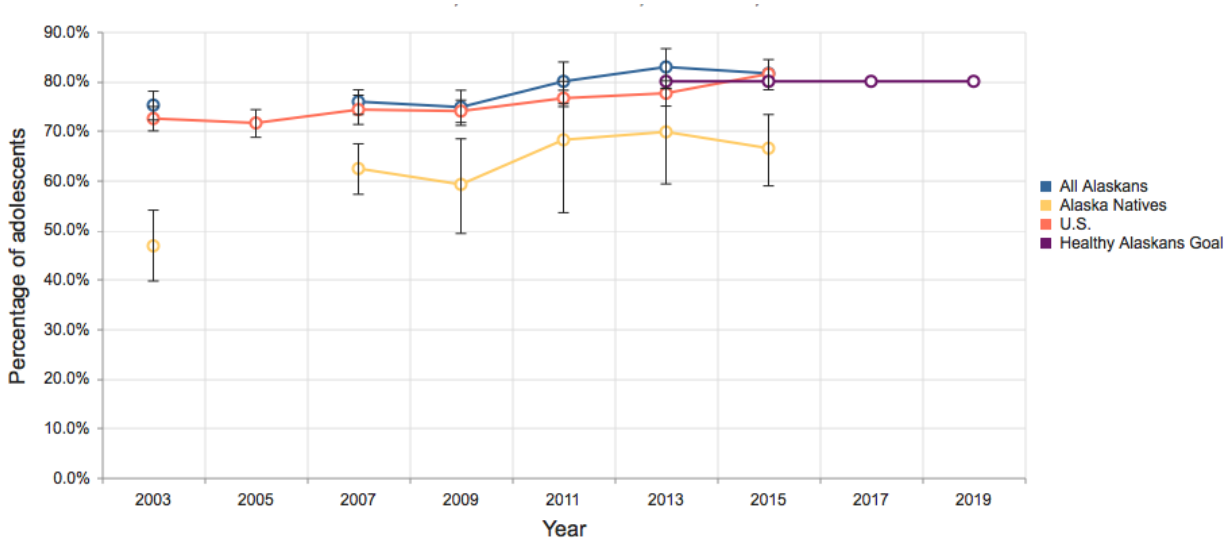
The number of alcohol-related fatal crashes in 2016 increased by 4% from 2015 (Alaska Department of Transportation and Public Facilities [ADOT&PF], 2017), (see Section 5.1.3.4, Traffic Accidents and Injuries, or Resource Report No. 5).

### 3.1.1.5.6. Tobacco Use

Tobacco use is the leading cause of preventable disease and death in the U.S. (CDC, 2007). According to the Office of the Surgeon General, there is no safe level of exposure to tobacco smoke. Smoking has been directly linked to one-third of all cancer deaths each year and is the cause of 85% of all lung cancers in the U.S. In addition, smoking increases the risk of adverse pregnancy outcomes, such as miscarriage and low birth weight, and can lead to DNA damage in sperm that might reduce fertility (USDHHS, 2010). Furthermore, there is no risk-free level of exposure to secondhand smoke; even brief exposure can be damaging to health.

In 2015, the percentage of adolescents who reported not smoking or using tobacco products within the past 30 days was lower among adolescent Alaska Natives in grades 9-12 (66.5%) as compared to all Alaskan adolescents statewide (81.6%) and adolescents nationally (81.5%) (Figure 9).

**Figure 9. Percent of Adolescents (grades 9-12) Who Have Not Smoked Cigarettes, Cigars, or Used, Chewing Tobacco, Snuff, or Dip on One or More of the Past 30 Days, All Alaskans, Alaska Natives, and U.S. (2003-2019)**




Source: AK-IBIS, 2016

The Alaska BRFSS program collects data regarding use of tobacco products and environmental exposure to tobacco smoke among Alaska adults. Table 12 shows the age-adjusted prevalence of residents who reported to be current smokers or users of smokeless tobacco products, and the age-adjusted prevalence of residents who had said that they themselves or someone else had, smoked inside of the home within the past 30 days. The NSB had both the highest prevalence of smoking and use of smokeless tobacco products and smoking inside of the home, among all Alaskans residing in potentially affected regions (48.3% and 19.3%, respectively). The NSB also had the highest rates among Alaska Native residents; however, the prevalence of smoking in the home was slightly higher among Alaska Native residents living in the MSB (23.4% as compared to 24.2%). The Municipality of Anchorage had the lowest prevalence of smokers and users of smokeless tobacco products, while the Yukon-Koyukuk Census Area had the lowest prevalence of people reporting exposure to tobacco smoke within the home within the past 30 days.

**Table 12. Tobacco Use and Environmental Exposure to Tobacco Smoke, Potentially Affected Area, all Alaskans and Alaska Natives (2011-2013)**

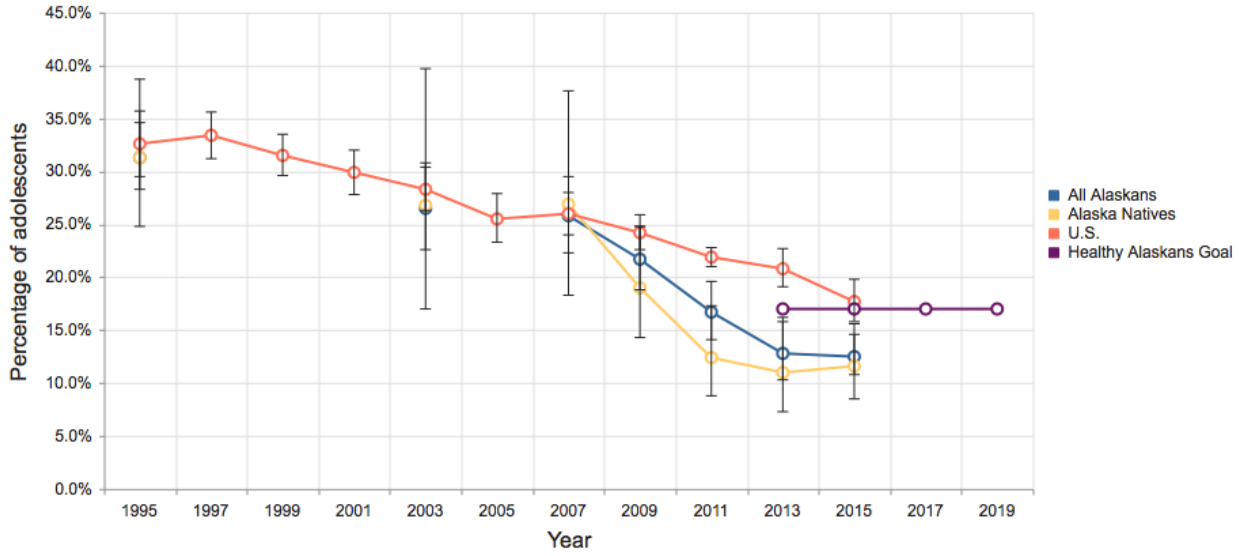
| Census Area | Percentage of Residents who are Current Smokers or Smokeless Tobacco Users | | Percentage of Residents Reporting Exposure to Smoking Inside the Home-Past 30 days | |
|---|---|---|---|---|
| | Age-adjusted Prevalence / All Alaskans | Age-adjusted Prevalence / Alaska Natives | Age-adjusted Prevalence / All Alaskans | Age-adjusted Prevalence / Alaska Natives |
| North Slope Borough | 48.3% | 56.6% | 19.3% | 23.4% |
| Yukon-Koyukuk Census Area | 46.4% | 54.1% | 6.5% | 5.2% |
| Fairbanks North Star Borough | 24.4% | 38.0% | 10.8% | 13.2% |
| Denali Borough | 33.8% | ** | 16.0% | ** |
| Matanuska-Susitna Borough | 26.0% | 42.9% | 12.1% | 24.2% |
| Kenai Peninsula Borough | 25.8% | 53.7% | 11.7% | 19.9% |
| Municipality of Anchorage | 21.5% | 33.4% | 8.6% | 12.6% |
| Southeast Fairbanks Census Area | 24.0% | ** | 12.6% | ** |
| Hoonah-Angoon Census Area | 32.1% | ** | 7.5% | ** |
| Valdez-Cordova Census Area | 24.4% | 31.1% | 14.6% | ** |
| Source: BRFSS, 2016 | | | | |

### 3.1.1.5.7. Alcohol Use

Alaska experiences a disparately high rate of alcohol-induced mortality compared to the U.S. Alcohol and other drug use is common among adolescents and is a strong predictor of dependence in later life. In 2013, the rate of alcohol induced mortality among all Alaskans statewide was 16.4 per 100,000 population as compared to 52.8 per 100,000 populations among Alaska Natives statewide and 8.2 per 100,000 population, nationally (AK-IBIS, 2016).

Binge drinking is defined as having five or more drinks on one or more occasion in the past 30 days for men, and more than four drinks for women. Figure 10 shows a decrease in the rate of binge drinking among adolescents since 1995. In 2015, the rate of binge drinking among all Alaskans (12.5%) was higher than that among Alaska Natives statewide (11.6%).

**Figure 10. Percentage of Adolescents (Students in Grades 9-12) Who Reported Binge Drinking in the Past 30 Days, all Alaskans, Alaska Natives, and the U.S. (1995-2019)**




Source: AK-IBIS, 2016

The BRFSS is a source for estimating binge-drinking prevalence for Alaskan adults. The BRFSS is a telephone survey of adults ages 18 and older. Information on background and methodology of the BRFSS managed by the CDC can be found at: http://www.cdc.gov/brfss/. The website for the Alaska BRFSS is: http://dhss.alaska.gov/dph/Chronic/Pages/brfss/default.aspx.

Adult Native Hawaiian/Other Pacific Islanders had the highest rate of self-reported binge drinking within the past 30 days between 2012 and 2014 (Table 13), while Asians reported the lowest percentage of binge drinking, at less than half of most other races. Among potentially affected boroughs/census areas, adult residents of the NSB reported the lowest level of binge drinking within the past 30 days among both all residents and among Alaska Natives. The FNSB had the second lowest reported percentage, also among all residents as well as Alaska Natives. The highest percentage of adults that self-reported binge drinking within the past 30 days were Alaska Native adults residing in the Southeast Fairbanks Census Area at 50.5%. This percentage represents more than twice that reported by adults living in other potentially affected boroughs/census areas (Table 14).

**Table 13. Percentage of Adults Who Reported Binge Drinking in the Past 30 Days by Race/Ethnicity, All Alaskans, 2014-2016 (3-Year Average)**

| Race/Ethnicity | Percentage of Adults | Lower Limit | Upper Limit | Numerator | Denominator |
|---|---|---|---|---|---|
| Alaska Native (any mention) | 11.40% | 6.80% | 18.30% | 25 | 191 |
| Asian (non-Hispanic) | 18.50% | 11.00% | 29.40% | 18 | 149 |
| Black (non-Hispanic) | 17.20% | 7.80% | 33.70% | 9 | 51 |
| Native Hawaiian/Other Pacific Islander (non-Hispanic) | 19.10% | 17.70% | 20.50% | 1,246 | 8,270 |
| White (non-Hispanic) | 26.60% | 13.60% | 45.50% | 14 | 89 |
| Multiracial/Other (non-Hisp.) | 22.20% | 16.00% | 29.90% | 57 | 287 |
| Hispanic (alone or multi) | 21.90% | 16.90% | 27.90% | 85 | 400 |
| Healthy Alaskans Goal | 20.00% | | | | |
| Source: AKIBIS | | | | | |

**Table 14. Percentage of Adults (18+) Who Reported Binge Drinking in the Past 30 days, Potentially Affected Area, All Alaskans and Alaska Natives, 2014-2016 (3-Year Average)**

| Race/Ethnicity | Borough/Census Area | Percentage of Adults | Lower Limit | Upper Limit | Numerator | Denominator |
|---|---|---|---|---|---|---|
| All Alaskans | Anchorage Municipality | 19.00% | 16.80% | 21.50% | 347 | 2,269 |
| All Alaskans | Fairbanks North Star Borough | 17.70% | 15.20% | 20.50% | 273 | 1,811 |
| All Alaskans | Kenai Peninsula Borough | 21.60% | 18.30% | 25.40% | 192 | 1,213 |
| All Alaskans | Matanuska-Susitna Borough | 16.60% | 14.30% | 19.20% | 255 | 1,808 |
| All Alaskans | North Slope Borough | 15.50% | 8.30% | 27.00% | 14 | 107 |
| All Alaskans | Skagway Municipality | ** | | | | 22 |
| All Alaskans | Southeast Fairbanks | 16.20% | 9.40% | 26.40% | 25 | 250 |
| All Alaskans | Valdez-Cordova | 20.80% | 14.00% | 29.90% | 42 | 247 |
| All Alaskans | Yukon-Koyukuk | 30.60% | 19.10% | 45.10% | 40 | 185 |
| Alaska Native people | Anchorage Municipality | 21.10% | 15.00% | 28.90% | 38 | 213 |
| Alaska Native people | Fairbanks North Star Borough | 17.00% | 10.80% | 25.70% | 30 | 168 |
| Alaska Native people | Kenai Peninsula Borough | 20.60% | 12.70% | 31.60% | 17 | 109 |
| Alaska Native people | Matanuska-Susitna Borough | 20.40% | 13.70% | 29.40% | 30 | 172 |
| Alaska Native people | North Slope Borough | 17.30% | 8.10% | 33.30% | 9 | 61 |
| Alaska Native people | Skagway Municipality | ** | | | | 1 |
| Alaska Native people | Southeast Fairbanks | ** | | | | 28 |
| Alaska Native people | Valdez-Cordova | ** | | | | 31 |
| Alaska Native people | Yukon-Koyukuk | 37.60% | 22.20% | 56.00% | 30 | 104 |
| Source: AK-IBIS, 2018<br>** Data statistically unreliable | | | | | | |

#### 3.1.1.5.8. Other Drug Use

Drug-induced deaths include all deaths for which drugs are the underlying cause, including those attributable to acute poisoning by drugs (drug overdoses) and deaths from medical conditions resulting from chronic drug use (e.g., drug-induced Cushing's syndrome). A drug includes illicit or street drugs (e.g., heroin and cocaine), as well as legal prescription and over-the-counter drugs; alcohol is not included (CDC, 2005). In 2013, the drug-induced mortality rate among Alaskans statewide was 14.2 per 100,000 population, lower than the national rate of 16.4 per 100,000 population (AK-IBIS, 2016).

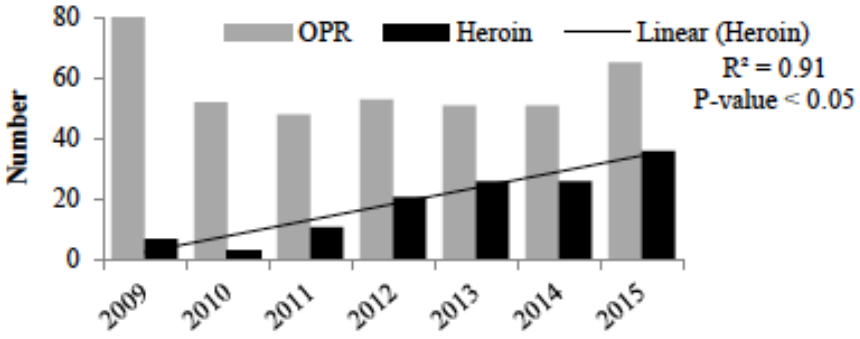
Marijuana is the most commonly used illicit drug in the U.S. (NIH, 2016). Marijuana use alters perceptions and mood, disrupts learning and memory, and causes thinking and problem-solving difficulties. In 2015, 19.0% of all Alaskan in grades 9-12 had reported using marijuana within the past 30 days, as compared to 26.1% of Alaska Natives statewide and 21.7% of all adolescents in grades 9-12 nationally (AK-IBIS, 2016). In Alaska, marijuana was the primary drug of abuse among about one-third of adolescents (ages 12-17) entering treatment in 2013 and 2014 (AK-IBIS, 2016).

Prescription drugs are the third most commonly abused category of drugs, behind alcohol and marijuana. Some prescription drugs can become addictive, especially when used in a manner inconsistent with their labeling by someone other than the patient for whom they were prescribed, or when taken in a manner or dosage other than prescribed (National Council on Alcoholism and Drug Dependence, 2015). In 2015, 6.4% of all Alaskan adolescents in grades 9-12 reported taking a prescription drug without a prescription in the past 30 days (AK-IBIS, 2016). This was a higher percentage than the percentage of Alaska Native adolescents statewide (4.1%).

##### 3.1.1.5.8.1. Heroin and Opioid Pain Reliever Use

In 2012, Alaska's prescription opioid pain reliever (OPR) overdose rate was more than twice the U.S. rate (10.5 versus 5.1 per 100,000 population, respectively). Alaska's heroin-associated overdose death rate exceeded that of the U.S. by more than 50% (3.0 versus 1.9 per 100,000 population, respectively). Between 2009 and 2015, there were 774 drug overdose deaths reported in the Alaska mortality database (ADHSS, 2016). Prescription drugs were noted as a primary or contributing cause in 66% of these deaths. While the rate of OPR-associated deaths have remained relatively stable since 2010, the number of heroin-associated overdose deaths increased more than 10-fold from <5 deaths in 2010 to 34 deaths in 2015 (Figure 11).

**Figure 11. Overdose Deaths Associated with OPR or Heroin - Alaska, 2009–2015**




Source: ADHSS, Section of Epidemiology (SOE), 2016

According to studies conducted by the ADHSS, there were a total of 51 hospital admissions and 201 outpatient evaluations linked to heroin poisoning between 2008 and 2012 (ADHSS SOE, 2015). The rate of inpatient hospital discharges coded for heroin poisoning nearly doubled from 2.4 per 10,000 population in 2008 to 4.7 per 10,000 population in 2012. Between 2008 and 2013, the number of heroin-associated deaths more than tripled; 72 persons died with heroin use as the primary or contributing cause of death. Between 2009 and 2013, heroin-related admissions to publicly-funded substance use treatment centers nearly doubled, and the majority of patients admitted for heroin use treatment were aged 21–29 years. The number of treatment admissions for all patients reporting heroin as their primary substance of choice increased by 58%; and the number of treatment admissions for patients aged 21–29 reporting heroin as their primary substance of choice increased by 74% (ADHSS SOE, 2015).

#### 3.1.1.6. Economic Indicators

Economic status creates a powerful context for human health and improved income is generally thought to be associated with improved community health. While there are many indicators used to assess economic status, the HIA reports median household income, employment, and the percentage of households living below poverty levels. Indicators that are important in the HIA evaluation are described below. See Section 5.3.2 of Resource Report No. 5 for economic data including employment and income, and labor force characteristics of the PACs.

##### 3.1.1.6.1. Median Household Income

Median household income is one important measure of economic well-being and a key determinant of human health. Median means that half of the households have higher income and half of the households have lower income. In Alaska, income includes all monetary sources of income including wages, the Permanent Fund Dividend, Corporation Dividends, and Public Assistance. Income does not include subsistence resources.

Section 5.1.3.2.3, Income and Unemployment Rate, of Resource Report No. 5, describes income and unemployment in detail. As shown in Table 5.3.2-4 (Income and Labor Force Characteristics in the Socioeconomic Study Area, per capita income was highest in NSB at $46,457 and lowest in the Yukon-

Koyukuk Census Area between 2009 and 2013. Rural communities often lack significant job opportunities and endure a high cost of living, while more populous and urbanized areas tend to offer more job opportunities and higher wages. The high per capita income in the NSB is influenced by the high paying jobs in the oil and gas industry.

The per capita income in KPB was $31, 625 between 2009 and 2013, slightly below the statewide per capita income of $32,651. Of Kenai communities, Moose Pass had the highest per capita income at $36,927. The per capita income in Nikiski was $32,337 with an unemployment rate of 6.0%, similar to the statewide unemployment rate (6.5%). Dot Lake ANVSA had the highest unemployment rate of 57%.

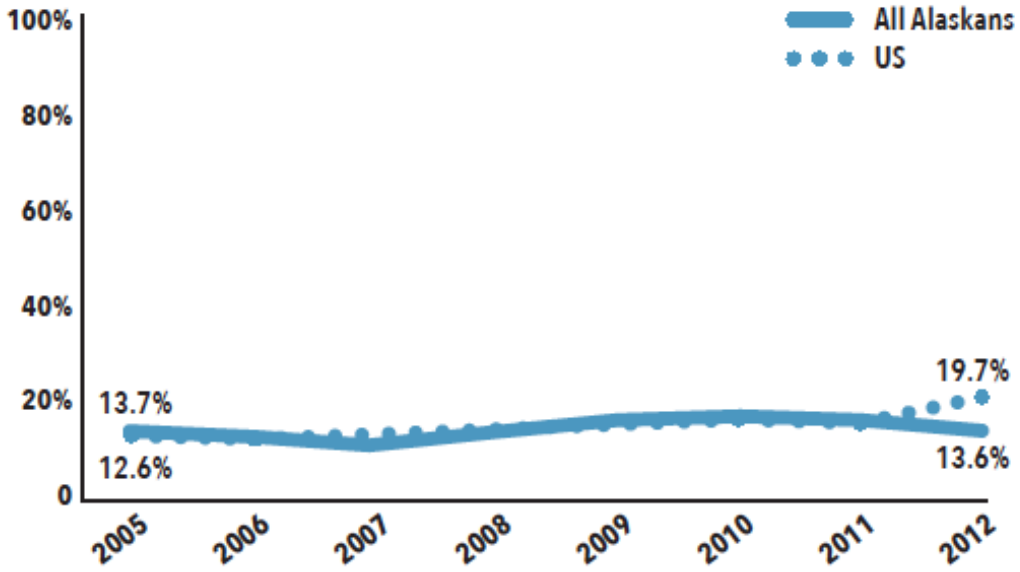
#### 3.1.1.6.2. Employment

Employment is another key demographic factor that influences health. According to U.S. Department of Labor, unemployment includes anyone who has made an active attempt to find work in the 4-week period up to and including the week that includes the 12th of the referenced month. Due to the scarcity of employment opportunities in rural Alaska, many individuals do not meet the official definition of unemployed because they are not conducting active job searches.

#### 3.1.1.6.3. Percentage of Households Living Below Poverty Line

Poverty, which takes into account household income level as well as household size is a powerful determinant of human health. The U.S. Census Bureau defines poverty in a complex way that does not take into account the higher cost of living in Alaska. The ADHSS adjusts poverty guidelines for entitlement programs, such as women, infants and children, and temporary assistance for needy families for local factors. Due to the higher cost of living in Alaska compared to the U.S. overall, poverty status for Alaska is defined as 125% of the federal poverty threshold. The Alaska rate shows more variability than the U.S. rate over the past 8 years; however, in 2012, the percentages of Alaskans and U.S. residents who met this definition of being in poverty were similar (Figure 12).

**Figure 12. Percentage of Persons Living Below the Federal Poverty Level, All Alaskans and the U.S. (2005-2012)**




Source: HA2020, 2014

Table 5.3.2-16 (Average Poverty Rate in the Socioeconomic Study Area) of Resource Report No. 5, shows the poverty rate in the PACs and the state as a whole according to data from the U.S. Census Bureau. In general, the poverty rate is higher in Alaska's rural areas than in urbanized areas. Among the PACs, the poverty rates for the Yukon-Koyukuk Census Area, NSB, and Southeast Fairbanks Census Area in 2013 were higher than that of the state as a whole. The state's most populous areas, including the Municipality of Anchorage, FNSB, MSB, and KPB, tend to have less poverty (Shanks, 2012). In general, boroughs and census areas with high unemployment rates and/or with larger Alaska Native populations have high poverty rates.

#### 3.1.1.6.4. Educational Attainment

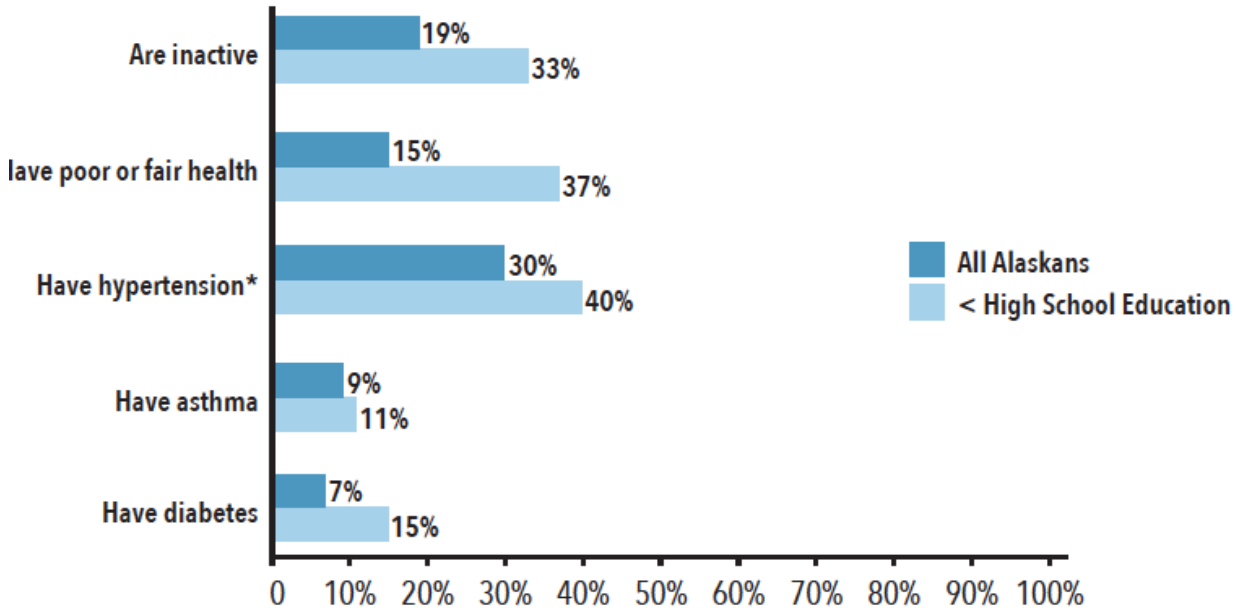
Table 5.3.4-1 (Characteristics of School Districts in the Area of Interest, FY2015) of Resource Report No. 5, identifies the number of schools in communities within the PACs, as well as the grade levels and student enrollment at those schools in terms of average daily membership (ADM). ADM is the average number of students enrolled to attend a specific school district on any given school day. As noted in Resource Report No. 5, the aggregate school facility capacity was not exceeded in any school district; however, enrollment may be above capacity at some schools within a district.

The level of educational attainment in a household can influence health. Internationally, the highest level of household educational attainment positively correlates with improved overall family health status. In addition, household head educational attainment levels also predict challenges or opportunities that will occur in regards to local hiring programs. Selected risk factor prevalence is higher for people with less than a high school education compared to the total Alaska population (HA2020, 2014). Alaskans who have

not completed high school report higher rates of inactivity, poor or fair self-rated health status, and have higher prevalence of hypertension, asthma, and diabetes (Figure 13).

The percentage of residents over the age of 25 who have achieved high school graduation or higher and received a bachelor's degree or higher are presented in Table 15, in addition to high school dropout rates for potentially affected school districts for the 2016-2017 calendar school year. Skagway Municipality had the highest percentage of residents with a high school diploma or higher and a bachelor's degree or higher and Skagway district had the lowest high school dropout rate at 0.00%. Among census areas and boroughs, FNSB had the highest level of educational attainment for both indicators. Nenana City had the highest high school dropout rate at 24.93% and the lowest percent of residents with a high school education or higher and the lowest percentage of residents who had obtained a bachelor's degree or higher (Table 15).

**Figure 13. Prevalence of Selected Risk Factors, by Education Level (2012)***




*Except 2011, where noted
Source: HA2020, 2014

**Table 15. Education Indicators among Potentially Affected Communities (2012-2016)**

| Borough/School District | Educational Attainment of Population 25 Years and Over | | |
|---|---|---|---|
| | High School Graduate or Higher (%) | Bachelor's Degree or Higher (%) | High School Drop-out Rate 2016-2017 (%) |
| North Slope Borough | 37.8% | 9.7% | - |
| North Slope Borough School District | - | - | 9.55% |
| Yukon-Koyukuk Census Area | 39.9% | 7.7% | - |
| Yukon-Koyukuk School District | - | - | 6.01% |
| Fairbanks North Star Borough | 22.2% | 20.7% | - |

| Borough/School District | Educational Attainment of Population 25 Years and Over | | |
|---|---|---|---|
| | High School Graduate or Higher (%) | Bachelor's Degree or Higher (%) | High School Drop-out Rate 2016-2017 (%) |
| Fairbanks North Star Borough School District | - | - | 3.66% |
| Denali Borough | 23.4% | 29.9% | - |
| Denali Borough School District | - | - | 2.06% |
| Nenana City School District | - | - | 20.73% |
| Matanuska-Susitna Borough | 31.8% | 13.7% | - |
| Matanuska-Susitna Borough School District | - | - | 1.91% |
| Kenai Peninsula Borough | 32.2% | 14.7% | - |
| Kenai Peninsula Borough School District | - | - | 1.69% |
| Municipality of Anchorage | 24.0% | 21.7% | - |
| Anchorage School District | - | - | 3.31% |
| Southeast Fairbanks Census Area | 33.4% | 11.1% | - |
| Alaska Gateway School District | - | - | 5.06% |
| Delta-Greely School District | - | - | 1.42% |
| Skagway Municipality | 24.9% | 26.9% | - |
| Skagway School District | - | - | 2.44% |
| Valdez-Cordova Census Area | 27.3% | 21.6% | - |
| Chugach School District | - | - | 4.37% |
| Copper River School District | - | - | 3.47% |
| Cordova City School District | - | - | 2.04% |
| Valdez City School District | - | - | 1.09% |
| Source: U.S. Census Bureau, 2012-2016 American Community Survey 5-Year Estimates, State of Alaska Report Card, 2016-2017 School Year | | | |

#### 3.1.1.6.5. Family Structure

Family stability is generally considered to exist in families whose parents are healthy and earning incomes; whose members experience housing changes only infrequently; and whose family members stay together with infrequent divorce and remarriage, or few separations due to immigration and job-seeking reasons. The benefits of family stability on children are numerous. Family stability results in more effective child supervision and parental monitoring; less family conflict, and more family cohesion. Good parental monitoring, in particular, results in better child physical and mental health (Proescholdbell, 2010).

The ABVS maintains a database on divorce for the state, boroughs, and census areas. The FNSB had the highest divorce rate among both males and females, followed by the Municipality of Anchorage and MSB (Table 16). These rates were higher than the divorce rate for Alaska statewide. Yukon-Koyukuk Census Area had the lowest rate for both genders, followed by the NSB. In general, the more rural areas appear to have lower rates of divorce, as compared to urban areas.

**Table 16. Divorce Rate by Potentially Affected Communities (2013)**

| Census Area | Female Rate per 1,000 Population | Male Rate per 1,000 Population |
|---|---|---|
| North Slope Borough | 2.4 | 1.5 |
| Yukon-Koyukuk Census Area | 1.5 | 1.6 |
| Fairbanks North Star Borough | 9.4 | 8.7 |
| Denali Borough | 6.2 | 4.1 |
| Matanuska-Susitna Borough | 8.8 | 8.1 |
| Kenai Peninsula Borough | 7.9 | 7.6 |
| Municipality of Anchorage | 8.8 | 8.3 |
| Southeast Fairbanks Census Area | 4.1 | 3.6 |
| Skagway-Hoonah-Angoon Census Area | 4.0 | 3.6 |
| Valdez-Cordova Census Area | 4.7 | 5.8 |
| Alaska Statewide | 7.9 | 7.3 |
| Source: ABVS, 2016 | | |

**Table 17. Household Characteristics by Potentially Affected Community and Statewide, 2016 ACS**

| Location | Number of Households | Average Household Size | Percent of Family Households | Female Headed Households (Percent of Family Households) | Married-Couple Family Household with own Children Present <18 |
|---|---|---|---|---|---|
| North Slope Borough | 2,018 | 3.25 | 75.1% | 29.6% | 31.3% |
| Prudhoe Bay | 0 | 0.00 | - | - | - |
| Yukon-Koyukuk Census Area | 1,981 | 2.75 | 64.0% | 26.8% | 21.1% |
| Bettles | 5 | 1.6 | 20.0% | 0.0% | 0.0% |
| Coldfoot | 0 | 0 | - | - | - |
| Evansville | 8 | 1.38 | 25% | 0.0% | 0% |
| Livengood | 0 | 0 | - | - | - |
| Manley Hot Springs | 38 | 2.16 | 71.0 | 0.00% | 0.0% |
| Minto | 69 | 3.09 | 59.4% | 31.7% | 29.3% |
| Nenana | 144 | 2.59 | 61.8% | 20.2% | 9.0% |
| Wiseman | 4 | 3.0 | 100% | 0% | 100% |
| Fairbanks North Star Borough | 35,303 | 2.72 | 63.1% | 12.9% | 35.6% |
| Fairbanks City | 10,965 | 2.75 | 62% | 20% | 35.4% |
| Denali Borough | 707 | 2.29 | 55.2% | 7.4% | 39.7% |
| Anderson | 64 | 2.05 | 69% | 2% | 25.0% |
| Cantwell | 95 | 2.15 | 53% | 12% | 28.0% |
| Healy | 428 | 2.61 | 64% | 8% | 47.4% |
| Denali Park | 105 | 1.4 | 17% | 0% | 0.0% |
| Matanuska-Susitna Borough | 30,839 | 3.14 | 71.0% | 11.5% | 36.0% |
| Big Lake | 1,252 | 2.84 | 69% | 14% | 26.0% |
| Houston | 690 | 2.93 | 66% | 12% | 30.9% |
| Knik-Fairview | 5,051 | 3.37 | 73% | 11% | 37.4% |
| Palmer | 2,063 | 3.01 | 63.8% | 22.3% | 36.9% |

| Location | Number of Households | Average Household Size | Percent of Family Households | Female Headed Households (Percent of Family Households) | Married-Couple Family Household with own Children Present <18 |
|---|---|---|---|---|---|
| Point MacKenzie | 94 | 1.99 | 45.7% | 0.0% | 23.3% |
| Skwentna | 25 | 2.04 | 68.0% | 0.0% | 29.4% |
| Talkeetna | 344 | 2.42 | 52.3% | 5.0% | 29.4% |
| Trapper Creek | 180 | 1.94 | 42.8% | 24.7% | 13.0% |
| Wasilla | 2,970 | 2.99 | 65.5% | 22.1% | 31.8% |
| Willow | 715 | 2.9 | 64.1% | 5.2% | 26.9% |
| Kenai Peninsula Borough | 21,481 | 2.6 | 63.8% | 12.6% | 29.1% |
| Anchor Point | 821 | 2.46 | 58% | 6% | 27.7% |
| Beluga | 5 | - | 0% | - | - |
| Clam Gulch | 89 | 2.22 | 48% | 0% | 34.9% |
| Cohoe | 568 | 2.3 | 63% | 13% | 21.5% |
| Cooper Landing | 182 | 2.68 | 83% | 3% | 37.1% |
| Happy Valley | 269 | 2.36 | 65% | 16% | 24.7% |
| Homer | 2,149 | 2.46 | 61% | 17% | 26.4% |
| Kalifornsky | 2,895 | 2.75 | 71% | 7% | 37.1% |
| Kasilof | 133 | 3.06 | 63% | 6% | 27.4% |
| Kenai | 3,085 | 2.43 | 56% | 20% | 29.8% |
| Moose Pass | 138 | 2.57 | 89.1% | 27.6% | 10.6% |
| Nikiski | 1,770 | 2.83 | 63.6% | 6.7% | 32.4% |
| Ninilchik | 359 | 2.13 | 55.2% | 11.6% | 13.1% |
| Salamatof | 241 | 2.73 | 69.7% | 14.9% | 19.0% |
| Seward | 838 | 2.49 | 55.8% | 15.6% | 27.8% |
| Soldotna | 1,696 | 2.59 | 64.4% | 26.3% | 23.7% |
| Sterling | 2,051 | 2.75 | 69.2% | 6.8% | 28.3% |
| Tyonek | 79 | 3.71 | 72.2% | 49.1% | 12.3% |
| Municipality of Anchorage | 104,969 | 2.77 | 66.6% | 18.2% | 32.9% |
| Southeast Fairbanks Census Area | 2,085 | 3.15 | 68.7% | 12.8% | 32.2% |
| Big Delta | 176 | 3.28 | 66% | 0% | 35.0% |
| Delta Junction | 290 | 3.62 | 67% | 8% | 48.2% |
| Dot Lake Village | 0 | - | - | - | - |
| Dry Creek | 33 | 2.76 | 45% | 0% | 33.3% |
| Tanacross | 57 | 2.88 | 38.6% | 18.2% | 13.6% |
| Tok | 482 | 2.56 | 69.9% | 20.8% | 23.7% |
| Tetlin | 29 | 4 | 48.3% | 21.4% | 7.1% |
| Northway Junction | 18 | 3.11 | 61.1% | 18.2% | 18.2% |
| Northway Village | 28 | 3.5 | 53.6% | 20.0% | 6.7% |
| Alcan Border | 7 | 5 | 100% | 0% | 100.0% |
| Municipality of Skagway Borough | 428 | 2.07 | 46.3% | 12.1% | 24.7% |
| Valdez-Cordova Census Area | 2,937 | 3.14 | 67.2% | 12.6% | 26.2% |
| Chistochina | 16 | 4.31 | 69% | 64% | 0.0% |

| Location | Number of Households | Average Household Size | Percent of Family Households | Female Headed Households (Percent of Family Households) | Married-Couple Family Household with own Children Present <18 |
|---|---|---|---|---|---|
| Copper Center | 91 | 3.54 | 49% | 29% | 35.6% |
| Gakona | 45 | 3.69 | 78% | 26% | 25.7% |
| Glennallen | 77 | 2.27 | 83% | 0% | 18.8% |
| Gulkana | 25 | 2.96 | 64% | 38% | 31.3% |
| Mentasta Lake | 45 | 4.02 | 66.7% | 46.7% | 16.7% |
| Paxson | 9 | - | 0.0% | - | - |
| Slana | 0 | - | - | - | - |
| Tazlina | 93 | 3.46 | 66.7% | 37.1% | 8.1% |
| Tonsina | 14 | - | 0.0% | - | - |
| Valdez | 1,154 | 3.24 | 64.4% | 17.8% | 23.8% |
| Whittier | 119 | 2.67 | 42.9% | 2.0% | 33.3% |
| Other | | | | | |
| Adak | 36 | 3.39 | 58% | 33% | 9.5% |
| Nome Census Area | 2,879 | 3.3 | 76.0% | 26.1% | 29.5% |
| Unalaska | 938 | 3.59 | 58.5% | 10.7% | 45.0% |
| Alaska Statewide | 250,235 | 2.86 | 65.9% | 18.5% | 29.7% |
| Source: U.S. Census Bureau, 2012-2016 American Community Survey 5-Year Estimates | | | | | |

#### 3.1.1.6.6. Dependency Factors

Dependency ratio, a measure of the portion of a population that is composed of dependents (people who are too young or too old to work and need support or care) to those of working, age is a measure of the need for social services. This ratio, in part, determines the amount of services needed in a community and the economic workforce available to fund them. It is also a factor in economic growth and stability. The dependency ratio is equal to the number of individuals aged below 15 or above 64 divided by the number of individuals aged 15 to 64, expressed as a percentage. An increase in this ratio can indicate an increased burden on the productive part of the population in terms of maintaining the upbringing and pensions of the economically dependent proportion of the population.

Population age structure is discussed in detail in Resource Report No. 5, Section 5.3.1.2. Both the KPB and Yukon-Koyukuk Census Area have larger proportions of people aged 65 or older compared to the state as a whole (Table 18). The KPB maintains a high retiree population (Shanks and Rasmussen 2010), while the out-migration of working-age adults likely accounts for the high percentage of seniors in the Yukon-Koyukuk Census Area (Shanks, 2013).

Denali Park, Point MacKenzie, Chistochina, and Bettles had the lowest dependency ratio (excluding Prudhoe/Deadhorse) at 9.1%, while the highest occurred in Manley Hot Springs (121.6%), Alcan Border (125.0%), and Beluga (150.0%); these are more than twice, and in the case of Beluga, more than three times, the statewide dependency ratio of 45.1%.

**Table 18. Age Characteristics of Potentially Affected Communities and Alaska Statewide (2012-2016)**

| Location | Median Age | Percent Ages 15-64 | Percent Under 16 and Over 65 | Dependency Ratio |
|---|---|---|---|---|
| Alaska | 33.6 | 69.3 | 30.7 | 53.5 |
| North Slope Borough | 33.8 | 73.7 | 26.3 | 43.4 |
| Prudhoe Bay/Deadhorse | 49 | 95.9 | 4.1 | 4.2 |
| Yukon-Koyukuk Census Area | 35.2 | 63.3 | 36.7 | 70.6 |
| Bettles | 37.9 | 86.2 | 13.8 | 16.1 |
| Coldfoot | 35.5 | 100 | 0 | - |
| Evansville | 58.3 | 54.6 | 45.4 | 83.3 |
| Evansville ANVSA | 51.4 | 78.7 | 21.3 | 27.0 |
| Livengood | - | - | - | - |
| Manley Hot Springs | 57.5 | 45.1 | 54.9 | 121.6 |
| Minto | 27.2 | 65.3 | 34.7 | 63.8 |
| Nenana | 48.3 | 64.6 | 35.4 | 73.5 |
| Wiseman | 41.3 | 58.3 | 41.7 | 71.4 |
| Fairbanks North Star Borough | 30.7 | 71.2 | 28.8 | 47.8 |
| Fairbanks | 27.7 | 70.1 | 29.9 | 47.1 |
| Denali Borough | 37.3 | 77.6 | 22.4 | 33.7 |
| Anderson | 44.7 | 72 | 28 | 38.8 |
| Cantwell | 45.8 | 64.9 | 35.1 | 56.9 |
| Healy | 40.4 | 71.9 | 28.1 | 49.5 |
| Denali Park | 31.6 | 93.9 | 6.1 | 6.5 |
| Matanuska-Susitna Borough | 34.8 | 67.7 | 32.3 | 58.7 |
| Big Lake | 39.6 | 64.8 | 35.2 | 66.2 |
| Houston | 36.7 | 65.9 | 34.1 | 60.4 |
| Knik-Fairview | 33.5 | 68.1 | 31.9 | 56.1 |
| Palmer | 30.4 | 67.4 | 32.6 | 59.3 |
| Point MacKenzie | 41.8 | 92.7 | 7.3 | 11.5 |
| Skwentna | 54.6 | 48.9 | 51.1 | 104 |
| Talkeetna | 38.3 | 71.8 | 28.2 | 56.3 |
| Trapper Creek | 49.6 | 62.8 | 37.2 | 62.3 |
| Wasilla | 33.9 | 65 | 35 | 64.3 |
| Willow | 41.6 | 70.3 | 29.7 | 53.1 |
| Kenai Peninsula Borough | 40.5 | 66.9 | 33.1 | 59.0 |
| Anchor Point | 47.5 | 63.8 | 36.2 | 65.7 |
| Beluga | 68.2 | 40 | 60 | 150.0 |
| Clam Gulch | 50.9 | 59.1 | 40.9 | 94.1 |
| Cohoe | 49.9 | 69.8 | 30.2 | 50.1 |
| Cooper Landing | 37.2 | 53.7 | 46.3 | 93.3 |
| Happy Valley | 46.5 | 65.3 | 34.7 | 65.2 |
| Homer | 40.4 | 65.5 | 34.5 | 63.6 |
| Kalifornsky | 32.8 | 65.5 | 34.5 | 64.1 |

| Location | Median Age | Percent Ages 15-64 | Percent Under 16 and Over 65 | Dependency Ratio |
|---|---|---|---|---|
| Kasilof | 44.1 | 62 | 38 | 79.3 |
| Kenai | 37 | 66 | 34 | 61.4 |
| Moose Pass | 46.1 | 65.8 | 34.2 | 51.9 |
| Nikiski | 44.2 | 68.3 | 31.7 | 60.3 |
| Ninilchik | 57.7 | 60.8 | 39.2 | 70.2 |
| Ninilchik ANVSA | 43.7 | 66.2 | 33.8 | 60.8 |
| Salamatof | 40.7 | 79.1 | 20.9 | 31.1 |
| Seward | 38.7 | 75.9 | 24.1 | 36.2 |
| Soldotna | 36.4 | 67.4 | 32.6 | 55.6 |
| Sterling | 47 | 65.1 | 34.9 | 67.8 |
| Tyonek | 31.3 | 73.3 | 26.7 | 48.7 |
| Municipality of Anchorage | 32.8 | 70 | 30 | 51.4 |
| Eklutna ANVSA | 52.8 | 66.8 | 33.2 | 60.0 |
| Southeast Fairbanks Census Area | 36.4 | 65.9 | 34.1 | 62.1 |
| Big Delta | 28.7 | 66.7 | 33.3 | 57.2 |
| Delta Junction | 31.3 | 65.6 | 34.4 | 60.3 |
| Dot Lake | - | - | - | - |
| Dot Lake ANVSA | 43.3 | 81.5 | 18.5 | 44.4 |
| Dry Creek | 53.3 | 66 | 34 | 51.7 |
| Tanacross | 41.5 | 65.8 | 34.2 | 56.2 |
| Tok | 41.2 | 64.7 | 35.3 | 69.0 |
| Tetlin | 29.2 | 67.2 | 32.8 | 50.6 |
| Tetlin ANVSA | 29.2 | 67.2 | 32.8 | 50.6 |
| Northway Junction | 30.4 | 67.9 | 32.1 | 75 |
| Northway | 27.4 | 67.8 | 32.2 | 50.5 |
| Northway ANVSA | 29.3 | 63.3 | 36.7 | 64.7 |
| Alcan Border | 16.6 | 58.3 | 41.7 | 125 |
| Municipality of Skagway Borough | 44.1 | 79.5 | 20.5 | 29.5 |
| Valdez-Cordova Census Area | 37.6 | 68.9 | 31.1 | 52.2 |
| Chistochina | 46.6 | 86.8 | 13.2 | 15.0 |
| Copper Center | 33.9 | 73.3 | 26.7 | 42.6 |
| Copper Center ANVSA | 32.3 | 66.5 | 33.5 | 56.0 |
| Gakona | 23.7 | 51 | 49 | 102.4 |
| Gakona ANVSA | 25.1 | 58.2 | 41.8 | 80.0 |
| Glennallen | 24.5 | 72.4 | 27.6 | 41.2 |
| Gulkana | 36.5 | 59.5 | 40.5 | 68.2 |
| Gulkana ANVSA | 30.5 | 49.6 | 50.4 | 101.6 |
| Mentasta Lake | 32.5 | 66.8 | 33.2 | 49.6 |
| Mentasta Lake ANVSA | 32.5 | 66.8 | 33.2 | 49.6 |
| Paxson | - | 0 | 100 | - |
| Slana | - | - | - | - |

| Location | Median Age | Percent Ages 15-64 | Percent Under 16 and Over 65 | Dependency Ratio |
|---|---|---|---|---|
| Tazlina | 31.8 | 77.7 | 22.3 | 30.9 |
| Tazlina ANVSA | 30.5 | 76 | 24 | 35.2 |
| Tonsina | - | 0 | 100 | - |
| Valdez | 34.2 | 71.6 | 28.4 | 47.4 |
| Whittier | 40.5 | 63.6 | 36.4 | 70.1 |
| Adak | 29.9 | 59.8 | 40.2 | 71.8 |
| Nome | 30.8 | 68.1 | 31.9 | 61.0 |
| Nome ANVSA | 31.1 | 66.6 | 33.4 | 61.3 |
| Unalaska | 37.5 | 81.7 | 18.3 | 26.2 |

Source: U.S. Census Bureau, 2012-2016 American Community Survey 5-Year Estimates
An '-' entry in the estimate column indicates that either no sample observations or too few sample observations were available to compute an estimate, or a ratio of medians cannot be calculated because one or both of the median estimates falls in the lowest interval or upper interval of an open-ended distribution.

#### 3.1.1.6.7. Cultural Indicators

Cultural factors are also important determinants of health in that people who are involved with their communities and culture tend to be healthier than people who are not. Cultural continuity has been linked to numerous health outcomes including reduced rates of suicide (Chandler, 1998; Chandler, 2004). Speaking a native language and participating in subsistence activities have been highlighted by circumpolar Natives as important signifiers of community health and cultural continuity (Stevenson, 2009). In addition, in Alaska, cultural identification is closely related to the use of subsistence foods, which are not only eaten for nutrition value but for cultural practices. The Alaska Federation of Natives describes subsistence as “the hunting, fishing, and gathering activities which traditionally constituted the economic base of life for Alaska's Native peoples and which continue to flourish in many areas of the state today…Subsistence, being integral to our worldview and among the strongest remaining ties to our ancient cultures, is as much spiritual and cultural, as it is physical” (U.S. Department of the Interior, 2005).

Subsistence uses are central to the customs and traditions of many cultural groups in Alaska. These customs and traditions encompass sharing and distribution networks, cooperative hunting, fishing, and ceremonial activities. Participation in subsistence activities promotes transmission of traditional knowledge from generation to generation and serves to maintain people’s connection to the physical and biological environment.

Table 19 displays the primary Alaska Native cultural groups present in each borough/census area. The predominant group in the NSB is Inupiat and in the Yukon-Koyukuk and Southeast Fairbanks Census Areas, Athabascan. In general, the more populous regions comprise a greater diversity of Alaska Native cultural groups. As noted in Resource Report No. 5 Socioeconomics, larger populations tend to correspond with lower proportions of Alaska Native residents. Table 5.1.3-17 of Resource Report No. 5 presents a detailed breakdown of race and ethnicity.

Table 19 also shows the percentage of households where a language other than English was spoken at home. It should be noted that this percentage is inclusive of all languages spoken and does not reflect only Alaska Native languages spoken at home.

**Table 19. Cultural Indicators by Potentially Affected Area and Statewide (2012-2016)**

| Location | Primary Alaska Native Cultural Group(s) | Percent Speaking a Language Other Than English at Home (2012 to 2016) (%)[a] |
|---|---|---|
| North Slope Borough Census Area | Inupiat | 31.9 |
| Yukon-Koyukuk Census Area | Athabascan | 15.1 |
| Fairbanks North Star Borough | Athabascan, Inupiat, Yup'ik, Tlingit-Haida | 10.5 |
| Denali Borough | Athabascan | 11.3 |
| Matanuska-Susitna Borough | Athabascan, Inupiat, Yup'ik, Tlingit-Haida, Aleut | 7.1 |
| Kenai Peninsula Borough | Athabascan, Inupiat, Yup'ik, Tlingit-Haida, Aleut | 7.6 |
| Municipality of Anchorage | Athabascan, Inupiat, Yup'ik, Tlingit-Haida, Aleut | 17.5 |
| Southeast Fairbanks Census Area | Athabascan | 26.0 |
| Skagway Municipality | Tlingit-Haida | 11.7 |
| Valdez-Cordova Census Area | Athabascan, Aleut | 7.9 |
| Alaska Statewide | | 16.2 |
| [a]U.S. Census Bureau, 2012-2016 American Community Survey 5-Year Estimates | | |

## 3.2. Health Effect Category 2: Accidents and Injuries

Accidents and Injuries are an important cause of mortality and morbidity in Alaska. The term unintentional injury refers to causes of injury or death other than suicide and homicide. Fatal injury information is drawn from death certificates and the Alaska Violent Death Reporting System while non-fatal injuries are typically obtained from the Alaska Trauma Registry. Alcohol use is a powerful risk factor for accidents and injuries and so alcohol related injury events are reported. The presence of law enforcement or Village Public Safety Officers (VPSOs) also influences safety in rural communities.

### 3.2.1. Fatal Accidents and Injuries

#### 3.2.1.1. Unintentional Injury and Poisoning Deaths

Unintentional injuries (including unintentional poisonings) are the third leading cause of death in Alaska. In 2015, unintentional injuries claimed the lives of 385 Alaskans. More Alaskans died due to unintentional poisoning than any other type of unintentional injury; 85 males and 49 females.

Among the leading causes of death in Alaska, unintentional injuries ranked first in total years of potential life lost with 11,151 years lost. On average, 29 years of life were lost prematurely for each unintentional injury death.

Since 2006, the crude rate for unintentional injuries has increased 12.5%. During this same time period, the age-adjusted rate has increased 9.6% (ADHSS, 2015b).

#### 3.2.1.2. Firearm-Related Deaths

Firearm-related mortality is a composite that includes deaths due to unintentional discharge of a firearm, and deaths due to intentional discharge (suicide or homicide.)

In 2015, firearm-related deaths claimed the lives of 176 Alaskans. Since 2006, the crude death rate for firearm-induced deaths has increased 47.5%. During this same time period, the age-adjusted rate has increased 39.6%.

There were 6,798 years of potential life lost due to firearm-related deaths, with 38.6 years lost prematurely for each death, on average (ADHSS, 2015b).

#### 3.2.1.3. Assault (Homicide) Deaths

Assault (homicide) is the 10th leading cause of death in Alaska. In 2015, assault (homicide) claimed the lives of 62 Alaskans.

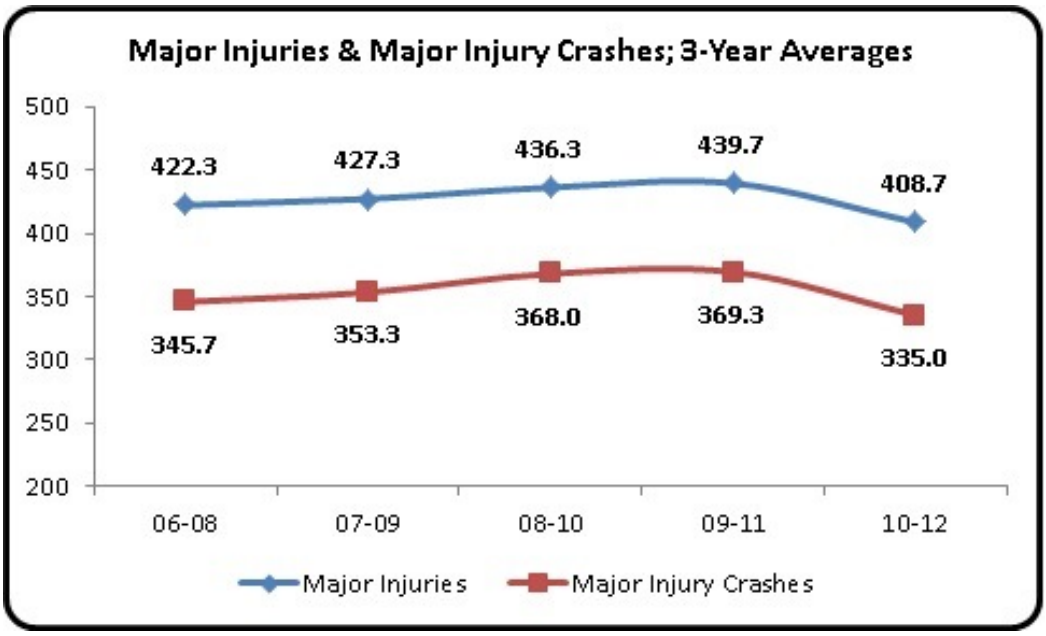
Among the leading causes of death in Alaska, assault (homicide) ranked fifth in years of potential life lost with 2,589 years lost. On average, 41.8 years of life were lost prematurely for each assault (homicide) death.

Since 2006, the overall crude death rate for assault (homicide) has increased 31.3%. During this same time period, the age-adjusted rate has increased 30.6% (ADHSS, 2015b).

#### 3.2.1.4. Traffic Accident Fatalities

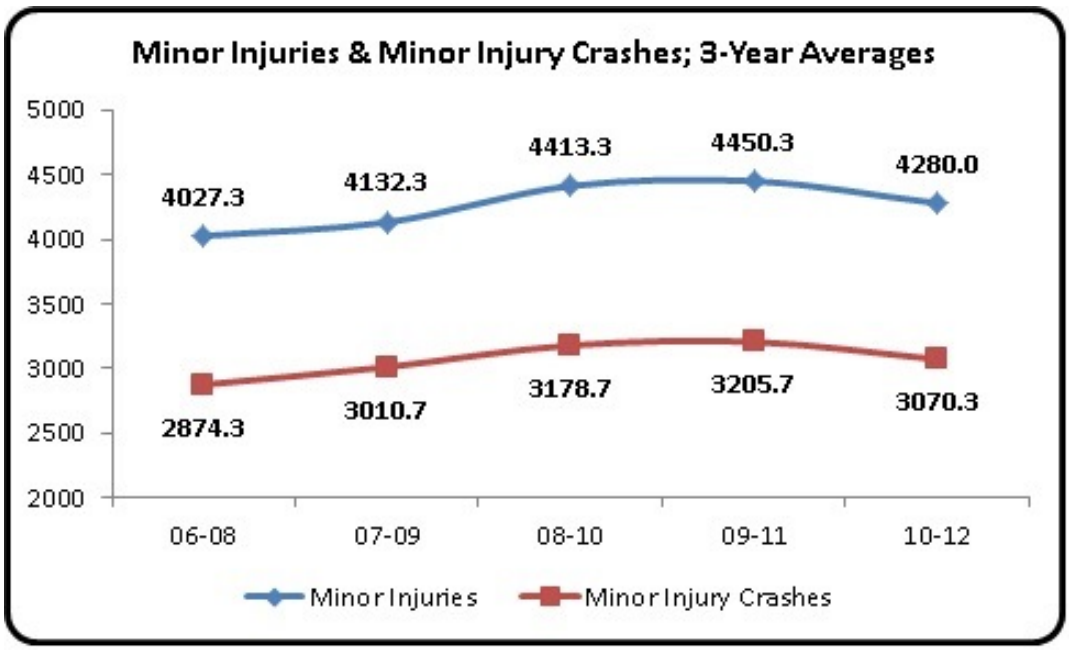
In 2016, Alaska experienced 84 fatalities in 78 crashes. These figures show a 31% increase in fatalities and a 30% increase in fatal crashes from 2015 (ADOT&PF 2017). Figures 14 and 15 shows 3-year averages of major/minor injuries and major/minor injury crashes. Figure 16 shows fatalities and fatal crashes, averaged over 3 years, between 2009 and 2015 in Alaska.

**Figure 14. Major Injuries and Major Injury Crashes; 3-Year Averages 2006 - 2012**



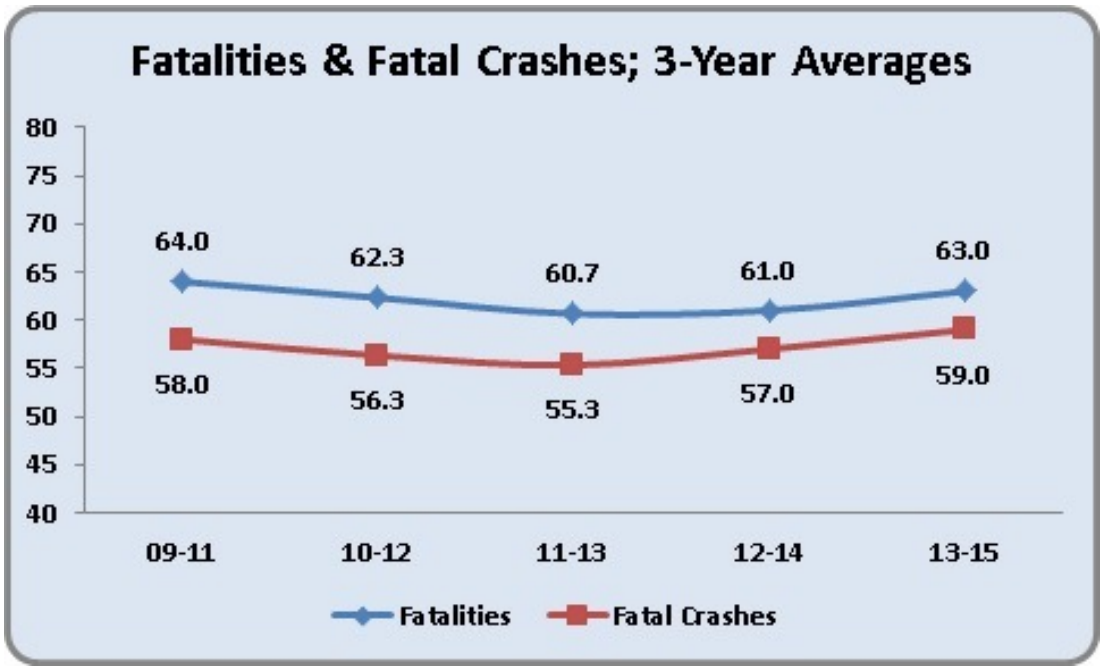

Source: Alaska Highway Safety Office, Transportation & Public Facilities

**Figure 15. Minorr Injuries and Minor Injury Crashes; 3-Year Averages 2006 - 2012**




Source: Alaska Highway Safety Office, Transportation & Public Facilities

**Figure 16. Fatalities and Fatal Crashes; 3-Year Averages 2009 - 2015**




Source: Alaska Highway Safety Office, Transportation & Public Facilities

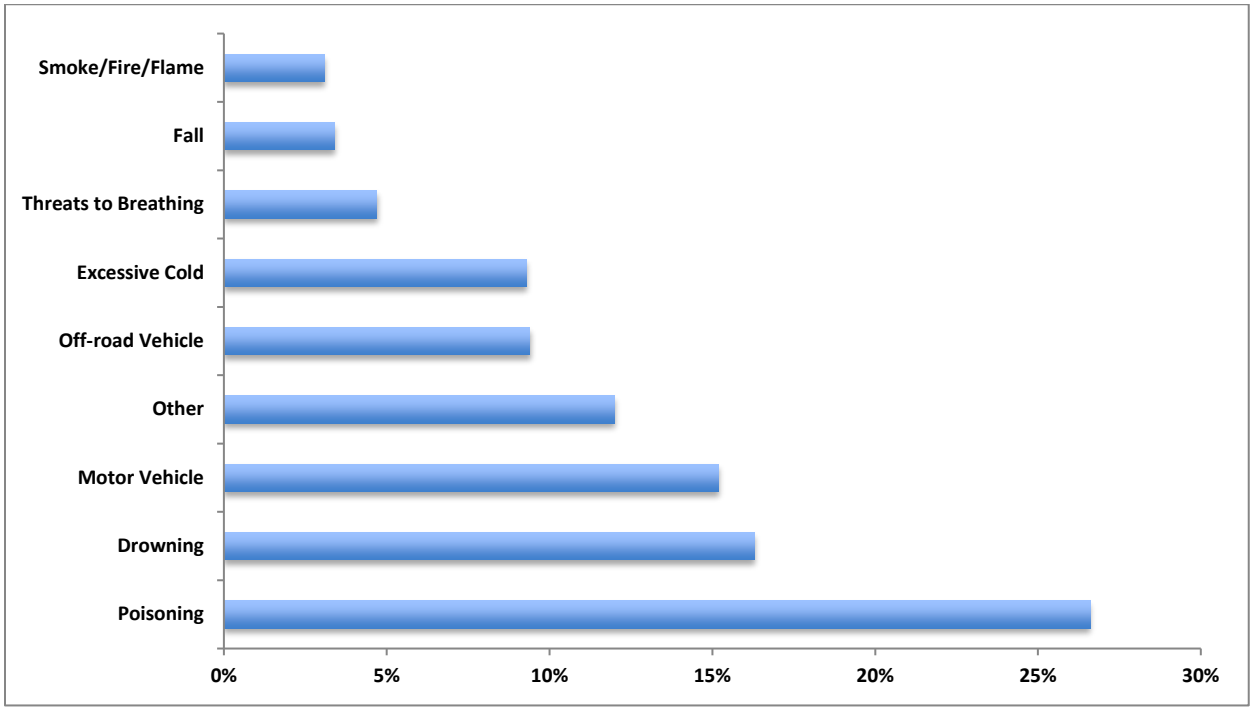
### 3.2.1.5. Unintentional Injury Deaths among Alaska Natives

From 2008 to 2011, unintentional injury was the third leading cause of death among Alaska Native people, with a mortality rate of 106.9 per 100,000, and the leading cause of death people aged 25–44 years (AN EpiCenter, 2014). Despite improvements in rates over the past 30 years, Alaska Native people had an unintentional injury mortality rate 2.2 times that of Alaska non-Natives and 2.6 times that of U.S. whites from 2008 to 2011 ($p<0.01$). Unintentional mortality rates varied widely by tribal health region, ranging from 64.2 to 153.6 deaths per 100,000 during this time period. Among the potentially affected Tribal Health Regions, the Interior had the highest unintentional injury death rate at 131.1 per 100,000 population, while the rate in the KPB was less than half of this value, at 65.0 per 100,000 (Table 20). Only Anchorage-Mat-Su had an unintentional injury death rate among Alaska Natives similar to that of the state overall. Between 2002 and 2011, poisoning was the leading cause of unintentional injury death among Alaska Natives, comprising 26.6% (Figure 17). Drowning was the second leading cause, followed by motor vehicle accidents.

**Table 20. Average Annual Age-adjusted Unintentional Injury Death Rates per 100,000 by Potentially Affected Tribal Health Region, Alaska Natives, 2012 to 2015**

| Tribal Health Region | Number | Rate |
|---|---|---|
| Arctic Slope | 14 | 96.4 |
| Interior | 58 | 131.1 |
| Anchorage/Mat-Su | 118 | 101.7 |
| Copper River/Prince William Sound | 6 | 106.1 |
| Kenai Peninsula | 10 | 65.0 |
| Statewide | 401 | 99.4 |
| Source: AN Epicenter, 2017<br>Note: Rates based on fewer than 20 cases are not statistically reliable and should be used with caution. Number and rate not reported for less than five cases | | |

**Figure 17. Unintentional Injury Death by Type, Alaska Native People, All Ages (2002-2011)**



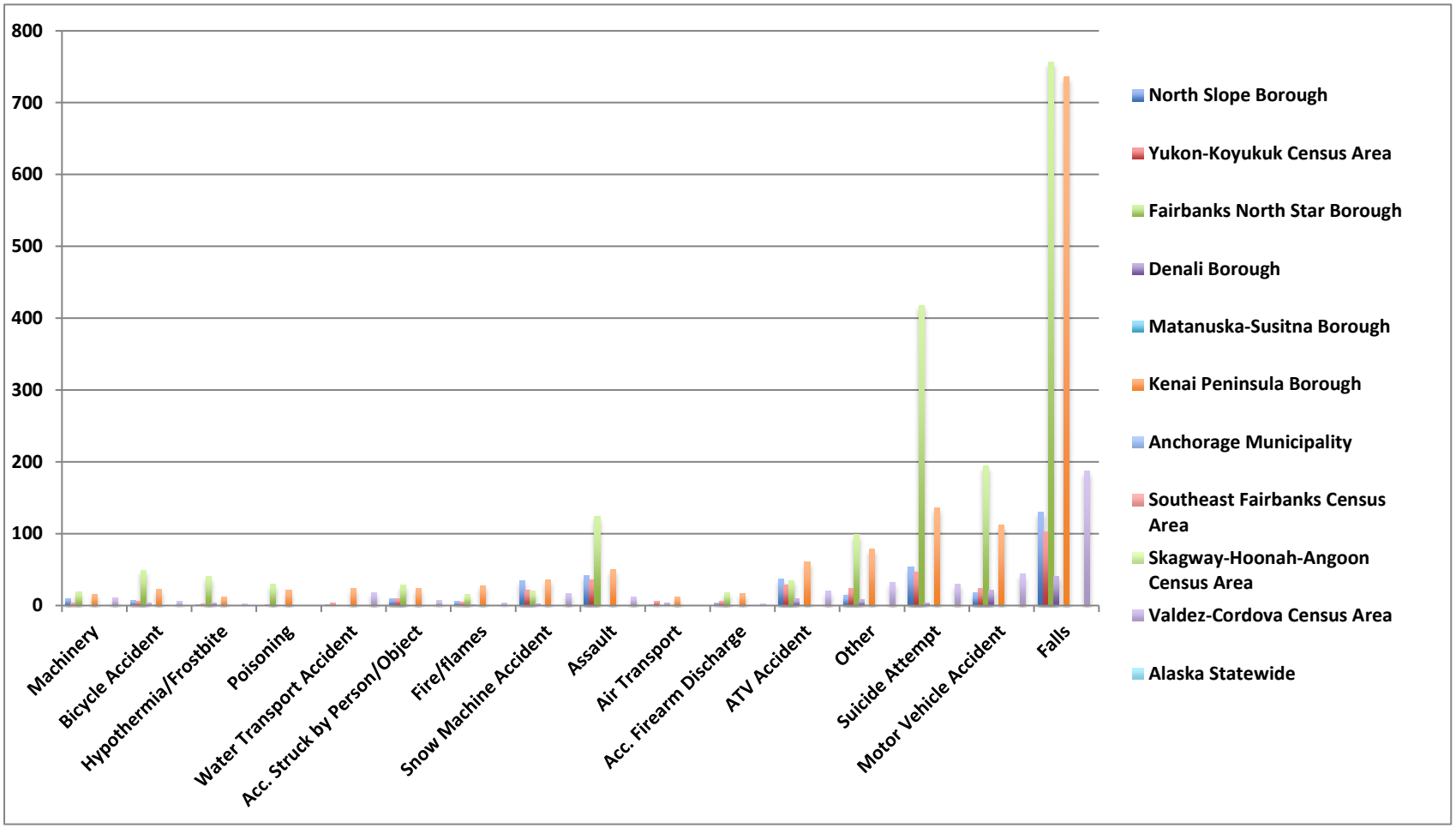

Source: AN EpiCenter, 2014

### 3.2.1.6. Non-fatal Injuries

Injury hospitalizations are collected in the Alaska Trauma Registry (ATR). The cases reported in the ATR include patients with injuries admitted to an Alaska hospital, held for observation, transferred to another acute care hospital, or declared dead in the emergency department. Between 2007 and 2011, falls were the leading cause of non-fatal injury among all potentially affected boroughs/census areas.

- Page Intentionally Left Blank -

**Figure 18. Leading Causes of Non-fatal Injury by Potentially Affected Area and Alaska Statewide (2007-2011)**




Source: Alaska Trauma Registry, 2015

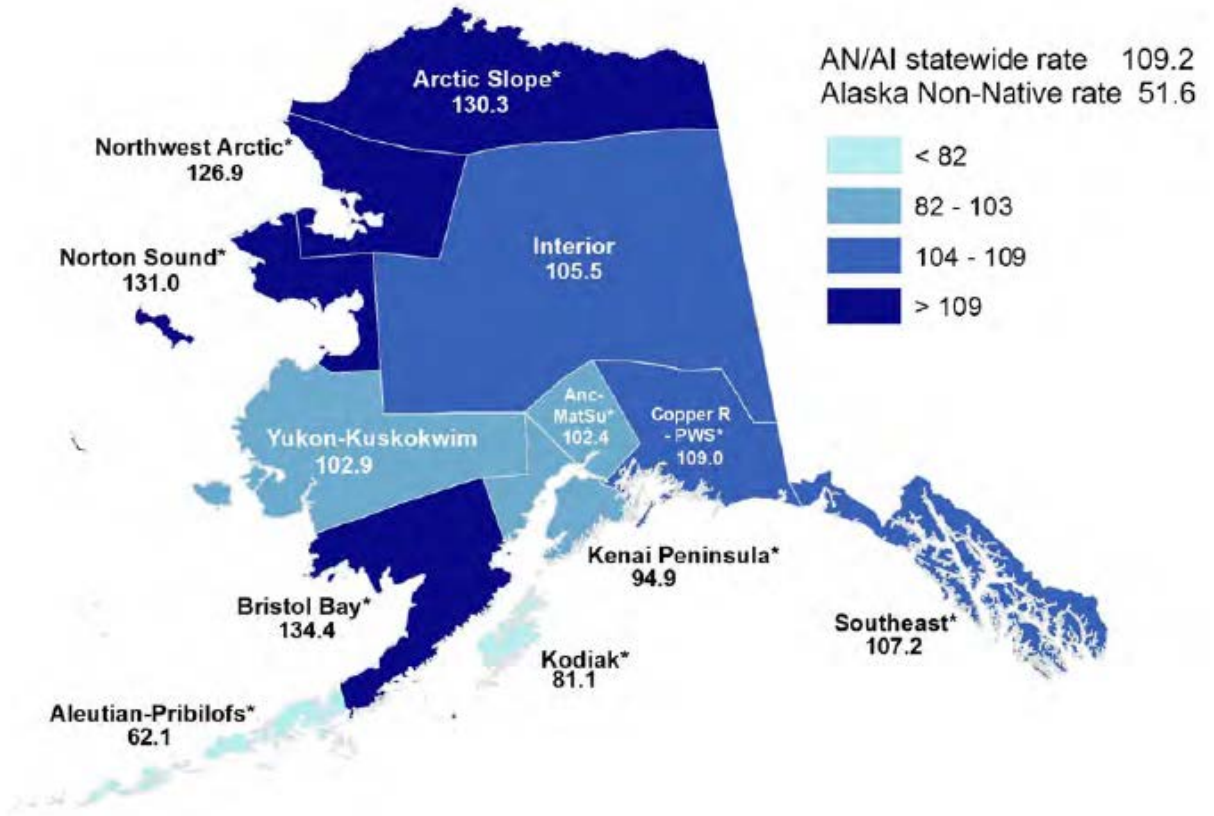
- Page Intentionally Left Blank -

### 3.2.1.7. Non-fatal Unintentional Injuries among Alaska Natives

Between 2002 and 2011, there were 10,955 hospitalizations for unintentional injuries among Alaska Native people, representing 67.9% of all injury hospitalizations (16,141). Alaska Native people were 2.1 times more likely to be hospitalized for an unintentional injury than non-Natives statewide (2002-2011, 109.2 and 51.6 per 10,000, respectively, $p<0.05$) (Figure 19). Among potentially affected regions, Alaska Natives living in the Arctic Slope had the highest rate of non-fatal unintentional injury. Rates among the Interior, Kenai Peninsula, and Anchorage-Mat-Su were similar to the state rate of non-fatal unintentional injury hospitalization.

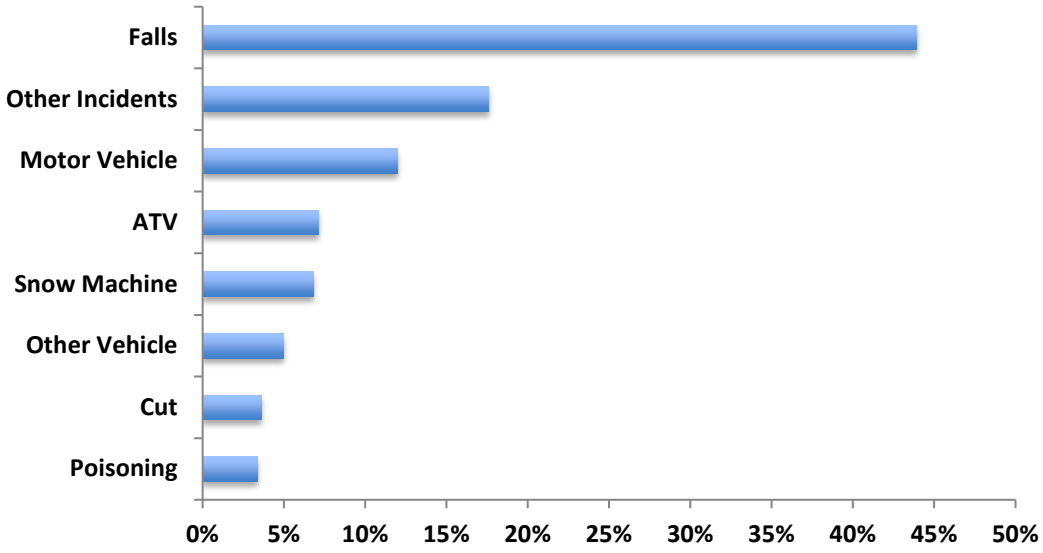
Similar to all races combined, falls were the leading cause non-fatal unintentional injury hospitalizations among all Alaska Natives statewide (43.9% of 10,955) (Figure 20). Between 2002 and 2011, there were 4,089 hospitalizations for fall injuries among Alaska Native people.

**Figure 19. Unintentional Hospitalization Rates by Region, Alaska Native People, 2002-2011**




Source: AN EpiCenter, 2014

**Figure 20. Unintentional Injury Hospitalization by Type, Alaska Native People, All Ages, 2002-2011**




Source: AN EpiCenter, 2014

### 3.2.1.8. Law Enforcement

The Alaska State Troopers (AST) is a division of the Alaska Department of Public Safety with posts throughout the state. Because Alaska does not have counties, and therefore, lacks county police or sheriffs, the troopers also handle civil papers and mental health custody orders and serve as police throughout most of rural Alaska. Some cities do have local police departments; however, their staffs, with the exception of Fairbanks and Anchorage, are fairly limited.

The AST, Alaska Bureau of Highway Patrol (ABHP) has an emphasis on impaired driving enforcement and is responsible for coordinating and/or conducting traffic law enforcement on a statewide basis. The ABHP is also responsible for investigating fatal and major incapacitating injury collisions statewide and for responding to enforcement and investigative requests by other agencies. Most team members are AST. Some of the team members are officers with local police departments as well as personnel from the DOT Commercial Vehicles Enforcement section. ABHP traffic teams deploy from Fairbanks, Mat-Su West, Soldotna, and Girdwood (AST, 2016).

Table 21 provides the location of AST detachments, headquarters, and posts. Posts along the Project transportation corridor include: Fairbanks, Cantwell, Healy, Glennallen, Palmer, Mat-Su West, Wasilla, Nenana, Northway, Tok, Anchorage, Girdwood, Cooper Landing, Soldotna, Ninilchik, and Seward. A post in Talkeetna was slated to close in 2015, leaving the posts in Willow and Cantwell as the closest to the community (Hollander, 2015).

Law enforcement in most rural areas is the primary responsibility of the AST; however, local law enforcement response in Alaska Native villages is often undertaken by a VPSO. The VPSO Program was designed to train and employ individuals residing in the village as first responders to public safety

emergencies such as search and rescue, fire protection, emergency medical assistance, crime prevention, and basic law enforcement. The VPSO position is overseen by the AST and funded by Alaska Native Corporations. The AST D Detachment serves as the primary or secondary source of law enforcement for more than 30 villages located in Interior Alaska. The Fairbanks-based Rural Service Unit supports the VPSOs in the region and responds to calls for police services and search and rescue support in Interior Alaska.

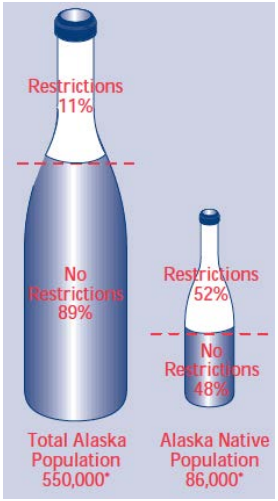
**Table 21. Alaska State Troopers Detachments, Headquarters, and Posts**

| Detachment | Headquarters | Posts |
|---|---|---|
| A | Ketchikan | Haines, Juneau, Klawock, Ketchikan, Petersburg |
| B | Palmer | Glennallen, Palmer, Mat-Su West |
| C | Anchorage | Anchorage, Aniak, Bethel, Dillingham, Emmonak, Iliamna, King Salmon, Kodiak, Kotzebue, McGrath, Nome, Saint Mary's, Selawik, Unalakleet |
| D | Fairbanks | Barrow, Cantwell, Delta Junction, Fairbanks, Galena, Healy, Nenana, Northway, Tok |
| E | Soldotna | Anchor Point, Cooper Landing, Girdwood, Ninilchik, Seward, Soldotna |
| ABI | Anchorage | Anchorage, Bethel, Dillingham, Fairbanks, Juneau, Ketchikan, Kotzebue, Nome, Palmer, Soldotna, Wasilla |
| Source: Alaska Department of Public Safety, 2016 | | |

### 3.2.1.9. Dry/Damp/Wet Community

Alaska Native village policies have been enacted that designate a community as dry (i.e., alcohol sale and consumption prohibited), damp (i.e., sale of alcohol illegal, but possession allowed), and wet (i.e., sale and possession allowed). Approximately 11% of the total Alaska population and 52% of the Native population live in places that restrict the availability of alcohol (Figure 21). Of the PACs, Minto and Tetlin have a ban on the sale and importation of alcohol, and Tanacross and Gulkana have a ban on the sale, importation as well as possession of alcohol (Berman and Hull, 1997).

**Figure 21. Alcohol Control Status by Population**




Source: Berman and Hull, 1997

## 3.3. Health Effect Category 3: Exposure to Potentially Hazardous Materials

When gathering data on exposure to potentially hazardous materials, the HIA team reports on outcomes, such as the prevalence of illnesses, which result from exposures to hazardous materials including asthma/COPD, cancer, thyroid disorder, developmental delays and birth defects. For health determinants, the HIA relies on information, where available, regarding soil, water and air to understand the types and quantities of contamination present. Physical and material hazards include illnesses related to radiation, noise, vibration, light, or wildlife interactions as well as pollutants.

ADHSS monitors two pollutants: methyl mercury (through hair samples of pregnant women) and lead exposures. There are currently no statewide monitoring programs for other criteria air pollutants, such as ozone, nitrous oxide (NOx), carbon monoxide (CO), sulfur dioxide ($SO_2$), and particulate matter (PM).

### 3.3.1. ADHSS Mercury Monitoring Program

People are most commonly exposed to mercury through consumption of fish and marine mammals. In July 2002, the Alaska Section of Epidemiology began the Statewide Maternal Hair Mercury Bio-monitoring Program, offering free and confidential hair mercury testing to all pregnant women and all women of childbearing age (i.e., women aged 15 to 45 years) in Alaska. This program focuses on women of childbearing age because the growing fetus is particularly vulnerable to the neurotoxic effects of mercury.

Through 2012, the Alaska State Public Health Laboratory analyzed hair samples from 312 pregnant women and 685 non-pregnant women of childbearing age from 127 communities throughout Alaska.

### 3.3.2. Pre-existing Environmental Hazardous Materials

Alaskans in rural communities have several possible contamination exposure sources, including industrial fuel and biomass combustion, pollution transported through the air, water or locally bio-accumulated from global sources, local waste processes, and abandoned contaminated sites.

Inhalation is one method of exposure to released contaminants. Pollutants can also dissolve in water sources or deposit on terrestrial surfaces. From their presence in any of these mediums, they can be ingested through drinking or ingesting contaminants directly or through their bio-accumulation in subsistence flora or fauna. Contaminant bio-accumulation in subsistence animals is a pathway of particular concern for Alaskans.

#### 3.3.2.1. Contamination in Nikiski

Nikiski is an industrial area where there may be higher risk for pre-existing environmental hazards. For example, the 10-acre Arness Septage disposal site property was used from the late 1970s to the mid-1980s to process waste, including septage (i.e., the partially treated waste from septic tanks), oily waste water and bilge waste water. Some clean-up and monitoring has occurred at the site. A 135-foot groundwater monitoring well was installed in 1988 and sampled four times between 1988 and 2004. In each sample, the 1,1,1-trichloroethane or TCA level was between 0.006 parts per million (ppm) (or milligrams per liter) and 0.019 ppm – concentrations that are well below the Alaska Department of Environmental Conservation's (ADEC) groundwater cleanup level of 0.2 ppm (ADEC, 2014). In 2012, an

oilfield service company, AIMM Technologies Inc., applied for a permit from ADEC's Solid Waste Program to dispose of oilfield wastes in a proposed monofill on a 10-acre parcel adjoining and southwest of the Arness Septage site property. The company installed six groundwater monitoring wells as per requirements of the Solid Waste Program's permit application. Samples from four wells initially installed showed no detection of chlorinated solvents or hydrocarbons. The other two wells were drilled later and had not yet been sampled at the time. The primary health concern is potential exposure to chlorinated solvents and hydrocarbons that may occur if drinking water wells in the area draw contaminated groundwater.

In 2012, ADEC sampled eight drinking water wells belonging to eight small businesses within a half-mile of the Arness Septage disposal site. Two wells tested positive for two chlorinated contaminants; all but one sample was well below the ADEC groundwater clean-up level. One sample tested above the ADEC regulatory level for trichloroethylene or TCE of 0.005 ppm at 0.00558 ppm; however, the ADEC considers that this contamination resulted from the Arness site (ADEC, 2014). As a result of the public concerns associated with the Arness property and AIMM's proposed monofill, the KPB applied for and received a $150,000 legislative appropriation to investigate groundwater conditions in the Nikiski area; this study is ongoing (ADEC, 2014).

### 3.3.3. Natural Environmental Patterns (Weather/Climate Change)

Some hazardous exposures may emerge from natural environmental patterns, such as flooding, wind and weather patterns, that create air quality problems (i.e., inversions or high PM content), or secondary effects from climate change.

### 3.3.4. Air Quality

Air pollution has been shown to increase the risk of or exacerbate a number of respiratory and cardiac conditions. The elderly, children, and those with underlying health problems are particularly vulnerable to the effects of air pollution. Information on air quality in the AOI has been provided in Resource Report No. 9.

According to U.S. Environmental Protection Agency (EPA), tribes in Alaska face unique challenges to protecting air quality and reducing health risks in their communities, including the following:

- Most tribes do not have a reservation or defined lands where they can assert jurisdiction to address air quality issues.
- Frozen ground prevents burying waste in landfills, and many communities resort to burning trash that creates air pollution.
- Electricity primarily comes from diesel generators that produce particulate and other air pollutants.
- The cold climate means people spend significant time indoors in homes and buildings where indoor air pollution can accumulate.
- Many homes have older wood stoves that can be inefficient and create air pollution.

- Dust from unpaved roads may contain pollutants that can be inhaled or deposited on subsistence food sources (Ware et al., 2013).

Ware et al. conducted surveys focused on understanding the demographics, home heating practices, indoor activities, community/outdoor activities, and air quality perceptions in rural Alaska communities over a 2-year period. Results from these surveys showed that there is an elevated potential for $PM_{10}$/$PM_{2.5}$ exposures in rural Alaska. Significant indoor air quality concerns included mold, lack of ventilation or fresh air, and dust. Important outdoor air pollution concerns identified were open burning/smoke, road dust, and vehicle exhaust (e.g., snow machines, ATVs, etc.) (Ware et al., 2013).

### 3.3.5. Water Quality

See Resource Report No. 2, Sections 2.2 and 2.3 for water resources baseline conditions.

The Safe Drinking Water Information System contains information about public water systems and violations of EPA's drinking water regulations, as reported to EPA by the states. These regulations establish maximum contaminant levels, treatment techniques, and monitoring and reporting requirements to ensure that water systems provide safe water to their customers. Drinking water violations is an indicator of the presence or absence of health-based drinking water violations in counties served by community water systems. Health-based violations include Maximum Contaminant Level, Maximum Residual Disinfectant Level, and Treatment Technique violations (County Health Rankings 2016b). A "Yes" indicates that at least one community water system in the county received a violation during the specified time frame, while a "No" indicates that there were no health-based drinking water violations in any community water system in the county. During fiscal year 2013, the only potentially affected area that did not have at least one violation was the NSB. There was no data for Denali Borough.

## 3.4. Health Effect Category 4: Food, Nutrition, and Subsistence Activity

See Resource Report No. 5, Appendix D, as well as ADF&G baseline subsistence data provided as an attachment and filed in response to FERC on submitted on December 1, 2017 (see Accession No. 20171201-5211), for subsistence and food security baseline conditions in the PACs.

The Alaska Natives Commission describes subsistence as “the hunting, fishing, and gathering activities which traditionally constituted the economic base of life for Alaska's Native peoples and which continue to flourish in many areas of the state today” (U.S. Department of the Interior, 2005).

Subsistence is part of a rural economic system, called a “mixed, subsistence-market” economy, wherein families invest money into small-scale, efficient technologies to harvest wild foods. Fishing and hunting for subsistence resources provide a reliable economic base for many rural regions. Subsistence is focused toward meeting the self-limiting needs of families and small communities (Wolfe and Walker, 1987). Participants in this mixed economy in rural Alaska augment their subsistence production by cash employment. Cash (from commercial fishing, trapping, and/or wages from public sector employment, construction, firefighting, oil and gas industry, or other services) provide the means to purchase the equipment, supplies, and gas used in subsistence activities. The combination of subsistence and

commercial-wage activities provides the economic basis for the way of life so highly valued in rural communities (Wolfe and Walker, 1987).

The State of Alaska confirms that subsistence fishing and hunting are important sources of employment and nutrition in almost all rural communities (Alaska Department of Fish and Game, undated). Subsistence is a source of nutrition for residents in an area of Alaska where food prices are high. While some people earn income from employment, these and other residents rely on subsistence to supplement their diets throughout the year. Furthermore, subsistence activities support a healthy diet and contribute to residents' overall wellbeing.

### 3.4.1. Contribution of Subsistence Activities

Johnson et al. (2009) note that Alaska Native foods are especially nutritious as they are dense in protein, iron, vitamin B12, polyunsaturated fats, monounsaturated fats and omega-3 fatty acids. Fish and seafood especially contributed to energy, protein, mono and polyunsaturated fatty acids, selenium, magnesium and vitamins D and E. In addition, they are low in saturated fat, added sugar, and salt. Native meats, such as moose and caribou, are generally lean. Berries and greens are high in water content and micronutrients and low in empty calories. In addition, hunting, gathering, harvesting and preserving Native foods are energy intensive, providing physical activity.

Johnson et al. (2009) report the findings of this research as:

- Daily seal oil and salmon consumption were associated with lower prevalence of glucose intolerance compared with individuals reporting less than-daily consumption.
- Higher intakes of the omega-3 fatty acids may afford some degree of protection against coronary heart disease.
- Lower rates of atherosclerotic lesions among Alaska Natives on autopsy compared with non-Native people was attributed to high intake of omega-3 fatty acids.
- Greater amounts of alpha-tocopherol and fresh bird intake were associated with higher HDL/LDL-cholesterol ratios.
- Elevated intakes of simple sugars, which might be contributing to an excess intake of energy that leads to a rise in obesity and diabetes.
- Low intake of calcium, dietary fiber, fruits and vegetables could be contributing to an increased incidence of cancers of the digestive system.

### 3.4.2. Food Security

Food security means having enough food to fully meet basic needs at all times. Food Insecurity is the percentage of the population who did not have access to a reliable source of food during the past year (Gundersen et al., 2015). Lacking constant access to food is related to negative health outcomes such as weight-gain and premature mortality (Brownson et al., 2006; Adams et al., 2003). The Core Food Insecurity Model was developed by the U.S. Department of Agriculture (USDA) to measure the ability of the

population to access food. In addition to asking about having a constant food supply in the past year, the module also addresses the ability of individuals and families to provide balanced meals further addressing barriers to healthy eating. This measure was modeled using data collected from the Community Population Survey, Bureau of Labor Statistics, and American Community Survey. In 2013, 14% of Alaskans statewide were determined as food insecure. The highest percentage of food insecure persons were residents of the Yukon-Koyukuk Census Area (Table 22), while the lowest were residents of the Municipality of Anchorage and MSB. This trend is most likely a result of the fact that there are a larger percentage of rural communities in the Yukon-Koyukuk Census Area.

"Limited access to healthy foods" is defined as the percentage of the population who are low income and do not live close to a grocery store. Grocery store proximity is defined differently for rural versus nonrural areas. For rural areas, it means living less than 10 miles from a grocery store and in nonrural areas, less than 1 mile (County Health Rankings, 2016a). Low income is defined as having an annual family income of less than or equal to 200% of the federal poverty threshold for the family size.

There is strong evidence that residing in a geographic area where affordable and nutritious food is difficult to obtain, is correlated with a high prevalence of overweight, obesity, and premature death (Ahern et al., 2011; Taggert, 2005; Schafft, 2009). Supermarkets generally provide healthier options than convenience stores or smaller grocery stores (Wrigley et al., 2002). In addition, lack of access to fresh fruits and vegetables is a significant barrier to consumption and is related to premature mortality (Brownson et al., 2006).

In 2010 (the most currently available data) indicated that Yukon-Koyukuk Census Area had the highest percentage of residents with limited access to healthy foods at 50%, more than 5 times the percentage of all Alaskans statewide (see Table 22). The second highest percentage of person with limited access to healthy foods resided in Denali Borough.

"Food environment" is a composite of the percentage of food insecure persons and percentage of persons with limited access to healthy foods (County Health Rankings, 2016a). The "food environment index" ranges from 0 (worst) to 10 (best) and equally weights two indicators of the food environment. The Yukon-Koyukuk Census Area scored lowest on the food environment index (1.4), more than 5 times lower than the overall value for the state as a whole (see Table 22). The Anchorage Municipality scored the highest at 7.9.

**Table 22. Percentage of the Population Who Lack Adequate Access to Food by Potentially Affected Area and Alaska Statewide (2010 and 2013)**

| Census Area | No. of Persons Food Insecure (2013) | Percent of Persons Food Insecure (2013) | No. Persons with Limited Access to Healthy Foods (2010) | Percentage of Persons with Limited Access to Healthy Foods (2010) | Food Environment Index |
|---|---|---|---|---|---|
| North Slope Borough Census Area | 1,330 | 14% | 360 | 4% | 7.7 |
| Yukon-Koyukuk Census Area | 1,180 | 21% | 2,799 | 50% | 1.4 |
| Fairbanks North Star Borough | 13,050 | 13% | 9,737 | 10% | 7.2 |
| Denali Borough | 290 | 14% | 338 | 19% | 6.1 |
| Matanuska-Susitna Borough | 11,370 | 12% | 5,138 | 6% | 7.8 |
| Kenai Peninsula Borough | 7,310 | 13% | 3,273 | 6% | 7.7 |
| Municipality of Anchorage | 36,350 | 12% | 13,342 | 5% | 7.9 |
| Southeast Fairbanks Census Area | 1,160 | 16% | 644 | 9% | 6.6 |
| Skagway-Hoonah-Angoon Census Area | 570 | 18% | 360 | 4% | 4.9 |
| Valdez-Cordova Census Area | 1,250 | 13% | 1,047 | 11% | 7.2 |
| Alaska Statewide | ND | 14% | ND | 8% | 7.3 |

Source: Gunderson et al., 2015
ND: Not determined

### 3.4.3. Food Costs

Overall, the cost of living in Rural Alaska is 8% higher than the average cost of living in the U.S. (Economic Policy Institute, 2016). Of the four locations included in the Economic Policy Institute's dataset for Alaska, Rural Alaska is the fourth most expensive. In general, groceries are more expensive in rural Alaska due to the costs of shipping to remote locations and because there is typically no competition among vendors (i.e., often only one grocery or convenience store present per community).

### 3.4.4. Nutrition

Measuring the consumption of fruits and vegetables is a means of assessing adult diet. The data show the percentage of adults who report having eaten at least two servings of fruits and at least three servings of vegetables per day during the past month (AN EpiCenter, 2014). Fruits include 100% fruit juice and fruit. Vegetables include green salad, potatoes (excluding French fries, fried potatoes, or potato chips), carrots, or other vegetables. The amount of fruits and vegetables recommended daily varies according to age, sex, and level of physical activity. One of the key recommendations from the Dietary Guidelines for Americans is to increase fruit and vegetable intake. Eating more fruits and vegetables adds nutrients to diets, reduces

the risk for heart disease, stroke, and some cancers, and helps manage body weight when consumed in place of more energy-dense food (USDA, 2015). In 2013, the age-adjusted prevalence of Alaskans meeting the recommended standard of consuming at least 2 cups of fruit and 3 cups of vegetable per day was low at 13.1% and 8.9%, respectively (Moore and Thompson, 2015). The highest percentage of all Alaskans living in Matanuska-Susitna reported consuming the standard of fruits and vegetables (15.3%) and Alaska Native residents of FNSB (Table 23). The lowest percentage of all Alaskans and Alaska Natives who reported meeting the standard of fruits and vegetables were residents of Yukon-Koyukuk Census Area.

**Table 23. Fruit and Vegetable Consumption (2+ Fruits and 3+ Vegetables per Day) by Potentially Affected Area**

| Borough/Census Area | Age-adjusted Prevalence/All Alaskans | Age-adjusted Prevalence/Alaska Natives |
|---|---|---|
| North Slope Borough Census Area | 7.9% | ** |
| Yukon-Koyukuk Census Area | 4.0% | 4.5% |
| Fairbanks North Star Borough | 12.8% | 16.1% |
| Denali Borough | 5.9% | ** |
| Matanuska-Susitna Borough | 15.3% | 13.8% |
| Kenai Peninsula Borough | 12.5% | 11.4% |
| Municipality of Anchorage | 11.9% | 8.8% |
| Southeast Fairbanks Census Area | 7.3% | ** |
| Hoonah-Angoon Census Area | ** | ** |
| Valdez-Cordova Census Area | 8.6% | ** |
| State of Alaska | | |
| Source: BRFSS, 2016<br>**Data statistically unreliable | | |

Micronutrients are nutrients required by humans and other organisms throughout life in small quantities to orchestrate a range of physiological functions. Vitamin D deficiency is a common problem for children and adults in Alaska and can lead to bone diseases such as rickets. A review of rickets and vitamin D deficiency cases among Alaska Native children aged <10 years for the period 2001 to 2010 was performed by ADHSS SOE (2014). Results of the study indicated rickets was more common in Alaska Native children than in other U.S. children, and the incidence of rickets increased with increasing geographic latitude within Alaska. Pediatric risk factors for rickets in Alaska include general malnutrition, darker pigmentation, living at higher latitude, and lack of vitamin supplementation in breastfed and formula fed infants (ADHSS, 2014).

There were no reported deaths by malnutrition among the PACs or by nutritional disorders such as scurvy, marasmus, vitamin B12, or other deficiencies. Information on clinical visits for deficiencies other than vitamin D is not available at this time, but incidence is generally low and not likely related to involuntary nutritional limitations.

## 3.5. Health Effect Category 5: Infectious Diseases

Reportable communicable diseases include infectious and parasitic diseases, such as tuberculosis (TB), septicemia, viral hepatitis, HIV, and STIs as well as influenza and pneumonia. Reportable infectious diseases are tracked by local, state, and federal governments utilizing a cooperative relationship with

clinicians and laboratories. When an individual is identified with an infectious disease clinicians and laboratories report to their local or state health department. All disease specific information is collected regarding the infectious disease event and is then reported to the CDC.

Communicable diseases disproportionally affect poor populations and are exacerbated by unsanitary conditions, unsafe water, and inadequate personal hygiene. Children and adults without proper immunization are at higher risk of contracting infections and left untreated, chronic infections can lead to cancers, such as cervical (caused by HPV) and liver cancer (Hepatitis B and C) (WHO, 1999).

From 2011 to 2015, 36 cases of foodborne botulism were reported in the State; one case of infant botulism was reported in 2015. Seven cases of foodborne botulism, representing four outbreaks, were reported in 2015. The age range of patients with foodborne botulism in 2015 was 23–77 years (median age: 48 years); five (71%) were female (ADHSS, 2016).

Alaska averaged 103 cases of Campylobacter infection each year from 2011 to 2015. New for 2015, the case definition for campylobacteriosis included cases with positive results on culture independent diagnostic tests. Reported cases of campylobacteriosis have shown an increase during the summer months. There were five Campylobacter outbreaks in 2013, and the largest of these infected 31 people and was associated with raw milk consumption. Another Campylobacter outbreak linked to raw milk occurred in 2011, infecting 18 individuals (ADHSS, 2016).

In 2015, 5,653 cases of chlamydial infection (CT) were reported in the State; Alaska's CT incidence rate was 766 cases per 100,000 persons. This represents a 1.5% rate decrease compared to 2014 data (788 cases/100,000 persons). Alaska ranked first for national CT rates from 2010–2014 (ADHSS, 2016).

Alaska averaged 93 cases of giardiasis from 2011 to 2015. Giardia is a well-known inhabitant of Alaska's surface waters. Cases of Giardia have shown an increase during the summer months and the fall hunting season. However, cases are also transmitted from person-to-person and thus can occur year-round. Often cases occur sporadically with no source identified. During the summer of 2012, one major outbreak of giardiasis was identified and investigated. Reports were received for 21 ill patients, and the source was determined to be contaminated spring water. There was one giardia outbreak investigated in 2014, involving five individuals (ADHSS, 2016).

In 2015, 1,115 cases of gonococcal infection (GC) were reported to the State; Alaska's GC incidence rate was 151 cases per 100,000 persons. This represents a 16% decrease compared to 2014 data (ADHSS, 2016).

The State of Alaska received 107 reports of invasive Haemophilus influenzae cases from 2011 to 2015. In 2015, 22 cases of H. influenzae were reported. Of these 22 cases, six (27%) were type a, one (5%) was type b, one (5%) was type e, 13 (59%) were nontypeable, and one (5%) was not tested. The six cases of H. influenzae type a came from the Yukon-Kuskokwim Delta, the region that has seen the most H. influenzae from 2002 to 2013. The patient with H. influenzae type b (Hib) was aged less than 6 years. Six total cases of Hib were reported between 2011–2015; five cases of Hib were reported in children aged less than 10 years from Southwestern Alaska in 2009 (ADHSS, 2016).

From 2011 to 2015, the State of Alaska received an average of 1,189 reports annually of hepatitis C virus (HCV) infection, with 1,542 new reports of HCV infection in 2015. These data represent newly reported cases of either acute or chronic infections. Rates of HCV reports were highest in the Anchorage/Mat-Su, Gulf Coast, and Southeast regions (ADHSS, 2016).

From January 1, 1982, through December 31, 2015, 1,680 cases of HIV infection were reported to the state, including cases with an initial diagnosis in Alaska and those previously diagnosed out-of- state who are living in Alaska. Of the 1,680 cases, 586 (35%) were in persons who are known to have subsequently died. Of the 1,094 HIV-infected persons who are not known to have died, 671 (61%) are currently living in Alaska. During 2015, 64 cases of HIV infection were reported to SOE; 22 (34%) of which were initially diagnosed in Alaska, yielding a 2015 statewide incidence rate of 3 cases per 100,000 persons. Of the 22 newly diagnosed persons, 17 (77%) were male, 15 (68%) were non-whites, and 10 (45%) were men who have sex with men (MSM). Of the MSM who agreed to be interviewed, the most commonly reported venues to meet sexual partners were online and through mobile applications. Other reported risk factors for newly diagnosed persons include drug and alcohol abuse (57%), history of incarceration (38%), coinfection with a bacterial STI (29%), and homelessness (19%). The number of new HIV infections reported to SOE varies from year to year, as Alaska is a low incidence jurisdiction. The most common risk factor is MSM, which represents approximately half of new infections each year (ADHSS, 2016).

From 2011 to 2015, 42 cases of paralytic shellfish poisoning (PSP) were reported. During this time, the age range of patients with PSP was 13–72 years (median age: 51 years); 30 (72%) were male. All ill persons consumed self-harvested shellfish from the Gulf Coast or Southeast regions of Alaska, except one probable case from the Northern region in 2014. Confirmed or probable cases have been reported in every month, with the spring and summer months being most common. During 2011, a large outbreak accounting for 21 of the 26 cases from 2011 was identified in Metlakatla and Ketchikan that resulted in four hospitalizations. PSP cases from 1993–2014 were summarized in a 2015 bulletin. The State of Alaska does not monitor or certify any beaches for toxins associated with PSP for the purposes of recreationally harvested shellfish; however, commercially harvested shellfish are routinely tested by the ADEC prior to sale (ADHSS, 2016).

During 2015, 106 cases of pertussis were reported, yielding an incidence rate of 14 cases per 100,000 persons; nearly half of the cases were reported as part of an outbreak in the Interior. A breakdown of pertussis cases reported to SOE by age group for 2011–2015 is displayed. An outbreak of pertussis that began in 2012 accounted for significant increases in cases reported in 2012 and 2013.2 Data from 2012 and 2013 were also summarized in a report that estimated epidemic conditions are reached after monthly cases counts exceed 30.

There were eight cases of animal rabies confirmed at the Alaska State Virology Lab (ASVL) in 2015. The priorities for testing at ASVL have been animals for which there may be public health actions associated, such as to determine whether an exposed human would need administration of rabies post-exposure prophylaxis, or appropriate follow-up for another animal exposed to the suspected rabid one. In March 2011, the CDC trained staff from ADF&G, the University of Alaska Fairbanks, and the USDA Wildlife Services in field screening direct rapid immunohistochemical test (DRIT) methods. All animals tested

positive by DRIT must be confirmed by DFA (direct fluorescent antibody) at CDC. On average, annually DRIT is used to evaluate 10 times more animals than are tested at ASVL. Two of the five bats that have ever tested positive for rabies in Alaska initially tested positive by DRIT and were subsequently confirmed to have rabies by CDC. An Epidemiology Bulletin released in 2016 summarized updates to what is known about rabies in Alaska bats (ADHSS, 2016).

From 2011 to 2015, the State of Alaska received an average of 69 reports annually of salmonellosis. Many cases reported were sporadic with no confirmed source. During 2015, there were 21 laboratory-confirmed cases associated with the multistate outbreak of S. Poona linked to the consumption of cucumbers. There were 13 outbreaks detected during 2013-2014; 64 of the 83 cases reported in 2013 were linked to seven outbreaks. Eleven of 59 cases in 2012 were part of an S. Heidelberg outbreak linked to poultry from a single producer that sickened more than 120 people in 13 states (ADHSS, 2016).

In 2015, 20 cases of early (primary, secondary, and early latent) syphilis were reported, which represents a 50% decrease from 2014 data. The incidence rate fell from 5.4 cases per 100,000 persons in 2014 to 2.7 cases per 100,000 in 2015. This outbreak resulted in two congenital syphilis (CS) cases, one in 2012 and one in 2013. The 2013 CS case resulted in stillbirth. Common risk factors include MSM, and persons engaging in anonymous sex, often with multiple partners found through the internet and phone apps (ADHSS, 2016).

In 2015, 68 cases of TB were reported to the Alaska Tuberculosis Control Program, for a rate of 9.2 cases per 100,000. This was the highest rate in the U.S. in 2015, well above the nationwide rate of 3.0 cases per 100,000. The Southwest and Northern regions of Alaska traditionally have the highest rates of TB, and Alaska Natives and Asians/Pacific Islanders bear a disproportionate burden of TB in Alaska. In 2013, one village-based outbreak from the Southwest Region accounted for 17 cases of TB with a corresponding incidence rate of ~2,000/100,000 (ADHSS, 2016).

Alaska averaged 55 cases of varicella annually from 2011 to 2015. A spike in varicella cases occurred in the fall of 2012 in Kenai Peninsula communities with low vaccination rates. A Public Health Advisory was published and an investigation completed. Twelve cases were confirmed among school age children attending four schools in Homer. The majority of cases reported to the State of Alaska are only clinically diagnosed without laboratory confirmation; health care providers are encouraged to test to more accurately describe varicella epidemiology and ensure that appropriate disease control measures are implemented (ADHSS, 2016).

During 2011-2013, reportable communicable disease was not among the leading causes of death for any Potentially Affected Areas. Of infectious and parasitic diseases, septicemia, followed by viral hepatitis was the most common causes of death due to infectious and parasitic disease in all areas (Table 24). For most areas, the mortality rate due to influenza and pneumonia was higher than the rate for infectious and parasitic diseases, with pneumonia being the most common cause of death.

**Table 24. Deaths due to Reportable Communicable Diseases, by Potentially Affected Area and Alaska Statewide (2011-2013)**

| Cause of Death | Deaths | Age Adjusted Rate |
|---|---|---|
| **North Slope Borough** | | |
| Infectious and Parasitic Disease | 1 | ** |
| Tuberculosis | 0 | 0.0 |
| Septicemia | 1 | ** |
| Viral Hepatitis | 0 | 0.0 |
| HIV Disease | 0 | 0.0 |
| All Other Infectious Disease | 0 | 0.0 |
| Influenza and Pneumonia | 0 | 0.0 |
| Influenza | 0 | 0.0 |
| Pneumonia | 0 | 0.0 |
| **Yukon-Koyukuk Census Area** | | |
| Infectious and Parasitic Disease | 5 | ** |
| Tuberculosis | 0 | 0.0 |
| Septicemia | 5 | ** |
| Viral Hepatitis | 0 | 0.0 |
| HIV Disease | 0 | 0.0 |
| All Other Infectious Disease | 0 | 0.0 |
| Influenza and Pneumonia | 6 | 46.4* |
| Influenza | 0 | 0.0 |
| Pneumonia | 6 | 46.4* |
| **Denali Borough** | | |
| Infectious and Parasitic Disease | 2 | ** |
| Tuberculosis | 0 | 0.0 |
| Septicemia | 1 | ** |
| Viral Hepatitis | 1 | ** |
| HIV Disease | 0 | 0.0 |
| All Other Infectious Disease | 0 | 0.0 |
| Influenza and Pneumonia | 1 | ** |
| Influenza | 0 | 0.0 |
| Pneumonia | 1 | ** |
| **Fairbanks North Star Borough** | | |
| Infectious and Parasitic Disease | 23 | 9.8 |
| Tuberculosis | 0 | 0.0 |
| Septicemia | 12 | 5.3* |
| Viral Hepatitis | 6 | 1.8* |
| HIV Disease | 1 | ** |
| All Other Infectious Disease | 1 | ** |
| Influenza and Pneumonia | 21 | 12.1 |
| Influenza | 3 | ** |
| Pneumonia | 18 | 11.1* |
| **Matanuska-Susitna Borough** | | |
| Infectious and Parasitic Disease | 28 | 9.9 |
| Tuberculosis | 0 | 0.0 |
| Septicemia | 9 | 3.2* |
| Viral Hepatitis | 9 | 3.2* |

| Cause of Death | Deaths | Age Adjusted Rate |
|---|---|---|
| HIV Disease | 1` | ** |
| All Other Infectious Disease | 9 | 3.2* |
| Influenza and Pneumonia | 18 | 9.6* |
| Influenza | 0 | 0.0 |
| Pneumonia | 18 | 9.6* |
| **Kenai Peninsula Borough** | | |
| Infectious and Parasitic Disease | 23 | 12.0 |
| Tuberculosis | 1 | ** |
| Septicemia | 9 | 5.3* |
| Viral Hepatitis | 8 | 4.7* |
| HIV Disease | 1 | ** |
| All Other Infectious Disease | 4 | ** |
| Influenza and Pneumonia | 17 | 11.8* |
| Influenza | 1 | ** |
| Pneumonia | 16 | 9.4* |
| **Municipality of Anchorage** | | |
| Infectious and Parasitic Disease | 128 | 17.6 |
| Tuberculosis | 2 | ** |
| Septicemia | 55 | 8.7 |
| Viral Hepatitis | 33 | 3.2* |
| HIV Disease | 15 | 1.7* |
| All Other Infectious Disease | 23 | 3.7 |
| Influenza and Pneumonia | 64 | 10.9 |
| Influenza | 4 | ** |
| Pneumonia | 60 | 10.3 |
| **Southeast Fairbanks Census Area** | | |
| Infectious and Parasitic Disease | 4 | ** |
| Tuberculosis | 0 | 0.0 |
| Septicemia | 1 | ** |
| Viral Hepatitis | 2 | ** |
| HIV Disease | 0 | 0.0 |
| All Other Infectious Disease | 1 | ** |
| Influenza and Pneumonia | 1 | ** |
| Influenza | 0 | 0.0 |
| Pneumonia | 1 | ** |
| **Skagway-Hoonah-Angoon Census Area** | | |
| Infectious and Parasitic Disease | 2 | ** |
| Tuberculosis | 0 | 0.0 |
| Septicemia | 0 | 0.0 |
| Viral Hepatitis | 1 | ** |
| HIV Disease | 0 | 0.0 |
| All Other Infectious Disease | 1 | ** |
| Influenza and Pneumonia | 1 | ** |
| Influenza | 0 | 0.0 |
| Pneumonia | 1 | ** |
| **Valdez-Cordova Census Area** | | |
| Infectious and Parasitic Disease | 4 | ** |

| Cause of Death | Deaths | Age Adjusted Rate |
|---|---|---|
| Tuberculosis | 0 | 0.0 |
| Septicemia | 1 | ** |
| Viral Hepatitis | 1 | ** |
| HIV Disease | 0 | 0.0 |
| All Other Infectious Disease | 2 | ** |
| Influenza and Pneumonia | 3 | ** |
| Influenza | 0 | 0.0 |
| Pneumonia | 3 | ** |
| **Alaska Statewide** | | |
| Infectious and Parasitic Disease | 268 | 14.8 |
| Tuberculosis | 8 | 4* |
| Septicemia | 115 | 7.2 |
| Viral Hepatitis | 68 | 2.5 |
| HIV Disease | 19 | 8* |
| All Other Infectious Disease | 58 | 3.7 |
| Influenza and Pneumonia | 176 | 12.1 |
| Influenza | 11 | 5* |
| Pneumonia | 165 | 7.5 |

Source: ABVS, 2016

[a]Age-adjusted rates are per 100,000 U.S. year 2000 standard population

* Rates based on fewer than 20 occurrences are statistically unreliable and should be used with caution.

**Rates based on fewer than 6 occurrences are not reported.

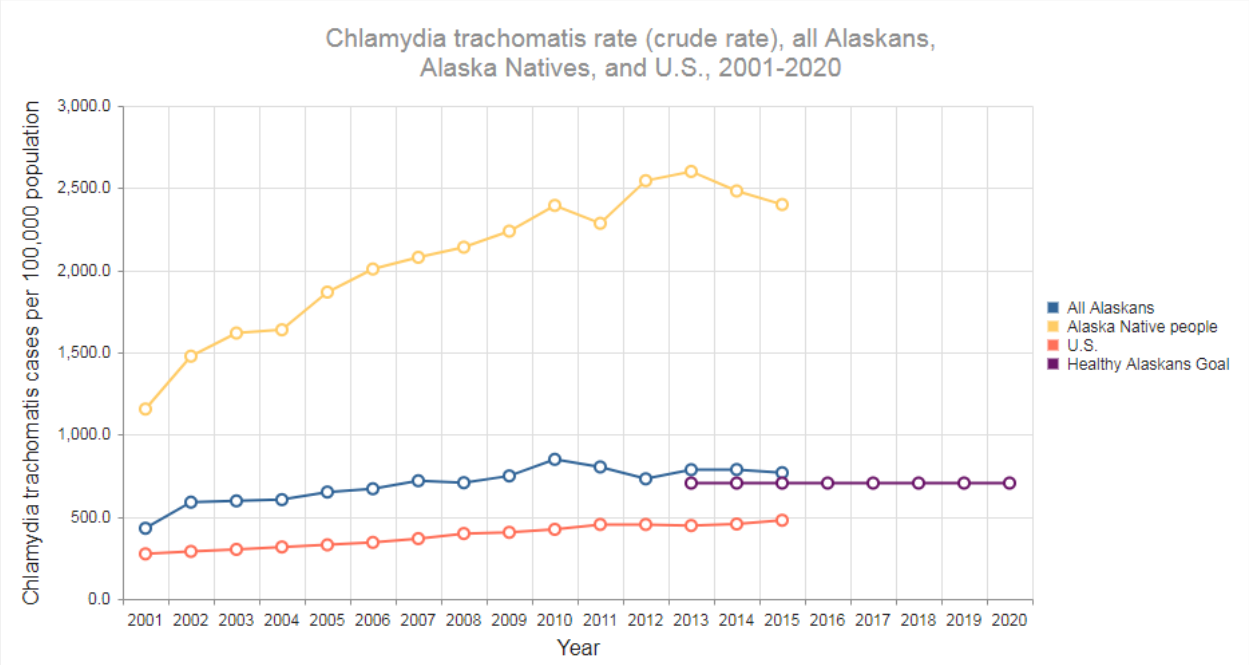
### 3.5.1. Chlamydia

Chlamydia trachomatis (CT or chlamydia) infection is the most commonly reported bacterial sexually transmitted disease in the U.S. and in Alaska. Chlamydia is known as a 'silent' infection because most infected people have no symptoms. Untreated CT infection can cause pre-term labor, pelvic inflammatory disease (PID), ectopic pregnancy, and infertility in women; epididymitis and Reiter's syndrome in men; and eye infection and pneumonia in newborns. Alaska has consistently had the first or second highest (CT) infection rate in the nation since 2000 (Figure 22) (ADHSS, 2011a). In 2015, there were a total of 5,653 cases statewide at an incidence rate of 766 per 100,000 population, representing a 1.5% decrease in incidence from 2014 (ADHSS, 2016). Among PACs, the Anchorage-Mat-Su region had the highest number of cases (2,890). Statewide, 67% of cases were among females, and 81% were in persons aged ≤29 years. The highest rate occurred among 20–24 year old age group.

Alaskan women, adolescents and young adults, and Alaska Natives are disproportionally impacted by chlamydia. There is a significant disparity in chlamydia rates between both the Alaska Native and non-Native populations as compared to the U.S. White population (AK-IBIS, 2016). In 2012, the highest number of new CT infections were seen among the 15-24 and 25-34 age groups, and approximately three of four infections reported were in among females. Chlamydia rates vary widely by tribal health region, from a low of 344.2 per 100,000 (Kodiak Area) to a high of 2,375.9 per 100,000 (Norton Sound; AN EpiCenter, 2014). Among potentially affected tribal health regions, Anchorage-Mat-Su had the highest incidence rate at 2,603.2 per 100,000 population (Table 25). The remaining regions had rates below that of the state overall.

To address the elevated rates of chlamydia in Alaska, several partners in state have sponsored expedited partner therapy as a means to promote safe sexual behavior (ADHSS SOE Bulletin Volume 14, 2011). The SOE regularly warns health care providers to be alert for risks and symptoms of STIs and to provide testing and prompt reporting of any outbreaks.

**Figure 22. Chlamydia Trachomatis Crude Rate, All Alaskans, Alaska Natives, and U.S. (2001-2020)**




Source: AK-IBIS, 2018

**Table 25. Age-Adjusted Alaska Native Chlamydia Incidence Rates by Region per 100,000 by Potentially Affected Native Health Corporation Region, Alaska Natives, 2016**

| Tribal Health Region | Age Adjusted Rate per 100,000 |
|---|---|
| Arctic Slope | 1,541.3 |
| Interior | 2,025.3 |
| Anchorage/Mat-Su | 2,519.1 |
| Copper River/Prince William Sound | 902.1 |
| Kenai Peninsula | 908.6 |
| Alaska Statewide | 7,444.9 |
| Source: AN EpiCenter, 2018 | |

### 3.5.2. Gonorrhea

Gonorrhea is an STI caused by the bacterium Neisseria gonorrhoeae. In 2014, Alaska had the third highest gonococcal infection (GC) rate in the nation (ADHSS, 2014; CDC, 2010). Untreated GC can result in PID, pre-term labor, ectopic pregnancy, and infertility in women; epididymitis and infertility in men; and conjunctivitis in neonates. GC can also facilitate the transmission of HIV (ADHSS, 2016). In 2015, there were 1,115 GC cases statewide at an incidence rate of 151 cases per 100,000 persons, representing a 16% decrease from 2014. The majority of cases occurred among persons aged ≤29 years (61%) and just over half were females (51%). The highest GC rate occurred among non-Hispanic American Indian/Alaska Native persons (AI/AN), Blacks, and Native Hawaiian/Pacific Islanders (NH/PI). Between 2014 and 2015, there was a 40% rate increase among NH/PI persons. While the demographic and geographic distribution of GC has remained relatively consistent over recent years, the observed rate increase among NH/PI persons was considered notable by the ADHSS Section of Epidemiology (ADHSS, 2016). In 2014, the Anchorage-Mat-Su Native Health Corporation Region had the highest incidence rate of gonorrhea among Alaska Natives residing in the PACs (Table 26).

**Table 26. Age-Adjusted Alaska Native Gonorrhea Incidence Rates by Region per 100,000 by Potentially Affected Native Health Corporation Region, Alaska Natives, 2016**

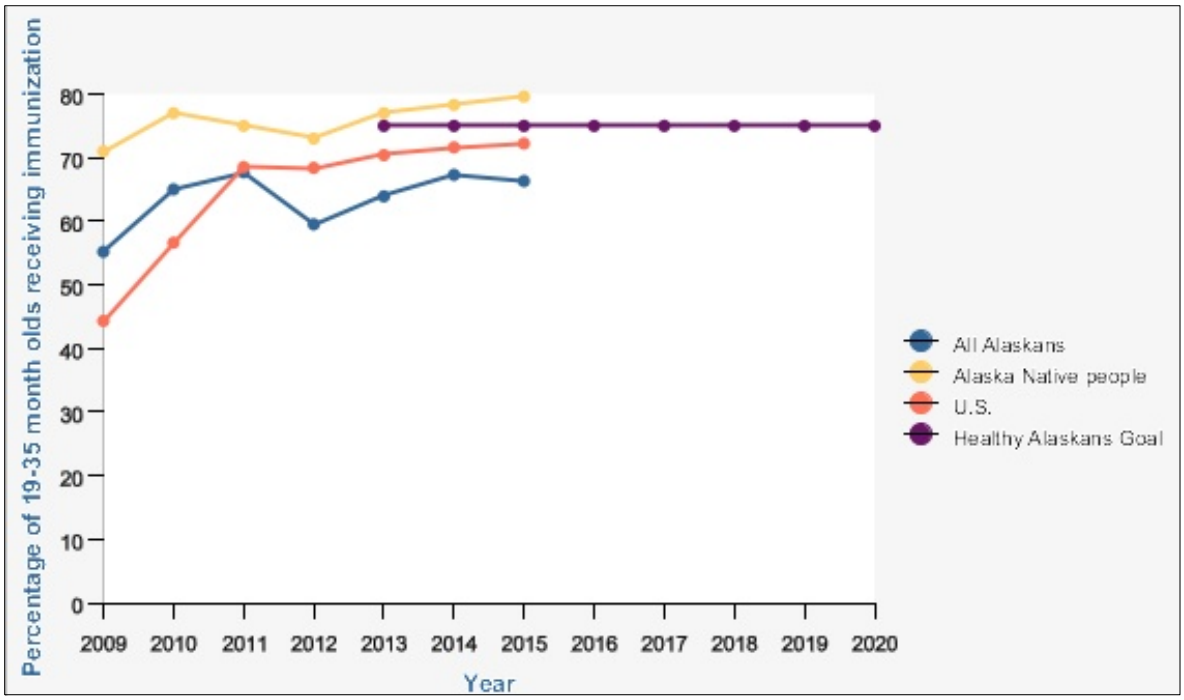
| Tribal Health Region | Age Adjusted Rate per 100,000 |
|---|---|
| Arctic Slope | 1,541.3 |
| Interior | 2,025.3 |
| Anchorage/Mat-Su | 2,519.1 |
| Copper River/Prince William Sound | 902.1 |
| Kenai Peninsula | 908.6 |
| Alaska Statewide | 7,444.9 |
| Source: AN EpiCenter 2018 | |

### 3.5.3. Immunizations

Immunization rates (greater than 80% coverage) for both children and adults are a critical community health population level performance indicator. By 2 years of age, it is recommended that all children should have received four doses of diphtheria-tetanus-pertussis, three doses of polio, one dose of measles-mumps-rubella, three doses of Hepatitis B, and three doses of Hemophilis Influenza, type B vaccines. This recommendation is referred to in shorthand as "4:3:1:3:3." For adults aged 65 years and older, respiratory diseases are an extremely important source of observed mortality and morbidity that can be reduced through proper immunization, along with behavior changes.

In 2013, 67% of all 19- to 35-month-old children statewide had received the recommended vaccination series, falling short of the Healthy Alaskans 2020 goal of 75% (Figure 23). The rate among Alaska Natives, however, exceeded both the national rate and the Healthy Alaskans 2020 goal in 2013 at 78%.

**Figure 23. Percentage of Children Aged 19-35 Months Who Received the 4:3:1:3:3 Vaccination Series, All Alaskans, and the U.S. (2009-2020)**




Source: AK-IBIS, 2018

Pneumonia, a respiratory disease, most often causes illness in children under 5 years and older adults (>65 years). Also at higher risk are those with other medical conditions, such as chronic liver, heart or lung disease (NIAID, 2011). In 2013, pneumonia was the most common cause of death due to a reportable infectious disease in: Yukon-Koyukuk Census Area, FNSB, KPB, and statewide. Between 2005 and 2013, 65.1% of Alaskans over 65 years of age statewide had received the pneumococcal vaccine. The highest vaccine coverage occurred in Yukon-Koyukuk Census Area (72.6%) and the lowest, in Valdez-Cordova Census Area (57.5%). From 2011 to 2013, 33.1% of Alaskans statewide had received the influenza vaccine. The highest coverage occurred among Alaska Natives living in Yukon-Koyukuk Census Area (42.1%) and the lowest percentage of influenza vaccination occurred for all Alaskans living in Southeast Fairbanks Census Area.

## 3.6. Health Effect Category 6: Non-communicable Diseases

Non-communicable diseases include:

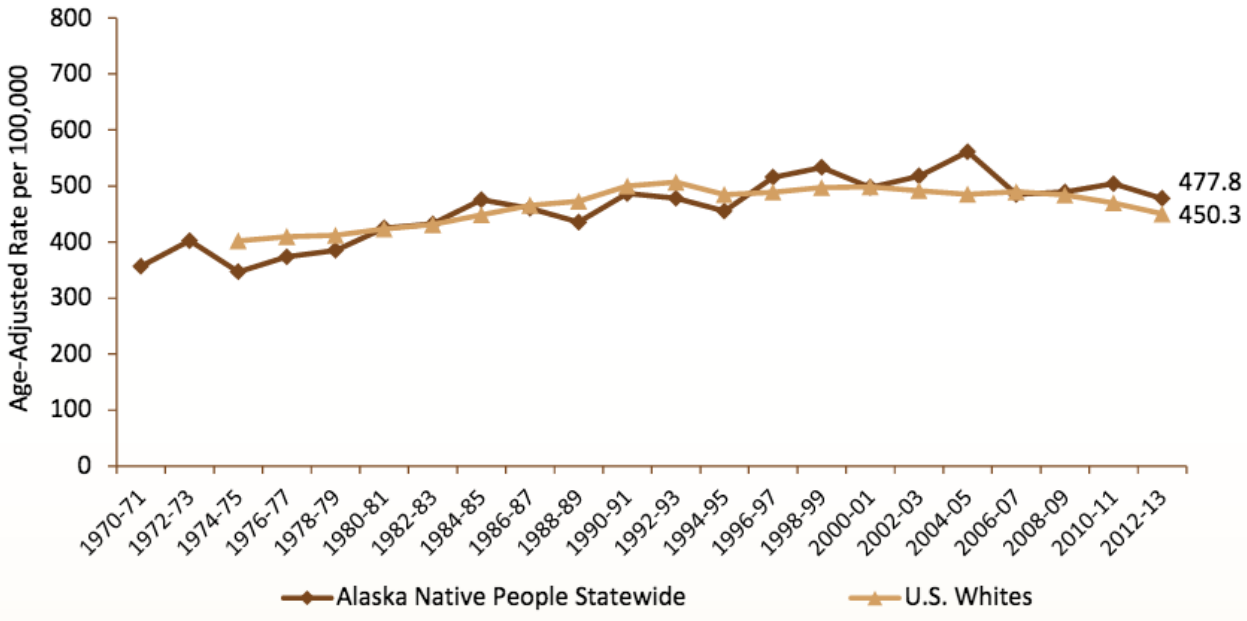
- Cardiovascular;
- Cerebrovascular;
- High blood pressure;
- Chronic lower respiratory diseases;

- Chronic obstructive pulmonary diseases;
- Mental health disorders;
- Physical activity/dietary diseases;
- Diabetes; and
- Cancer.

### 3.6.1. Cancer

Cancer incidence is defined as the number of new cancers diagnosed in a specified population during specified time period. Cancers incidence rates for a specific type of cancer are based on the primary site reported or on the site of origin. Alaska Native cancer incidence was similar to that of US Whites nationally during 2012-2013 (Figure 24). The number of deaths due to cancer defined as International Classification of Diseases (ICD)-9 codes 140-208 and ICD-10 codes C00-C97 as the underlying cause of death among residents during a calendar year. Despite the decline in the cancer death rate over the past decade, cancer remains the leading cause of mortality among all Alaskans and among Alaska Natives. In 2013, the cancer mortality rate among all Alaskans was 167.9, while for Alaska Natives the rate was 272.5 per 100,000 population (AK-IBIS, 2016).

**Figure 24. Trends in Cancer Incidence Rates per 100,000 Population (1970-1971 to 2012-2013)**




Source: AN EpiCenter, 2015

#### 3.6.1.1. Malignant Neoplasm (Cancer) Deaths

Malignant neoplasms, or cancer, is the number one leading cause of death in Alaska. In 2015, cancer claimed the lives of 962 Alaskans. More Alaskans died from cancer of the trachea, bronchus, and lung than any other type of cancer; 145 males and 112 females.

Among the leading causes of death in Alaska, cancer ranked second in total years of potential life lost with 9,214 years lost. On average, 9.6 years of life were lost prematurely for each cancer death.

Since 2006, the crude death rate for cancer has increased 12.6%. During this same time period, the age-adjusted death rate for cancer has decreased 14.4% (ADHSS, 2015b).

#### 3.6.1.2. Lung Cancer

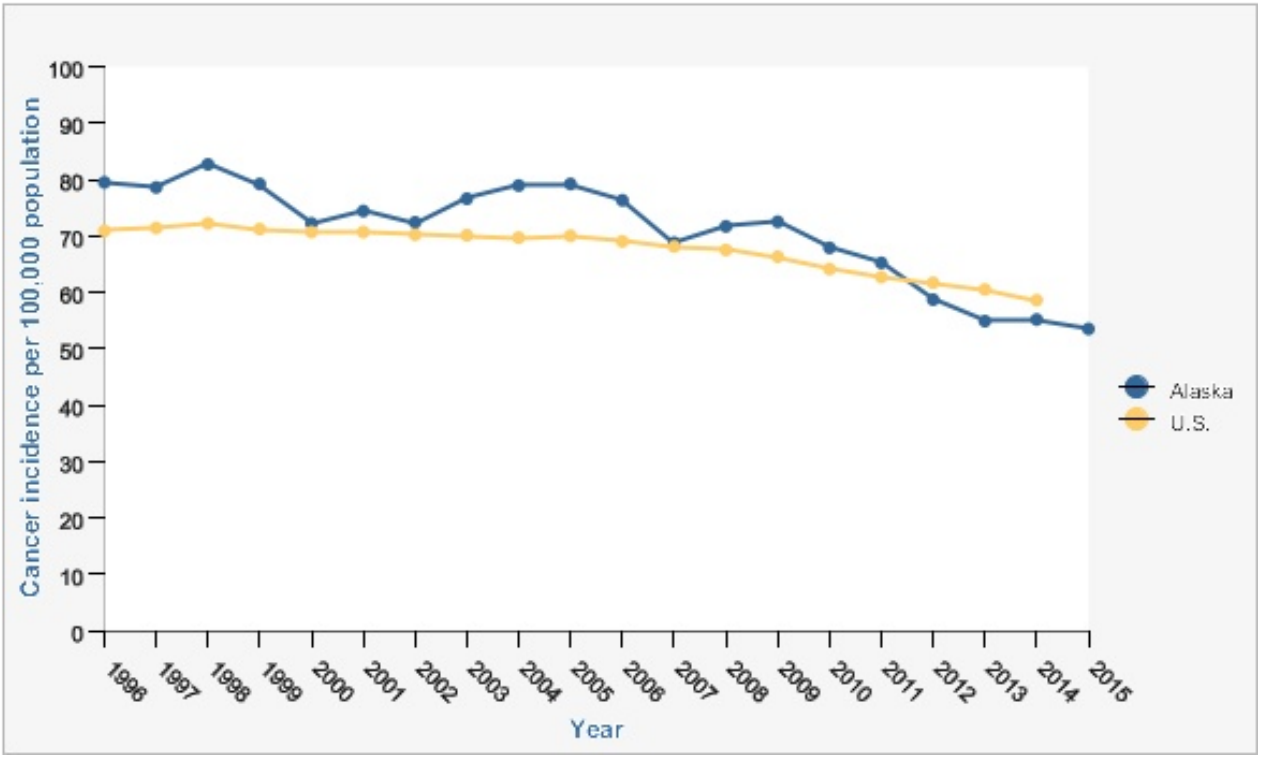
Lung cancer is the second most common cancer in men (after prostate cancer) and in women (after breast cancer) in the U.S. (AK-IBIS, 2016). Approximately two-thirds of people diagnosed with lung cancer are 65 or older; the average age at diagnosis is 70. The risk of men developing lung cancer is about 1 in 13; for women the risk is about 1 in 16. Typically, symptoms do not develop until the disease reaches an advanced stage, limiting early detection, thus lung cancer survival rates are relatively low (American Cancer Society, 2016).

Cigarette smoking is the largest risk factor for lung cancer, followed by cigar and pipe smoking and accounts for approximately 80% of lung cancer deaths. Chronic exposure to secondhand smoke will increase a non-smoker's chance of developing lung cancer by 20-30%. Other risk factors for lung cancer include: long-term exposure to radon, workplace exposure to asbestos fibers, exposure to diesel exhaust or outdoor air pollution, radiation therapy to the chest for a previous cancer, high levels of arsenic in drinking water, and a family history of lung cancer (American Cancer Society, 2016).

Between 2011 and 2013, the NSB (238.7 per 100,000 population) and Yukon-Koyukuk Census Area (229.4 per 100,000 population) had the highest rate of deaths due to malignant neoplasms exceeding the Alaska Statewide rate by more than 25% (168.1 per 100,000). Denali had the lowest number of deaths due to cancer (N=5). Among all regions, the highest death rate due to a specific cancer type was lung cancer.

Alaska has had consistently higher incidence rates of lung cancer than the U.S. overall. In 2011, Alaska's lung cancer incidence rate was 64.3 per 100,000 population compared with the national rate of 61.1 (Figure 25). Lung cancer is ranked second for the number of cancer incident cases in Alaska between 2008 and 2012. Lung cancer incidence rates have declined over the decade in both Alaska and the U.S. In Alaska, lung cancer incidence rates among men are consistently higher than among women, and men are on average about 1.4 times more likely to develop the disease (AK-IBIS, 2016). In 2012, the lung cancer incidence rate for men was 60.8 per 100,000 males, compared to 54.6 per 100,000 females. Between 1996 and 2012, the incidence of lung cancer ranged from a high of 120.3 per 100,000 population in NSB to a low of 34.9 per 100,000 population in Skagway-Hoonah-Angoon Census Area, compared to the statewide rate of 72.4. During this time period, Alaska Natives had a much higher incidence rate of lung cancer than any other race at 94.5 per 100,000 population, compared to 70.1 for Whites, 65.3 for Blacks, and 47.6 for Asians/Pacific Islanders.

**Figure 25. Lung Cancer Incidence Rate (Age-Adjusted), Alaska and US (1996-2015)**




Source: AK-IBIS, 2016

### 3.6.1.3. Breast Cancer

Excluding basal and squamous cell skin cancers, breast cancer is the most common cancer among U.S. women (AK-IBIS, 2016). Risk factors associated with breast cancer, include: excessive alcohol consumption, being overweight or obese after menopause, physical inactivity, previous exposure of the chest area to ionizing radiation for treatment of a different cancer at a young age, long-term use of hormone replacement therapy after menopause (especially estrogen plus progesterone), use of oral contraceptives, never having children or having a first child after age 30, having more menstrual cycles over a lifetime due to early start (before age 12) and/or late age of menopause, and a family history of breast cancer (American Cancer Society, 2014). Alaska has consistently had higher rates of breast cancer than the U.S. In 2011, Alaska's breast cancer rate was 128.4 per 100,000 females compared with the U.S. rate of 121.9.

Female breast cancer ranked first for the number of cancer incidence cases in Alaska between 2008 and 2012. Similar to the U.S. overall, breast cancer incidence in Alaska has remained relatively stable over the past decade. Among potentially affected regions, the lowest incidence of breast cancer occurred in Denali Borough (61.2 per females) and Yukon-Koyukuk Census Area (69.8 per females) between 1996 and 2012. During this time period, the highest incidence occurred among female residents of Matanuska Susitna Borough (135.4 per females). The statewide incidence was 131.9. Asians/Pacific Islanders had a lower incidence rate of breast cancer than any other race at 83.0 per 100,000 females, compared to 137.1 for

Alaska Natives, 134.8 for Whites, and 128.2 for Blacks. During 2011 to 2013, the breast cancer mortality rate was 18.6 per 100,000 women in Alaska. Among potentially affected regions, the KPB had the highest breast cancer mortality rate at 21.3 per 100,000 women, while Skagway-Hoonah-Angoon Census Area has the lowest breast cancer mortality rate with zero deaths.

#### 3.6.1.4. Prostate Cancer

Prostate cancer is the most common cancer among men (excluding basal and squamous cell skin cancers) in the U.S. Approximately 1 in 7 men (14%) will develop prostate cancer during their lifetime. Risk factors for developing prostate cancer include older age, Black race, a family history of prostate cancer, and a diet high in red meats, high-fat dairy products, or calcium (AK-IBIS, 2016). Prostate cancer ranked third among incident cancers among men between 2008 and 2012, statewide.

Among Potentially Affected regions, Southeast Fairbanks Census Area had the lowest incidence of prostate cancer with zero cases, while Hoonah-Angoon had the highest at 182.8 cases per 100,000 males (AK-IBIS, 2016). The statewide rate was 142.9 per 100,000 males. Prostate cancer incidence is strongly correlated with race. Between 1996 and 2012, Blacks had a much higher rate than any other race in Alaska at 249.4 per 100,000 males, compared to 151.7 for Whites, 106.3 for Asian/Pacific Islanders, and Alaska Natives had the lowest rate at 74.1 per 100,000 males. Despite the high incidence, most men who are diagnosed from cancer do not die as a result of the disease. The Alaska Statewide prostate cancer mortality rate was 18.2 per 100,000 males during 2011-2013, Rates among Potentially Affected Areas were similar to the statewide rate with the exception of Valdez-Cordova Census Area, which had a rate of 114.4. It should be noted, however, that this rate was based on fewer than 8 occurrences and is therefore statistically unreliable.

#### 3.6.1.5. Colorectal Cancer

Colorectal cancer is the third most common cancer found in men (after prostate and lung) and in women (after breast and lung) in the country. The risk of developing colorectal cancer is about 1 in 20 (5%) and is slightly higher for men as compared to women (AK-IBIS, 2016). Important risk factors for colorectal cancer include old age (approximately 90% of people with colorectal cancer are over age 50), diets high in red and processed meats, physical inactivity, obesity, smoking, and heavy alcohol use. Other risk factors include type 2 diabetes, inflammatory bowel disease, colorectal polyps, or previous colorectal cancer, as well as a family history of colorectal cancer (American Cancer Society, 2015).

Colorectal cancer ranked fourth in Alaska for the number of cancer incident cases during 2008-2012. Rates of colorectal cancer in Alaska and the U.S have declined over the past decade.

In 2011, the incidence of colorectal cancer was similar for all Alaskans (40.7 per 100,000 population) and the U.S. (40.0 per 100,000 population; AK-IBIS, 2016). Colorectal cancer incidence rates for men are consistently higher than for women, and men are 1.3 times more likely to develop the disease, on average in Alaska. In 2012, the colorectal cancer incidence rate for men was 41.7 per 100,000 males, as compared to 37.6 per 100,000 females.

Between 1996 and 2012, the NSB had the highest incidence rate for colorectal cancer (108.9 per 100,000 population), while Skagway-Hoonah-Angoon Census Area had the lowest (35.8 per population; AK-IBIS, 2016). During this same time period, Alaska Natives had a much higher incidence rate of colorectal cancer than any other race at 97.4 per 100,000 population, compared to 52.9 for Blacks, 44.6 for Whites, and 33.1 for Asians/Pacific Islanders (AK-IBIS, 2016). Between 2011 and 2013, colorectal cancer mortality rates were among the highest for all areas and in many cases, were the second leading rate of cancer death after lung cancer (Table 27).

The colorectal mortality rate cancer increases with age; median age at death is 74 years. Mortality from colorectal cancer is higher among men and in Black and American Indian/Alaska Native individuals of both sexes. Between 2007 and 2011, the highest rate of death from colorectal cancer was among Black men (National Cancer Institute, 2016).

**Table 27. Cancer Deaths by Type and Potentially Affected Area (2011-2013)**

| Cause of Death | Deaths | Age Adjusted Rate |
|---|---|---|
| **North Slope Borough** | | |
| Malignant Neoplasms | 36 | 238.7 |
| Colon, rectum and anus | 7 | 38.2 |
| Liver and intrahepatic bile ducts | 0 | 0.0 |
| Lung | 15 | 140.0* |
| Breast[b] | 2 | ** |
| Prostate[b] | 0 | 0.0 |
| Lymphoid & hematopoietic | 2 | ** |
| Non-hodgkin's lymphoma | 0 | 0.0 |
| Leukemia | 2 | ** |
| All other lymphoid & hematopoietic | 0 | 0.0 |
| All other malignant neoplasms | 0 | 0.0 |
| **Yukon-Koyukuk Census Area** | | |
| Malignant Neoplasms | 37 | 229.4 |
| Colon, rectum and anus | 4 | ** |
| Liver and intrahepatic bile ducts | 0 | 0.0 |
| Lung | 8 | 52.2* |
| Breast[b] | 2 | ** |
| Prostate[b] | 1 | ** |
| Lymphoid & hematopoietic | 4 | ** |
| Non-hodgkin's lymphoma | 3 | ** |
| Leukemia | 1 | ** |
| All other lymphoid & hematopoietic | 0 | 0.0 |
| All other malignant neoplasms | 18 | 107.6* |
| **Denali Borough** | | |
| Malignant Neoplasms | 5 | ** |
| Colon, rectum and anus | 1 | ** |
| Liver and intrahepatic bile ducts | 0 | 0.0 |
| Lung | 2 | ** |
| Breast[b] | 1 | ** |

| Cause of Death | Deaths | Age Adjusted Rate |
|---|---|---|
| Prostate[b] | 0 | 0.0 |
| Lymphoid & hematopoietic | 0 | 0.0 |
| Non-hodgkin's lymphoma | 0 | 0.0 |
| Leukemia | 0 | 0.0 |
| All other lymphoid & hematopoietic | 0 | 0.0 |
| All other malignant neoplasms | 1 | ** |
| **Fairbanks North Star Borough** | | |
| Malignant Neoplasms | 322 | 169.1 |
| Colon, rectum and anus | 26 | 12.6 |
| Liver and intrahepatic bile ducts | 11 | 5.6* |
| Lung | 94 | 51.2 |
| Breast[b] | 16 | 15.3* |
| Prostate[b] | 8 | 13.9* |
| Lymphoid & hematopoietic | 34 | 20.6 |
| Non-hodgkin's lymphoma | 13 | 7.9* |
| Leukemia | 12 | 6.7* |
| All other lymphoid & hematopoietic | 9 | 6.0* |
| All other malignant neoplasms | 133 | 65.4 |
| **Matanuska-Susitna Borough** | | |
| Malignant Neoplasms | 400 | 176.9 |
| Colon, rectum and anus | 29 | 14.2 |
| Liver and intrahepatic bile ducts | 14 | 4.6* |
| Lung | 116 | 51.7 |
| Breast[b] | 23 | 16.1 |
| Prostate[b] | 13 | 18.3* |
| Lymphoid & hematopoietic | 29 | 14.4 |
| Non-hodgkin's lymphoma | 9 | 4.3* |
| Leukemia | 16 | 8.1* |
| All other lymphoid & hematopoietic | 4 | ** |
| All other malignant neoplasms | 176 | 76.2 |
| **Kenai Peninsula Borough** | | |
| Malignant Neoplasms | 266 | 141.7 |
| Colon, rectum and anus | 25 | 13.4 |
| Liver and intrahepatic bile ducts | 10 | 3.7* |
| Lung | 77 | 39.8 |
| Breast[b] | 21 | 21.3 |
| Prostate[b] | 15 | 23.5* |
| Lymphoid & hematopoietic | 19 | 10.4* |
| Non-hodgkin's lymphoma | 10 | 5.4* |
| Leukemia | 6 | 4.0* |
| All other lymphoid & hematopoietic | 3 | ** |
| All other malignant neoplasms | 99 | 53.8 |
| **Municipality of Anchorage** | | |
| Malignant Neoplasms | 1082 | 158.3 |
| Colon, rectum and anus | 83 | 11.7 |
| Liver and intrahepatic bile ducts | 63 | 8.0 |

| Cause of Death | Deaths | Age Adjusted Rate |
|---|---|---|
| Lung | 296 | 44.9 |
| Breast[b] | 79 | 20.8 |
| Prostate[b] | 39 | 14.2 |
| Lymphoid & hematopoietic | 236 | 15.3 |
| Leukemia | 90 | 5.9 |
| All other lymphoid & hematopoietic | 61 | 3.8 |
| All other malignant neoplasms | 1160 | 66.3 |

Source: ABVS, 2016
[a] Age-adjusted rates are per 100,000 U.S. year 2000 standard population
* Rates based on fewer than 20 occurrences are statistically unreliable and should be used with caution.
**Rates based on fewer than 6 occurrences are not reported.

### 3.6.2. Cardiovascular Disease

Heart disease is not a single disease, but rather multiple diseases with different causes, risks, and potential interventions. Heart diseases include coronary heart disease, rheumatic heart disease, ischemic heart disease, hypertension, pulmonary heart diseases, heart failure, heart valve disease, cardiomyopathy, and other heart conditions. The most common form of heart disease is coronary heart disease (CHD), also known as coronary artery disease. CHD is the largest contributor to death from heart disease.

Modifiable risk factors for CHD include behaviors (e.g., tobacco use, physical inactivity, and improper nutrition), health status (e.g., hypertension, hyperlipidemia, overweight, or diabetes), and policies (e.g., smoking policies in restaurants and worksites; Fryar and Chen, 2012). Substantial differences in CHD death rates and preventive measures exist by race, age, sex, place of residence, and other demographic factors (Mozaffarian, 2015).

Heart disease is the second leading cause of death in Alaska. In 2015, heart disease claimed the lives of 835 Alaskans.

Among the leading causes of death in Alaska, heart disease ranked fourth in total years of potential life lost with 7,383 years lost. On average, 8.8 years of life were lost prematurely for each heart disease death.

Heart disease in Alaska declined between 2000 (213.1 deaths per 100,000 people) and 2013 (132.2 deaths per 100,000; AK-IBIS, 2016). In 2013, national rates of heart disease mortality were higher in males (206.5 per 100,000) than females (180.6 per 100,000). There is a growing disparity in heart disease mortality rates between Alaska Native and non-Native people. Alaska Native people had significantly higher rates of heart disease mortality (214.2 per 100,000) than white individuals (122.7) in Alaska in 2013 (AK-IBIS, 2016). Between 2008 and 2011, Alaska Native residents of the Interior had the highest heart disease mortality rate, exceeding the statewide rate (201.5 per 100,000 population) for all Alaska Natives by close to 40% (see Table 28). The Copper River/Prince William Sound Region had the lowest heart disease mortality rate at 104.5 per 100,000 population.

Since 2006, the crude death rate for heart disease has increased 21.1%. During this same time period the age-adjusted death rate has decreased 11.6% (ADHSS, 2015b).

Among the potentially affected boroughs and census areas, Valdez Cordova Census Area had the highest rate of major cardiovascular disease death at 233.8 per 100,000 population (see Table 29). Between 2011 and 2013, the lowest rate occurred among residents of the Municipality of Anchorage (119. 1 per 100,000 population), which was lower than the statewide rate of 189.9 deaths per 100,000 population. Heart disease was the leading cause of major cause cardiovascular disease death in all regions, with ischemic heart disease as the most common type.

**Table 28. Age-Adjusted Alaska Native Heart Disease Death Rates by Potentially Affected Tribal Health Region per 100,000 by Potentially Affected Native Health Corporation Region, Alaska Natives (2012-2015)**

| Tribal Health Region | Number of Deaths | Age Adjusted Rate per 100,000 |
|---|---|---|
| Arctic Slope | 18 | 166.7 |
| Interior | 69 | 166.0 |
| Anchorage/Mat-Su | 178 | 226.1 |
| Copper River/Prince William Sound | 11 | 264.4 |
| Kenai Peninsula | 29 | 264.3 |
| Alaska Statewide | 618 | 208.2 |
| Source: AN EpiCenter, 2018 | | |

**Table 29. Major Cardiovascular Disease Deaths by Potentially Affected Area (2011-2013)**

| Cause of Death | Deaths | Age Adjusted Rate |
|---|---|---|
| **North Slope Borough** | | |
| Major Cardiovascular Diseases | 20 | 165.8 |
| Heart Disease | 14 | 84.7* |
| Ischemic heart disease | 7 | 24.8* |
| Acute myocardial infarction | 0 | |
| Atherosclerotic cardiovascular disease | 5 | ** |
| All other ischemic heart disease | 2 | |
| All other heart disease | 7 | 60.0* |
| Cerebrovascular disease | 5 | ** |
| All other cardiovascular diseases | 1 | ** |
| **Yukon-Koyukuk Census Area** | | |
| Major Cardiovascular Diseases | 41 | 261.9 |
| Heart Disease | 35 | 220.2 |
| Ischemic heart disease | 23 | 126.0 |
| Acute myocardial infarction | 4 | ** |
| Atherosclerotic cardiovascular disease | 11 | 52.8* |
| All other ischemic heart disease | 8 | 50.4* |
| All other heart disease | 12 | 94.2* |
| Cerebrovascular disease | 6 | 41.7* |
| All other cardiovascular diseases | 0 | 0.0 |
| **Denali Borough** | | |
| Major Cardiovascular Diseases | 5 | ** |
| Heart Disease | 4 | ** |
| Ischemic heart disease | 4 | ** |

| Cause of Death | Deaths | Age Adjusted Rate |
|---|---|---|
| Acute myocardial infarction | 0 | 0.0 |
| Atherosclerotic cardiovascular disease | 3 | ** |
| All other ischemic heart disease | 1 | ** |
| All other heart disease | 0 | 0.0 |
| Cerebrovascular disease | 1 | ** |
| All other cardiovascular diseases | 0 | 0.0 |
| **Fairbanks North Star Borough** | | |
| Major Cardiovascular Diseases | 338 | 191.5 |
| Heart Disease | 242 | 130.1 |
| Ischemic heart disease | 139 | 68.0 |
| Acute myocardial infarction | 27 | 14.1 |
| Atherosclerotic cardiovascular disease | 55 | 20.5 |
| All other ischemic heart disease | 57 | 33.5 |
| All other heart disease | 103 | 62.1 |
| Cerebrovascular disease | 74 | 48.9 |
| All other cardiovascular diseases | 22 | 12.5 |
| **Matanuska-Susitna Borough** | | |
| Major Cardiovascular Diseases | 355 | 182.2 |
| Heart Disease | 263 | 131.2 |
| Ischemic heart disease | 149 | 66.6 |
| Acute myocardial infarction | 33 | 14.6 |
| Atherosclerotic cardiovascular disease | 48 | 17.9 |
| All other ischemic heart disease | 68 | 34.1 |
| All other heart disease | 114 | 64.7 |
| Cerebrovascular disease | 68 | 39.6 |
| All other cardiovascular diseases | 24 | 11.3 |
| **Kenai Peninsula Borough** | | |
| Major Cardiovascular Diseases | 296 | 183.7 |
| Heart Disease | 232 | 142.6 |
| Ischemic heart disease | 145 | 84.4 |
| Acute myocardial infarction | 25 | 14.7 |
| Atherosclerotic cardiovascular disease | 65 | 36.0 |
| All other ischemic heart disease | 55 | 33.7 |
| All other heart disease | 87 | 58.2 |
| Cerebrovascular disease | 45 | 30.6 |
| All other cardiovascular diseases | 19 | 10.5* |
| **Municipality of Anchorage** | | |
| Major Cardiovascular Diseases | 1067 | 119.1 |
| Heart Disease | 792 | 127.5 |
| Ischemic heart disease | 450 | 70.9 |
| Acute myocardial infarction | 76 | 13.4 |
| Atherosclerotic cardiovascular disease | 161 | 19.7 |
| All other ischemic heart disease | 213 | 37.8 |
| All other heart disease | 342 | 56.6 |
| Cerebrovascular disease | 208 | 36.9 |
| All other cardiovascular diseases | 67 | 11.0 |

| Cause of Death | Deaths | Age Adjusted Rate |
|---|---|---|
| **Southeast Fairbanks Census Area** | | |
| Major Cardiovascular Diseases | 34 | 206.0 |
| Heart Disease | 28 | 168.5 |
| Ischemic heart disease | 22 | 121.4 |
| Acute myocardial infarction | 0 | 0.0 |
| Atherosclerotic cardiovascular disease | 13 | 67.3* |
| All other ischemic heart disease | 9 | 54.1* |
| All other heart disease | 6 | 47.0* |
| Cerebrovascular disease | 3 | ** |
| All other cardiovascular diseases | 3 | ** |
| **Skagway-Hoonah-Angoon Census Area** | | |
| Major Cardiovascular Diseases | 15 | 208.0* |
| Heart Disease | 11 | 160.0* |
| Ischemic heart disease | 6 | 87.0* |
| Acute myocardial infarction | 1 | ** |
| Atherosclerotic cardiovascular disease | 2 | ** |
| All other ischemic heart disease | 3 | ** |
| All other heart disease | 5 | ** |
| Cerebrovascular disease | 4 | ** |
| All other cardiovascular diseases | 0 | 0.0 |
| **Valdez-Cordova Census Area** | | |
| Major Cardiovascular Diseases | 43 | 233.8 |
| Heart Disease | 34 | 183.6 |
| Ischemic heart disease | 23 | 115.8 |
| Acute myocardial infarction | 5 | ** |
| Atherosclerotic cardiovascular disease | 12 | 68.7* |
| All other ischemic heart disease | 6 | 30.9* |
| All other heart disease | 11 | 37.1* |
| Cerebrovascular disease | 9 | 50.1* |
| All other cardiovascular diseases | 0 | 0.0 |
| **Alaska Statewide** | | |
| Major Cardiovascular Diseases | 2866 | 189.9 |
| Heart Disease | 2146 | 137.7 |
| Ischemic heart disease | 1225 | 74.3 |
| Acute myocardial infarction | 246 | 15.7 |
| Atherosclerotic cardiovascular disease | 450 | 22.6 |
| All other ischemic heart disease | 529 | 24.1 |
| All other heart disease | 921 | 63.4 |
| Cerebrovascular disease | 544 | 40.4 |
| All other cardiovascular diseases | 176 | 11.8 |

Source: ABVS, 2016

[a]Age-adjusted rates are per 100,000 U.S. year 2000 standard population.

* Rates based on fewer than 20 occurrences are statistically unreliable and should be used with caution.

**Rates based on fewer than six occurrences are not reported.

### 3.6.3. Chronic Lower Respiratory Disease (Chronic Obstructive Pulmonary Disease)

Chronic lower respiratory disease (CLRD), or chronic obstructive pulmonary disease (COPD), is the fourth leading cause of death in Alaska. In 2015, CLRD claimed the lives of 204 Alaskans.

Among the leading causes of death in Alaska, CLRD ranked tenth in total years of potential life lost with 1,263 years lost. On average, 6.2 years of life were lost prematurely for each CLRD death.

Since 2006, the overall crude death rate for CLRD has increased 34.5%. During this same time period, the age-adjusted rate has decreased 3.1% (ADHSS, 2015b).

### 3.6.4. Cerebrovascular Disease (Stroke)

Cerebrovascular disease, or stroke, is the sixth leading cause of death in Alaska. In 2015, stroke claimed the lives of 178 Alaskans.

Among the leading causes of death in Alaska, cerebrovascular disease ranked ninth in years of potential life lost with 1,307 years lost. On average, 7.3 years of life were lost prematurely for each stroke death.

Since 2006, the overall crude death rate for stroke has decreased 6.6%. During this same time period, the age-adjusted rate has decreased 26.2% (ADHSS, 2015b).

### 3.6.5. Chronic Liver Disease & Cirrhosis

Chronic liver disease and cirrhosis is the eighth leading cause of death in Alaska. In 2015, chronic liver disease and cirrhosis claimed the lives of 113 Alaskans; 57 males and 56 females.

Among the leading causes of death in Alaska, chronic liver disease and cirrhosis ranked sixth in years of potential life lost with 2,112 years lost. On average, 18.7 years of life were lost prematurely for each chronic liver disease and cirrhosis death.

Since 2006, the overall crude death rate for chronic liver disease and cirrhosis has increased 135.4%. During this same time period, the age adjusted rate has increased 117.6%.

This is the single largest crude or age-adjusted rate increase of any leading cause of death in Alaska (ADHSS, 2015b).

### 3.6.6. Alzheimer's Disease

Alzheimer's disease is the ninth leading cause of death in Alaska. In 2015, Alzheimer's claimed the lives of 67 Alaskans; 18 males and 49 females.

Among the leading causes of death in Alaska, Alzheimer's disease ranked 31st in terms of potential life lost with 27 years lost. On average, 0.4 years of life were lost prematurely for each Alzheimer's disease death.

Since 2006, the crude death rate for Alzheimer's disease has decreased 15.7%. During this same time period, the age-adjusted rate has decreased 37.5% (ADHSS, 2015b).

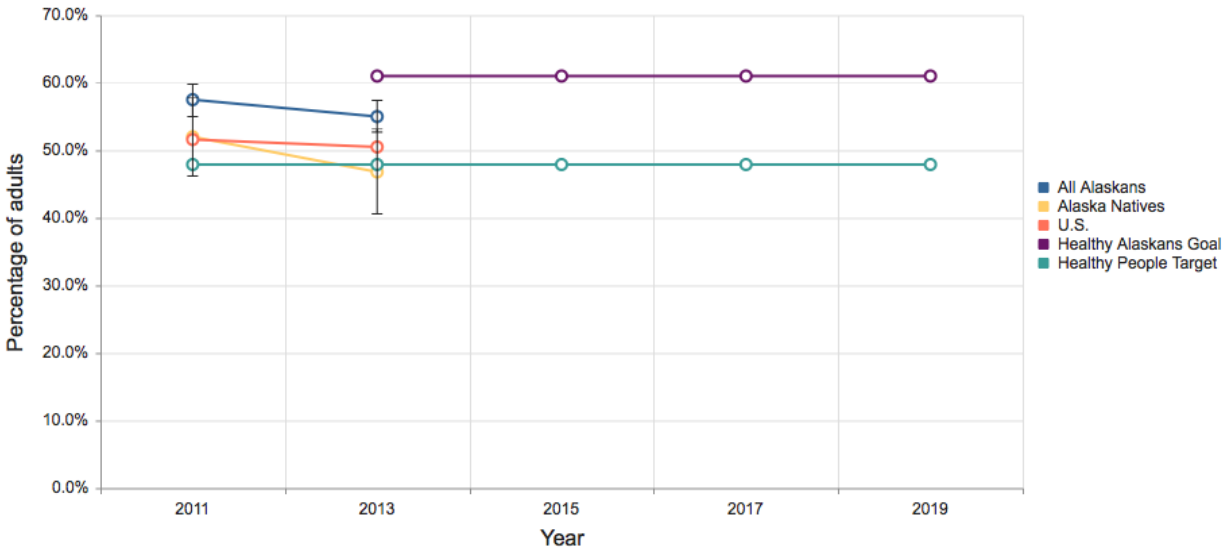
### 3.6.7. Physical Activity Levels

Consistent physical activity is an important indicator of future non-communicable diseases risk, particularly cardiovascular disease risk. Moderate physical activity is defined as some activity that causes an increase in breathing or heart rate (30 or more minutes a day, 5 or more days per week). Vigorous physical activity is defined as some activity that causes a large increase in breathing or heart rate (20 or more minutes a day, 3 times or more a week).

The HA2020 goal for physical activity is to increase the percentage of adults (age 18 years and older) who meet the 2008 U.S. Department of Health and Human Services Physical Activity Guidelines (150 minutes or more total minutes per week of moderate or vigorous exercise) to 61% by 2020. Figure 26 shows the percentage of adults getting the recommended amount of aerobic physical activity. In 2013, 55.0% of all Alaskans reported getting the recommended amount of physical activity, while 46.8% of Native Alaskans reported the same. The percentage of all adults nationally who reported getting the recommended amount of physical activity in 2013 was 50.5%.

Table 30 provides the percentage of people who had reported participating in any physical activities or exercises, such as running, calisthenics, golf, gardening, or walking for exercise, other than for their job for each potentially affected region. The highest percentage of people residing in Hoonah-Angoon Census Area answered yes to this question (92.7%), followed by the Municipality of Anchorage (80.9%). The lowest percent of people living in the NSB reported leisure time physical activity.

**Figure 26. Percent of Adults (18+) Who Report Getting the Recommended Amount of Aerobic Physical Activity, all Alaskans, Alaska Natives, and the U.S. (2011-2019)**




Source: ADHSS, Section of Chronic Disease Prevention and Health Promotion (DPH), 2018; National Center for Chronic Disease Prevention and Health Promotion, 2018

**Table 30. Leisure Time Physical Activity Rates by Potentially Affected Region (2011-2013)**

| Census Area | Number | Age-Adjusted Prevalence |
|---|---|---|
| North Slope Borough | 265 | 66.0% |
| Yukon-Koyukuk Census Area | 460 | 74.2% |
| Fairbanks North Star Borough | 2,816 | 79.1% |
| Denali Borough | 155 | 77.4% |
| Matanuska-Susitna Borough | 2,366 | 76.9% |
| Kenai Peninsula Borough | 1,986 | 75.1% |
| Municipality of Anchorage | 3,474 | 80.9% |
| Southeast Fairbanks Census Area | 431 | 76.8% |
| Hoonah-Angoon Census Area | 93 | 92.7% |
| Valdez-Cordova Census Area | 411 | 76.6% |
| Alaska Statewide | | |
| Source: BRFSS, 2016 | | |

### 3.6.8. Obesity and Overweight

Obesity and overweight are terms that define an accumulation of fat that is greater than what is considered healthy. Being overweight or obese increases the risk of diabetes, diseases of the heart (mainly stroke and heart disease), cancer, and even death (WHO, 2014).

The prevalence of obesity and overweight in the U.S. is significantly higher today as compared to previous decades, in all age groups. One of the largest changes has been an increase in the number of Americans in the obese category. In the 1970s, the prevalence of obesity was 5% for children between the ages of 2 and 5 years, 4% for children ages 6 to 11 years, 6% for adolescents ages 12 to 19 years, and 15% for adults. By 2008, the prevalence of obesity had reached 10% for children 2 to 5 years, 20% for children 6 to 11 years, 18% for adolescents 12 to 19 years, and 34% for adults. In the early 1990s, no state had an adult obesity prevalence rate of more than 25%. Since 2008, 32 states have an adult obesity rate more than 25% (USDHHS, 2015). Obesity increases the risk of Type 2 diabetes, heart disease, high blood pressure, stroke gallbladder disease, osteoarthritis, sleep apnea, respiratory problems, and some types of cancer. It also adversely effects physical performance, life expectancy, and quality of life. The current generation of children is predicted to have a shorter lifespan than their parents due to obesity (Olshansky et al., 2005).

Body mass index (BMI) is a commonly used indicator of obesity and overweight status. Current BMI assessment requires that height and weight be collected within the last 5 years or if over age 50, within the last 2 years. Children must have been assessed within the last year. These terms are defined as:

- Overweight (adults 19 – 74 years): Persons who have a current BMI assessment with a BMI of 25 to 29.9.
- Obese (adults 19 – 74 years): Persons who have a current BMI assessment with a BMI of 30 or greater.
- Overweight (children 18 and younger): Persons who have a current BMI assessment with a BMI greater than or equal to the 85th percentile using age-specific growth charts are considered ‘at risk of overweight’.

- Obese (children 18 years and younger): Persons who have a current BMI assessment with a BMI greater than or equal to the 95th percentile using age-specific growth charts are considered obese.

In 2014, the prevalence of obesity and overweight among all Alaskan adults (ages 18 and over) was 29.7% and 36.5%, similar to the national prevalence, 29.6% and 35.4%, respectively (AK-IBIS, 2016). Obesity and overweight prevalence among Alaskans adolescents (students in grades 9-12 in traditional schools) was 14.0% and 16.7% and among children (grades K-8), 17.3% and 16.7%, respectively. Between 2011 and 2013, the NSB had the highest prevalence of obesity at 39.9%, while Denali Borough had the lowest at 19.9% (see Table 31). Hoonah-Angoon Census Area had the highest percentage of overweight adults at 49.5%. The percentage of overweight adults was similar across other potentially affected regions.

**Table 31. Age-adjusted Prevalence of Obesity and Overweight Residents by Age Group and Potentially Affected Area, (2011-2013)**

| Census Area | Obesity | Overweight |
|---|---|---|
| | Age-adjusted Prevalence/ All Alaskan Adults | Age-adjusted Prevalence/ All Alaskan Adults |
| North Slope Borough | 39.9% | 37.9% |
| Yukon-Koyukuk Census Area | 27.5% | 38.2% |
| Fairbanks North Star Borough | 26.9% | 36.0% |
| Denali Borough | 19.9% | 41.8% |
| Matanuska-Susitna Borough | 28.3% | 38.4% |
| Kenai Peninsula Borough | 28.0% | 39.6% |
| Municipality of Anchorage | 29.0% | 36.8% |
| Southeast Fairbanks Census Area | 27.7% | 39.0% |
| Hoonah-Angoon Census Area | 28.9% | 49.5% |
| Valdez-Cordova Census Area | 27.6% | 39.2% |
| Alaska Statewide | | |
| Source: BRFSS, 2016 | | |

### 3.6.9. Cerebrovascular Disease (Stroke) Deaths

Cerebrovascular disease, or stroke, is the sixth leading cause of death in Alaska. In 2015, stroke claimed the lives of 178 Alaskans.

Among the leading causes of death in Alaska, cerebrovascular disease ranked ninth in years of potential life lost with 1,307 years lost. On average, 7.3 years of life were lost prematurely for each stroke death.

Since 2006, the overall crude death rate for stroke has decreased 6.6%. During this same time period, the age-adjusted rate has decreased 26.2% (ADHSS, 2015b).

### 3.6.10. Diabetes Mellitus Deaths

Diabetes mellitus is a metabolic disease characterized by high blood sugar levels, which result from defects in insulin secretion, insulin resistance, or both. Diabetes occurs when sugars stays in the bloodstream rather than going into the muscle and fat cells. There are two types of diabetes: Type 1 and Type 2. Type

2 is the most common type of diabetes and is considered a preventable illness. Uncontrolled diabetes can have serious medical consequences including eye disease, dysfunction of circulation and sensation in the hands and feet, cardiovascular diseases, and ultimately, death. As both a risk factor for many diseases and a serious medical condition needing treatment itself, diabetes is an extremely serious public health challenge with tremendous population health impacts.

Diabetes has reached epidemic proportions in the U.S. According to the CDC, the number of Americans diagnosed with diabetes has more than tripled, from 5.6 million in 1980 to 20.9 million in 2011 (Seaquist, 2012). Currently, the CDC estimates that one in three persons will develop diabetes during their lifetime (CDC, 2015).

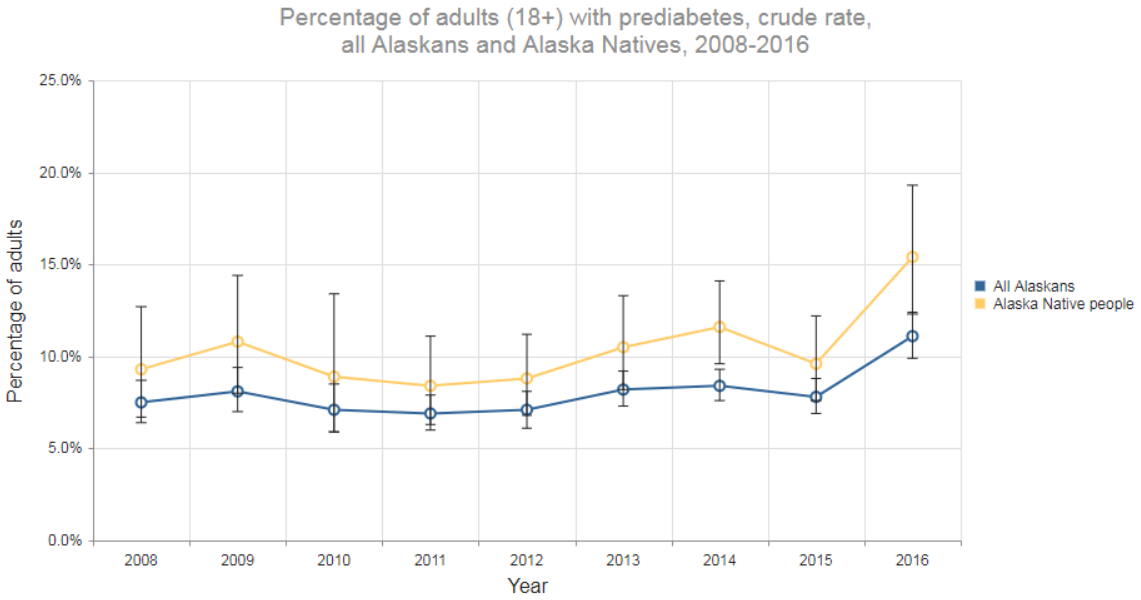
The prevalence of diabetes has steadily increased, both nationally and in Alaska due to: increasing rates of obesity and sedentary lifestyles; as well as while improvements in medical care, which has extended the lifetime of people living with diabetes. The percentage of adults with diabetes in Alaska is lower than that for the U.S. (Figure 27). As of 2012, only 39.2% of individuals with a diagnosis of diabetes in Alaska saw a health care professional for their diabetes (AK-IBIS, 2016).

Diabetes is the seventh leading cause of death in Alaska. In 2015, diabetes claimed the lives of 140 Alaskans: 91 males and 49 females.

Among the leading causes of death in Alaska, diabetes ranked 11th in terms of potential life lost with 1,236 years lost. On average, 8.8 years of life were lost prematurely for each diabetes death.

Since 2006, the crude rate of deaths due to Diabetes Mellitus has increased 17.3%. During this same time period, the age-adjusted rate has decreased 12.9% (ADHSS, 2015b).

**Figure 27. Percentage of Adults (18+) with Diabetes, Crude Rate, all Alaskans, Alaska Natives, and U.S. (1991-2014)**




Source: AK-IBIS, 2016

Table 32 shows the prevalence and death rate due to diabetes among potentially affected regions. Skagway Municipality had the highest prevalence of diabetes (9.7%), while Valdez-Cordova Census Area had the lowest (5.6%). Southeast Fairbanks Census Area (33.2 per 100,000 population) had the highest rate of diabetes death, exceeding the statewide rate of 19.4 per 100,000 population; however, this rate was based on fewer than 20 occurrences and is, therefore, not statistically reliable. The Municipality of Anchorage (22.2%) had the highest diabetes death rate, which was based on more than 20 occurrences, slightly above the statewide rate. FNSB had the lowest rate of death due to diabetes at 13.0 per 100,000 population.

**Table 32. Age-adjusted Diabetes Prevalence and Deaths due to Diabetes by Potentially Affected Area, (2011-2013)**

| Census Area | Age-adjusted Diabetes Prevalence/All Alaskan Adults | Number of Diabetes Deaths | Age-adjusted Diabetes Death Rate/All Alaskans |
|---|---|---|---|
| North Slope Borough | 7.5% | 2 | ** |
| Yukon-Koyukuk Census Area | 6.7% | 4 | ** |
| Fairbanks North Star Borough | 6.6% | 26 | 13.0 |
| Denali Borough | 7.3% | 1 | ** |
| Matanuska-Susitna Borough | 7.8% | 43 | 18.5 |
| Kenai Peninsula Borough | 6.9% | 33 | 17.8 |
| Municipality of Anchorage | 8.2% | 140 | 22.2 |
| Southeast Fairbanks Census Area | 7.3% | 7 | 33.2* |
| Skagway Municipality | 9.7% | ND | ND |
| Skagway-Hoonah-Angoon | ND | 3 | ** |
| Valdez-Cordova Census Area | 5.6% | 6 | 24.6* |
| Alaska Statewide | ND | 324 | 19.4 |

Source: BRFSS, 2016; ABVS, 2016
[a]Age-adjusted rates are per 100,000 U.S. year 2000 standard population.
* Rates based on fewer than 20 occurrences are statistically unreliable and should be used with caution.
**Rates based on fewer than 6 occurrences are not reported.
ND: Not determined

### 3.6.11. Chronic Lower Respiratory Diseases

CLRD includes asthma, COPD, bronchitis, and emphysema. In 2014, this suite of diseases was the fourth leading cause of death in Alaska and in the U.S. Between 2011 and 2013, the highest rate (statistically reliable) of death due to chronic respiratory disease occurred among MSB residents (50.0 per 100,000 population). The lowest rate occurred in Denali Borough where there were no deaths related to CLRD. Rates across other potentially affected regions were relatively similar to the statewide rate of 39.4 per 100,000 population (see Table 33).

**Table 33. Age-adjusted Chronic Lower Respiratory Disease Death Rate by Potentially Affected Area and Statewide (2011-2013)**

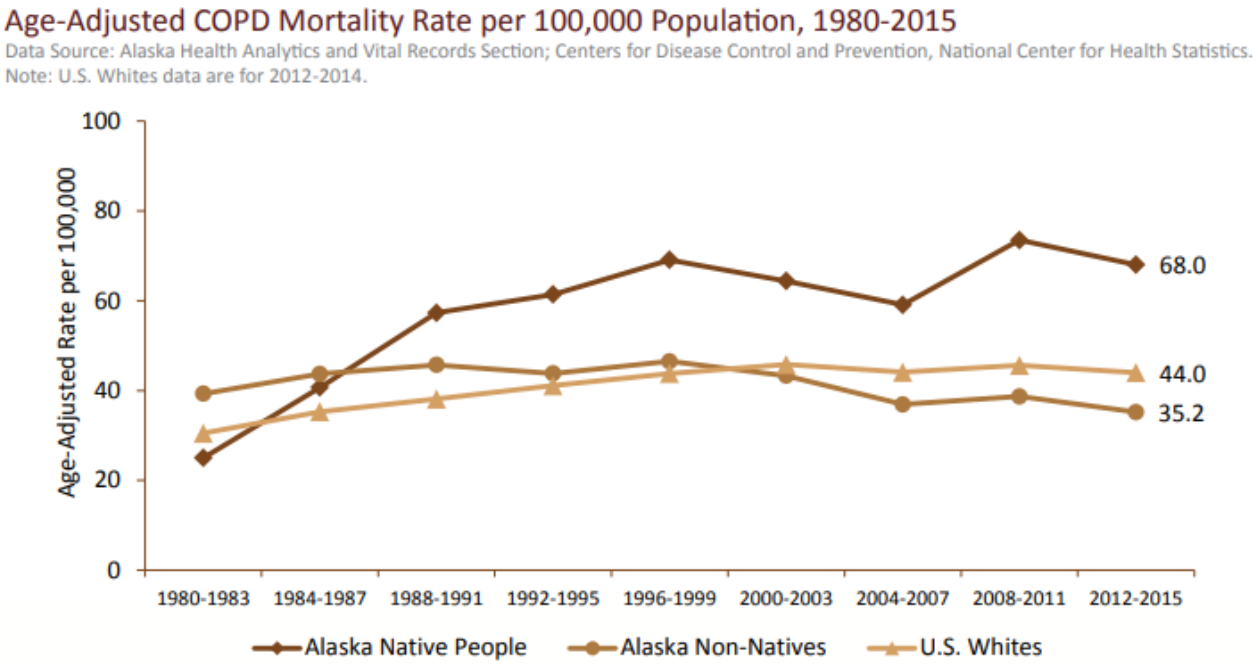
| Borough/Census Area | Number of Deaths | Age-adjusted Rate |
|---|---|---|
| North Slope Borough | 10 | 117.3* |
| Yukon-Koyukuk Census Area | 5 | ** |
| Fairbanks North Star Borough | 66 | 40.0 |
| Denali Borough | 0 | 0.0 |
| Matanuska-Susitna Borough | 87 | 50.0 |
| Kenai Peninsula Borough | 67 | 37.7 |
| Municipality of Anchorage | 215 | 35.0 |
| Southeast Fairbanks Census Area | 7 | 39.5* |
| Skagway-Hoonah-Angoon Census Area | 2 | ** |
| Valdez-Cordova Census Area | 6 | 27.0* |
| Alaska Statewide | 579 | 39.4 |
| Source: ABVS, 2016 | | |

## 3.6.12. Chronic Obstructive Pulmonary Disease

COPD refers to a group of lung diseases that block airflow and make breathing difficult. Risk factors include tobacco smoking, underlying asthma plus smoking, age, genetics and chronic exposure to chemical fumes, vapors, and dusts (Mayo Clinic, 2014). COPD mortality includes deaths from bronchitis, emphysema, and other CLRDs excluding asthma.

There is significant disparity in rates of COPD mortality between Alaska Natives and Non-Natives. During 2008-2011, Alaska Native people experienced a COPD mortality rate 1.9 times higher than non-Natives and 1.6 times higher than U.S. Whites ($p<0.01$; see Figure 28). The highest (statistically reliable) COPD mortality rate occurred in the Interior Tribal Health Region at 137.9 per 100,000 population, while the lowest occurred in Anchorage/Mat-Su (62.7 per 100,000 population; see Table 34). The statewide COPD mortality rate among Alaska Natives for this time period was 73.5 per 100,000 population.

**Figure 28. Average Annual Age-Adjusted COPD Mortality Rates per 100,000 Population (1980-2015)**




Source: AN EpiCenter, 2018

**Table 34. Average Annual Age-Adjusted COPD Mortality Rates per 100,000 Population by Tribal Health Region, Alaska Native People (2008-2011)**

| Tribal Health Region | Number of Deaths | Rate |
|---|---|---|
| Arctic Slope | 10 | 113.9 |
| Interior | 27 | 74.9 |
| Kenai Peninsula | 8 | 56.3 |
| Anchorage/Mat-Su | 45 | 61.2 |
| Statewide | 183 | 68.0 |
| Source: AN EpiCenter, 2017<br>Note: Rates based on fewer than 20 cases are not statistically reliable and should be used with caution. Number and rate not reported for less than five cases. | | |

## 3.6.13. Mental Health

Mental health, or behavioral health, is increasingly considered a critical component of overall health and is linked to physical health and well-being for people at all ages. Mental health was recognized in the U.S. Surgeon General's 1999 report as being fundamental to overall health (U.S. Office of the Surgeon General, 1990). Evidence has shown that mental disorders are strongly related to the occurrence, successful treatment, and course of many chronic diseases including diabetes, cancer, cardiovascular disease, asthma, and obesity, as well as many risk behaviors for chronic disease, including physical inactivity, smoking, excessive drinking, and insufficient sleep (AK-IBIS, 2016). In teens, depression can lead to poor grades at school, alcohol or drug use, and unsafe sex. Research has demonstrated that mental health issues have been the most commonly identified precipitating circumstance in suicides.

The HA2020 goal for mental health is reduce the mean number of days in the past 30 days that adults (age 18 and older) report being mentally unhealthy to 2.9 days by 2020. In 2014, the mean number of mentally unhealthy days was 3.1 for all Alaskans and 3.0 for Alaska Native people (AK-IBIS, 2016). Females reported a higher number of mentally unhealthy days (3.6) as compared to males (2.6) in 2014. Overall, people over the age of 65 reported fewer mentally unhealthy days than most younger age groups. Alaska Native people reported significantly more mentally unhealthy days during the past 30 days (3.7) than White individuals (3.0; AK-IBIS).

Results from the 2015 YRBS found both short-term and longer-term trends show an increase in the percentage of students feeling sad or hopeless (33.6% in 2015). There has also been an increase in the percentage of students who say they feel alone (24.8% in 2015; YRBS, 2016). Between 2013 and 2015, there was also an increase in the percentage of students who had seriously considered suicide (20.1% in 2015). There were no significant long-term or recent changes in the percentages of students planning (16.7% in 2015) or making a suicide attempt (10.7% in 2015) (YRBS, 2016).

## 3.7. Health Effect Category 7: Water and Sanitation

The lack of clean running water and proper sewage disposal is a leading cause of preventable disease in rural Alaska villages. Respiratory, gastrointestinal, and skin diseases are common in areas without safe water supplies. Many Alaska villages continue to lack adequate sources of water that are safe to drink and facilities that can safely dispose of their wastewater. Hennessy et al. (2008) found that regions with a lower proportion of home water service had significantly higher hospitalization rates for pneumonia and influenza (rate ratio [RR] = 2.5), skin or soft tissue infection (RR = 1.9), and respiratory syncytial virus (RR = 3.4 among those younger than 5 years) than did higher-service regions. Within one region, infants from villages with less than 10% of homes served had higher hospitalization rates for pneumonia (RR = 1.3) and respiratory syncytial virus (RR = 1.2) than did infants from villages with more than 80% served. Outpatient *Staphylococcus aureus* infections (RR = 5.1, all ages) and skin infection hospitalizations (RR = 2.7, all ages) were higher in low-service than in high-service villages.

A “served” community is one in which more than 55% of homes are served by a piped, septic tank and well, or covered haul system. An “unserved” community is one in which 55% or less of homes are served by a piped, septic and well, or covered haul system (ADEC, 2016). The number of occupied houses in the “unserved” communities ranges from 12 to 193 with an average of four people per household. There are currently more than 3,300 year-round occupied rural Alaska homes that lack running water and flushing toilets (2,300 homes in 47 "unserved" communities and 1,000 homes in served communities).

Water in sewer systems in rural Alaska primarily consist of the following:

- **Public laundry facilities and central watering points** – Treated drinking water is delivered to a single service connection and people must use their own containers to collect drinking water. These systems do not provide drinking water to homes or wastewater removal from homes.
- **Individual wells and septic systems** – Due to soil conditions (e.g. permafrost), these systems are not feasible in many parts of the State. Where they are used drinking water wells and septic

systems often do not meet the minimum separation distances for safety. Wells can become contaminated with inadequately treated sewage.

- **Water and sewer truck or trailer haul systems** – Because this type of service is costly, homeowners will often self-limit water use, and therefore, do not realize many of the health benefits associated with household running water and sanitary sewage removal.
- **Piped water and sewer systems** – This type of service provides centralized treatment, storage and piped distribution directly to homes (ADEC, 2016).

More than 700 homes are served by operation-intensive haul systems. There are approximately 4,500 rural homes connected to community-wide piped systems that have surpassed or are nearing the end of their design life. The ADEC, Division of Water recognizes that conventional, community-wide piped systems and truck haul systems are increasingly expensive to construct, maintain, and replace (ADEC, 2016). An increasing number of communities cannot afford the high operation and maintenance costs associated with piped or haul systems. The monthly user cost for operating these systems often exceeds 5% of total monthly household income in many villages (as compared to 1 – 2% of monthly household income in most urban areas). In response to this public health challenge, the ADEC, in partnership with a multi-agency steering committee (consisting of experts in various fields related to water and wastewater), is developing a decentralized approach to provide small scale treatment at each home, avoiding the need to pipe water from a central source to multiple homes and collect sewer from homes and pipe to a disposal site (ADEC, 2016).

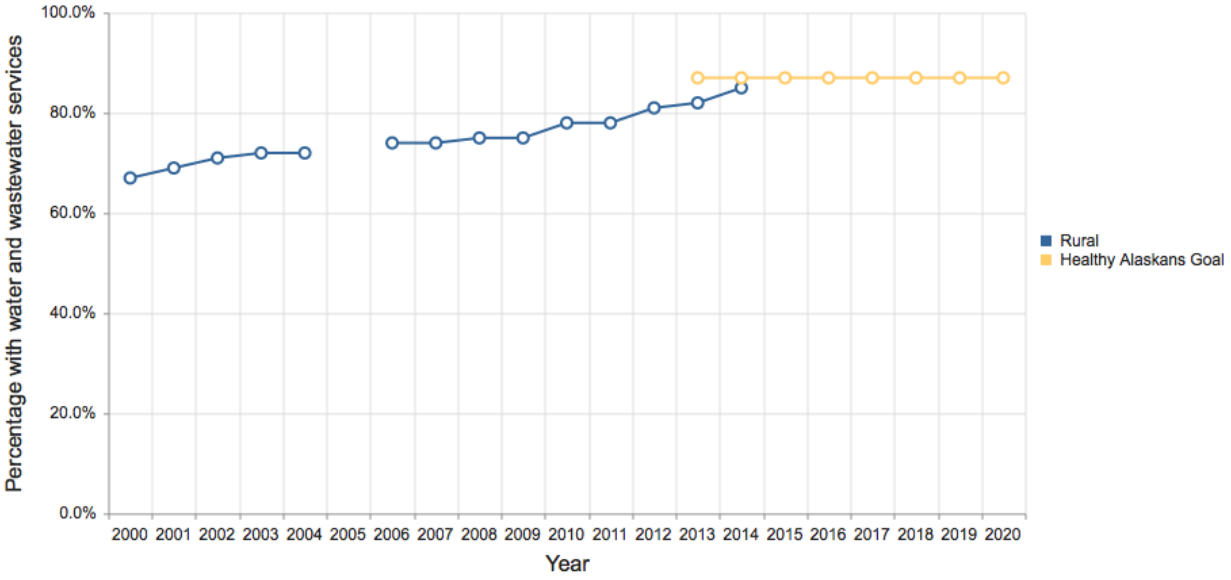
Proper disposal of solid waste is also important to human and animal health. Improper dumping and poorly designed landfills can contaminate water supplies, attract wildlife foraging, create unpleasant odors, and allow litter to be blown over surrounding land. ADEC regulates and permits landfills in rural and urban areas.

### 3.7.1. Water and Sanitation Facilities and Services within Potentially Affected Communities

See Resource Report No. 2, Sections 2.2 and 2.3, for water resources baseline conditions.

Despite major improvements in recent decades, Alaska still lags behind other states in having basic sanitation services. Table 35 provides the water and sanitation services available in the PACs. In 2014, 85.0% of rural community housing units statewide had water and sewer services, falling short of the HA2020 goal of 87.0% (Figure 29).

**Figure 29. Percentage of Rural Community Housing Units with Water and Sewer Services, Rural Alaska (2000-2020)**




Source: AK-IBIS, 2016

**Table 35. Water and Sanitation Services, Potentially Affected Communities**

| Location | Solid Waste | Sewer | Water Treatment and Distribution | Unserved Rural Community |
|---|---|---|---|---|
| **North Slope Borough** | | | | |
| Prudhoe Bay | NSB operates a Class I ADEC permitted landfill located northwest of Deadhorse on Oxbow Road | Three wastewater collection and treatment systems serving a total of approximately 2,000 people. Two are owned and operated by BP Exploration (Alaska) Inc., one by NSB | In November 2015, NSB opened a new processing facility off the Sag River Road in Prudhoe Bay for water, wastewater, and sewage | NA |
| **Yukon-Koyukuk Census Area** | | | | |
| Bettles | Use landfill in Evansville | ND | ND | NA |
| Coldfoot | Use Fairbanks North Star Borough South Cushman Landfill | ND | ND | NA |
| Evansville | ADEC Class III permitted landfill located in Evansville Village operated by the Village | ND | ND | ND |

| Location | Solid Waste | Sewer | Water Treatment and Distribution | Unserved Rural Community |
|---|---|---|---|---|
| Livengood | Use Fairbanks North Star Borough South Cushman Landfill | ND | ND | ND |
| Manley Hot Springs | ADEC Class I permitted landfill operated by the Manley Hot Springs Community Association | ND | ND | ND |
| Minto | ADEC Class III permitted landfill operated by the Native Village of Minto | ND | ND | ND |
| Nenana | Refuse is collected by a private firm and hauled to the new Denali Borough regional landfill, located south of Anderson | A piped gravity system collects sewage, which is treated at a secondary treatment plant | Close to 100% of residents have treated, fluoridated water piped to their homes There are 226 connections serving 432 people | ND |
| Wiseman | Use Fairbanks North Star Borough South Cushman Landfill | | | ND |
| **Fairbanks North Star Borough** | | | | |
| Fairbanks City | Fairbanks North Star Borough South Cushman Landfill is an ADEC Class I permitted landfill serving number of communities in the region | 2 wastewater collection and treatment systems (CUC and GHU) operated by Golden Heart Utilities serving a total of 41,182 people with 8,431 connections | The GHU water treatment and distribution system serves 77,535 people with 6,415 connections | NA |
| **Denali Borough** | | | | |
| Anderson | Use Denali Borough Denali Borough operates an ADEC Class III permitted landfill located on the Parks Highway outside of Anderson serving a number of communities in the area | ND | ND | ND |

| Location | Solid Waste | Sewer | Water Treatment and Distribution | Unserved Rural Community |
|---|---|---|---|---|
| Cantwell | Use Denali Borough landfill | ND | ND | ND |
| Healy | Use Denali Borough landfill | ND | ND | ND |
| McKinley Park | Use Denali Borough landfill | ND | ND | ND |
| **Matanuska-Susitna Borough** | | | | |
| Big Lake | Use Palmer Matanuska-Susitna Borough landfill | ND | ND | ND |
| Houston | Use Palmer Matanuska-Susitna Borough landfill | ND | ND | ND |
| Knik-Fairview | Use Palmer Matanuska-Susitna Borough | ND | ND | ND |
| Palmer | ADEC permitted landfill is operated by Matanuska-Susitna Borough | ND | ND | ND |
| Point MacKenzie | Use Palmer Matanuska-Susitna Borough landfill | ND | ND | ND |
| Skwentna | Matanuska-Susitna Borough operates an ADEC permitted Class III landfill | ND | ND | ND |
| Talkeetna | Use Palmer Matanuska-Susitna Borough landfill | Mat-Su Borough operates a wastewater collection and treatment system serving 450 residents with 215 connections | Mat-Su Borough operates a water treatment and distribution system serving 1,100 people | NA |
| Trapper Creek | Use Palmer Matanuska-Susitna Borough landfill | ND | ND | ND |
| Wasilla | Use Palmer Matanuska-Susitna Borough landfill | City of Wasilla operates a wastewater collection and treatment system serving 2,685 people with 895 connections | City of Wasilla operates a water treatment and distribution system with 848 connections, serving 18,222 people regionally | |
| Willow | Use Palmer Matanuska-Susitna Borough landfill | ND | ND | ND |

| Location | Solid Waste | Sewer | Water Treatment and Distribution | Unserved Rural Community |
|---|---|---|---|---|
| Kenai Peninsula Borough | Soldotna Kenai Peninsula Borough Central Landfill (operated by the borough) is located three miles south of the Kenai River bridge in Soldotna. Landfill accepts waste from all communities on Kenai Peninsula except Seldovia, Nanwalek, and Port Graham, which each have their own landfills | ND | ND | ND |
| Anchor Point | Anchor Point Transfer Site; waste is transported to Soldotna Kenai Peninsula Borough Central Landfill | ND | Anchor Point Water Treatment System serves 348 people | ND |
| Beluga | The Kenai Peninsula Borough operates a landfill in Beluga | ND | Water is supplied by three deep wells and is piped to 75% of households | ND |
| Clam Gulch | Use Soldotna Kenai Peninsula Borough Central Landfill | ND | ND | ND |
| Cohoe | Use Soldotna Kenai Peninsula Borough Central Landfill | ND | ND | ND |
| Cooper Landing | Locally use Cooper Landing Transfer Site; waste is transported to Soldotna Kenai Peninsula Borough Central Landfill | ND | | NA |

| Location | Solid Waste | Sewer | Water Treatment and Distribution | Unserved Rural Community |
|---|---|---|---|---|
| Happy Valley | Use Soldotna Kenai Peninsula Borough Central Landfill or Anchor Point Transfer Site; waste is transported to Soldotna Kenai Peninsula Borough Central Landfill | ND | ND | ND |
| Homer | Locally use Homer Baling/Landfill Facility or McNeil Canyon Transfer Site | ND | ND | ND |
| Soldotna Kenai Peninsula Borough Central Landfill. | City of Homer operates a wastewater treatment and collection system serving 5,400 people with 1,500 connections | City of Homer operates a water treatment and distribution system serving 6,008 people | NA | ND |
| Kalifornsky | Use Soldotna Kenai Peninsula Borough Central Landfill | ND | ND | ND |
| Kasilof | Locally use Kasilof Transfer Site; waste is transported to Soldotna Kenai Peninsula Borough Central Landfill | ND | ND | NA |
| Kenai | Locally use Kenai Transfer Facility | City of Kenai operates a wastewater collection and treatment system serving 5,380 people with 1,793 connections | City of Kenai operates a water distribution system serving 5,375 people | ND |
| Moose Pass | Locally use Crown Point Transfer Site; waste is transported to Soldotna Kenai Peninsula Borough Central Landfill | Individual septic | Private wells | NA |

| Location | Solid Waste | Sewer | Water Treatment and Distribution | Unserved Rural Community |
|---|---|---|---|---|
| Nikiski | Locally use Nikiski Transfer Facility; waste is transported to Soldotna Kenai Peninsula Borough Central Landfill | Individual septic | Private wells | NA |
| Ninilchik | Locally use Ninilchik Transfer Site; waste is transported to Soldotna Kenai Peninsula Borough Central Landfill | Individual septic | Private wells | NA |
| Salamatof | Use Soldotna Kenai Peninsula Borough Central Landfill or Kenai Transfer Site | Individual septic | Private wells | |
| Seward | Locally use Seward Transfer Facility; waste is transported to Soldotna Kenai Peninsula Borough Central Landfill | City of Seward operates a wastewater collection and treatment system serving 2,830 with 750 connections | City of Seward operates a water distribution system serving 4,000 people | NA |
| Soldotna | Use Soldotna Kenai Peninsula Borough Central Landfill | City of Soldotna operates a wastewater treatment and collection system serving 3,800 people with 1,300 connections | City of Soldotna water serves distribution system 4,307 people | NA |
| Sterling | Locally use Sterling Transfer Facility; waste is transported to Soldotna Kenai Peninsula Borough Central Landfill | Individual septic | Private wells | ND |

| Location | Solid Waste | Sewer | Water Treatment and Distribution | Unserved Rural Community |
|---|---|---|---|---|
| Tyonek | Kenai Peninsula Borough operates a landfill 2 miles northwest of the Village | A piped water and sewer system serves the entire community of approximately 50 homes (many used seasonally) and community facilities. Water is derived from Second Lake and is treated and stored in a 175,000-gallon tank. Back-up water supplies are available from a lake near the airport. All occupied homes are fully plumbed. A small coin-operated self-laundry service with one washer and dryer is available | ND | ND |
| Municipality of Anchorage | Anchorage Municipality operates a Class I ADEC permitted landfill located south of Eagle River, on West Hiland Road off the Glenn Highway | Anchorage Municipality operates 2 wastewater collection systems and 1 and wastewater treatment facility serving a total of 23,186 people | Anchorage Municipality operates a water distribution system with 85,146 service connections | NA |
| **Southeast Fairbanks Census Area** | | | | |
| Big Delta | Use Delta Junction landfill | ND | ND | ND |
| Delta Junction | ADEC permitted Class II landfill located at Milepost 257.2 Richardson Highway, 7 miles south of Delta Junction | ND | ND | ND |
| Dot Lake Village | Village operates a Class III ADEC permitted landfill | ND | ND | ND |
| Dry Creek | Village operates a Class III ADEC permitted landfill 1 miles south from Alaska Hwy | ND | ND | ND |
| Tanacross | Village operates a Class III ADEC permitted landfill | ND | ND | ND |

| Location | Solid Waste | Sewer | Water Treatment and Distribution | Unserved Rural Community |
|---|---|---|---|---|
| Tok | JD Refuse Services operates a Class III ADEC located at mile 120.5 Glenn Highway | ND | ND | ND |
| Tetlin | Village operates a Class III ADEC permitted landfill | ND | ND | ND |
| Northway Junction | Uses Northway Village landfill located 2 miles southeast of the community | ND | ND | ND |
| Northway Village | Village operates a Class III ADEC permitted landfill | ND | ND | ND |
| Alcan Border | Uses Tok landfill | ND | ND | ND |
| Municipality of Skagway Borough | Municipality operates an incineration plant and Class III ADEC permitted landfill located over 4 miles north of town on the Klondike Hwy | ND | ND | ND |
| **Valdez-Cordova Census Area** | | | | |
| Chistochina | The local landfill is closed pending clean-up and relocation to a new site. Use landfill in Glennallen | Some residents use individual septic tanks, however, the majority have outhouses or pit privies. Approximately 40% of homes are completely plumbed | Nearly half of residences have individual wells; the remainder haul treated water from the community center | ND |
| Copper Center | Refuse collection services are available from Copper Basin Sanitation, which hauls waste to the Glennallen landfill | The majority of homes use individual water wells and septic tanks. Others haul treated well water from a site operated by Copper Center Safe Water. A private Glennallen firm delivers water to home storage tanks for a fee. The school operates its own well-water system. 75% of homes are fully plumbed | ND | ND |

| Location | Solid Waste | Sewer | Water Treatment and Distribution | Unserved Rural Community |
|---|---|---|---|---|
| Gakona | Refuse collection services are available from Copper Basin Sanitation, which hauls waste to the Glennallen landfill | All residences have individual wells and septic systems and complete plumbing. The school uses its own well-water system | ND | ND |
| Glennallen | Copper Basin Sanitation Company operates a Class II ADEC permitted landfill located at Milepost 122.5 of the Richardson Highway. Accepts waste from Slana, Chitina, Copper Center, Paxson, Melchina, Mendeltna, Tolsina, Gulkana, Gakona, and Tazlina | All year-round homes are fully plumbed. The majority of downtown is connected to a piped sewage system operated by The Glennallen Improvement Corporation. The sewage system serves 52 homes and businesses. Most residences have individual septic tank systems, but permafrost and high water tables cause drainage failures | Although most residents have private wells in the Glennallen area, the water is often of very poor quality. Glennallen Heights utilizes two wells to serve a piped system, and a local private business delivers water by truck to fill home water tanks | ND |
| Gulkana | Refuse collection services are available from Copper Basin Sanitation, which hauls waste to the Glennallen landfill. | Village operates a Class II water treatment facility serving 83 people via haul system. Water is currently derived from a well, treated, and stored in a 100,000-gallon tank. A piped water and sewer system serves most homes. A community septic tank treats wastewater. Individual septic tanks are also used by a few residences. Permafrost and high water tables are problematic in this region. | ND | ND |
| Mentasta Lake | Use Tok landfill | Nearly half of homes have individual wells and septic tanks and are fully plumbed. Privies are used by most residents. | Mentasa Washeteria/14 plex water system serves untreated water to approximately 90 people via haul system (Washeteria) | ND |

| Location | Solid Waste | Sewer | Water Treatment and Distribution | Unserved Rural Community |
|---|---|---|---|---|
| Paxson | Garbage collection is provided monthly by Copper Basin Sanitation, and then hauled to the Glennallen landfill | Individual wells and septic tanks are used by residents. Public water sources are available for hauling. More than half of all homes are completely plumbed. | ND | ND |
| Slana | Use landfill in Glennallen | Outhouses, honeybuckets, and septic systems are used for sewage disposal. Approximately one-third of the homes have complete plumbing. | Individual wells are the primary source of water in Slana; others draw water from Rufus Creek. The schools operate individual wells. | ND |
| Tazlina | Copper River Native Association (CRNA) members haul trash to local dumps in the Village and the Council pays for the sanitation company to pick it up. | Copper River Sanitation located in Tazlina, provides septic services/collection and household and business garbage collection services for the whole region. Individual village councils cover the cost of these services for their members. Occupied houses are fully plumbed. | The new CRNA Robert Marshall Bldg. has a water treatment plant and there is a program, which provides elderly and single mother beneficiaries with free drinking water delivery. Others purchase drinking water from local meter cheaply. Well water is largely undrinkable due to the geology. | ND |
| Tonsina | Use landfill in Glennallen | ND | ND | ND |
| Valdez | City of Valdez operates a Class II ADEC permitted landfill located at mile 0.6 on the Valdez Glacier Road that utilizes a balefill system. | City of Valdez operates a waste water collection | ND | ND |

| Location | Solid Waste | Sewer | Water Treatment and Distribution | Unserved Rural Community |
|---|---|---|---|---|
| Capable of processing 1.25 million gallons a day, which serves 3,800 people with 1,103 connections. Sewage is deposited in a secondary treatment lagoon. Over 95% of homes are fully plumbed. | City of Valdez operates 3 water treatment and distribution systems with a total of 1,346 service connections. | ND | ND | ND |
| Water is derived from four primary wells and is stored in five 750,000-gallon reservoirs prior to piped distribution throughout Valdez (City). Water storage capacity is 2.24 million gallons. | NA | ND | ND | ND |
| Whittier | Use Anchorage Municipality landfill. | The City of Whittier operates a small, untreated water distribution system serving 650 people. | ND | NA |
| Adak | City of Adak operates a Class III ADEC permitted landfill. | The City of Adak operates a small, untreated water system serving 220 people. | ND | ND |
| Nome Census Area | City of Nome operates a Class II ADEC permitted landfill. | City of Nome operates a wastewater collection and treatment system serving 3,400 with 1,250 connections. | City of Nome operates a Class I water treatment and distribution system serving 3,930. | ND |
| Unalaska | City of Unalaska operates a Class I ADEC permitted landfill. | City of Unalaska operates a wastewater collection and treatment system serving 4,300 people with 526 connections. | City of Unalaska operates a water treatment and distribution system serving 9,200 people with 553 connections. | NA |

| Location | Solid Waste | Sewer | Water Treatment and Distribution | Unserved Rural Community |
|---|---|---|---|---|
| Source: Alaska Department of Commerce, 2016<br>ADHSS, YEAR 2015b???<br>Copper River Knowledge System, 2016<br>Notes: “Untreated" designation means that no treatment chemicals are added to the water. Passive forms of treatment may be used to treat water at a small treated system. Examples of passive treatment include the use of cartridge filters, UV disinfection, or water softeners. Membrane filtration is not considered passive treated. Small systems treating with membrane filtration, chemically aided filtration, or multiple chemicals are classified as water treatment systems.<br>NA: Not applicable<br>ND: Data not available | | | | |

### 3.7.2. Community Water Fluoridation

Community water fluoridation is the controlled adjustment of fluoride in a public water supply to optimal concentration prevent dental caries among members of the community. Fluoride impedes demineralization enhances remineralization of dental enamel, both of which prevent dental caries. While fluoride occurs naturally in water across the U.S., it is usually lower than the optimal concentration needed to prevent dental caries. The optimal concentration of fluoride in drinking water is the concentration that provides the best balance of protection from dental caries while limiting the risk of dental fluorosis (Truman et al., 2002). The USDHHS recommends an optimal water fluoridation concentration of water fluoridation concentration of 0.7 milligrams per liter (CDC, 2015).

The CDC recognizes community water fluoridation as one of ten significant public health achievements of the 20th Century. Water fluoridation is considered a safe, effective, and inexpensive means to deliver the benefits of fluoride to all residents of a community, regardless of age, educational attainment, or income level (AK-IBIS, 2016). Research suggests that water fluoridation reduces tooth decay by approximately 25% over a person's lifetime (Newbrun, 1989; Brunelle and Carlos, 1990). Untreated dental caries can lead to incapacitating pain, tooth extraction, and loss of dental function, and may progress to an acute systemic infection.

In 2013, 45.7% of all Alaskans were served by community water systems with optimally fluoridated water, falling short of the HA2020 goal of 58.0% (AK-IBIS, 2016). In 2012, 74.6% of the U.S. population was served by community water systems with optimally fluoridated water.

## 3.8. Health Effect Category 8: Health Services Infrastructure and Capacity

See Section 5.3.4.2 of Resource Report No. 5 for health services infrastructure and capacity baseline conditions.

### 3.8.1. Healthcare Delivery Organizational Structure

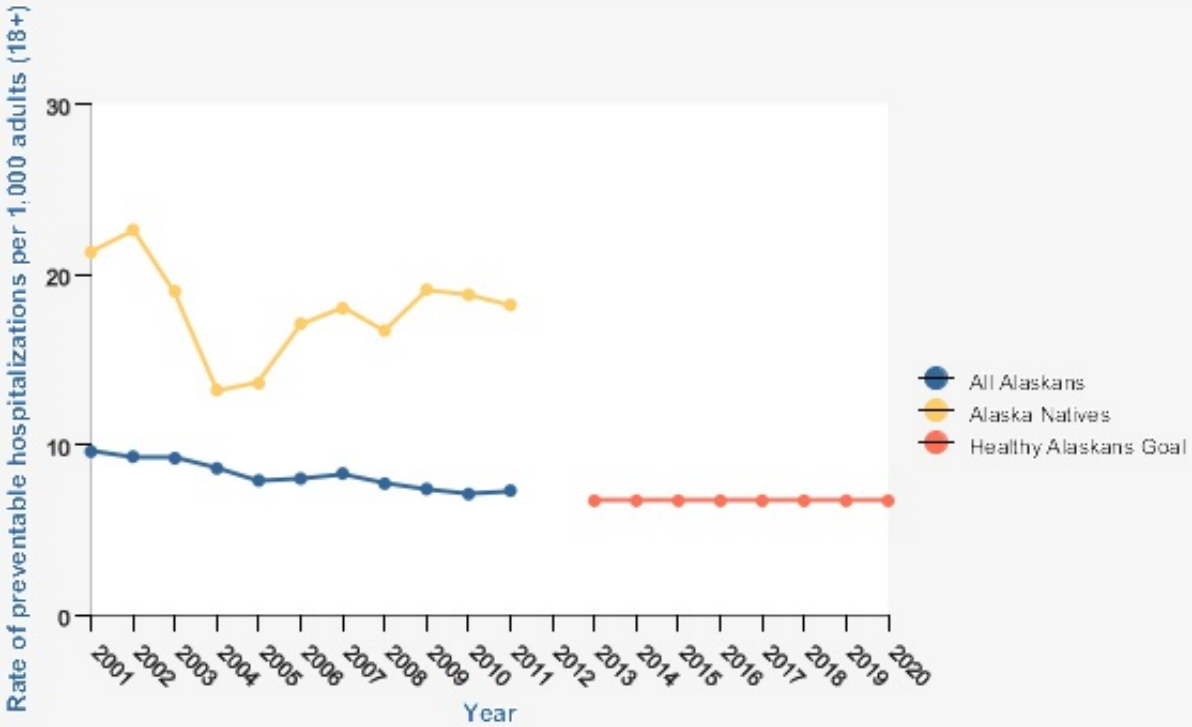
Alaska is made up of dozens of tribal health care organizations, which operate the area health care facilities. The Indian Health Service maintains a complete list of all the organizations and links to their respective websites: https://www.ihs.gov/alaska/tribalhealthorganizations/.

### 3.8.2. Access to Healthcare

Access to quality healthcare is influenced by a number of factors, including: having a usual source of care, having health insurance, and capacity to afford care (AK-IBIS, 2016). “Preventable hospitalizations” are defined as hospitalizations, which could be avoided if patients had early access to good quality outpatient healthcare. This measure can be used to assess the effectiveness and accessibility of primary health care.

Figure 30 shows the disparity between the rates of preventable hospitalizations among all adult Alaskans as compared to Alaska Native adults between 2001 and 2011. In 2012, the rate among Alaska Natives (18.2 per 1,000 adults) was more than twice that of all Alaskans (7.3 per 1,000 adults) statewide.

**Figure 30. Rate of Preventable Hospitalizations per 1,000 adults (18+), all Alaskans and Alaska Natives (2001-2020)**




Source: AK-IBIS

Health insurance plans provide partial or complete payment of specified health care costs for enrollee(s), with varied levels of coverage among individual plans. Some plans are provided by employers, some by government programs,

such as Medicare, and others are purchased directly by individuals from insurance companies. People without health insurance are more likely to lack a usual source of medical care, such as a primary care provider. They more often skip routine and preventive medical care thus increasing their risk for developing serious and disabling health conditions that cost more to treat (AK-IBIS, 2016).

In 2014, 13.6% of all Alaskans statewide reported cost as a barrier to accessing healthcare within the past year, 11.8% of all Alaska Natives reported cost as a barrier to care (AK-IBIS, 2016).

Examining insurance rates among nonelderly adults, or those ages 18-64, is a commonly used indicator because Medicare covers the preponderance of adults age 65 and older in this country.

Health services are provided by a variety of organizations in Alaska, some designed for all people and others that focus on the health needs of Alaska Natives. The Baseline Summary will include an analysis of health services and capacity of areas potentially impacted. Community online database, community KIIs.

Prudhoe Bay is classified as an isolated town/Sub-Regional Center. It is found in EMS Region 6A in the North Slope Region. Emergency Services have limited highway, coastal, and airport access. Emergency service is provided by a paid Emergency Medical Services unit and Fairweather Deadhorse Medical Clinic (open daily and on call 24 hours a day [907-685-1800] for emergencies and urgent care). Auxiliary health care is provided by oil company medical staff and the Greater Prudhoe Bay Fire Dept. Individuals requiring hospital care are usually transported to the nearest hospital/medical center, Sammuel Simmonds Memorial Hospital, in Barrow, Alaska. Because no roads connect Prudhoe Bay to Barrow, individuals are transported by helicopter or air ambulance (an approximately 45-minute flight).

- Page Intentionally Left Blank -

# 4. POTENTIAL HEALTH IMPACTS

The overall goal of an HIA is to identify potential health impacts and communicate these impacts to decision-makers during the planning and permitting process. A health impact is a positive or negative change in a specific health outcome or health determinant. Health impacts are:

- Changes in health outcomes or determinants, not general changes in environmental conditions;
- Specific health outcomes or determinants, not general statements about health status; and
- Quantifiable, whenever possible.

Each HEC contains potential health impacts that fit the criteria above. Detailed analyses of potential impacts are described utilizing standard NEPA methodologies, i.e., context and intensity.

The level of the human health impacts from the proposed Project were determined and ranked based on the impact assessment criteria for human health presented in Table 1. This table is derived from the Impact Assessment methodology described in the Alaska HIA Toolkit. The scoring system includes consequences (i.e., health effect, duration, magnitude, and geographic extent), which collectively determine the severity rating. Together the severity rating and the estimated likelihood determine the impact rating. Potential public health impacts from the proposed Project were ranked and rated by using the following four-step semi-quantitative risk assessment procedure:

- Step 1. Score the level of each consequence (health effect, duration, magnitude, and geographic extent,) on a four-point scale: low (0), medium (1), high (2), and very high (3), as described in Table 36.
- Step 2. Rate the severity of the health impact (low, medium, high, or very high) based on the sum of the scores of the consequences.
- Step 3. Rate the potential (or likelihood) of the impact to occur based on professional judgment on the percent probability of the impact occurring.
- Step 4. Rate the identified health impacts (low, medium, high, or very high) based on the intersection of the level of severity and potential (or likelihood) as shown in Table 37. Health issues anticipated to have negligible or zero impacts were identified as having no impacts.

**Table 36. Step Risk Assessment Matrix (Step 1 of 4)**

| Step Risk Assessment Matrix (Step 1 of 4) | | | | |
|---|---|---|---|---|
| **Step 1: Consequences** | | | | |
| **Impact Level (Score)** | **A – Health Effect** | **B – Duration*** | **C – Magnitude** | **D – Extent**** |
| **Low (0)** | Effect is not perceptible | Less than 1 month | Minor | Individual cases |
| **Medium (1)** | (+/-) minor benefits or risks to injury or illness patterns (no intervention needed) | Short-term: 1 - 12 months | Those impacted will:<br>1) Be able to adapt to the impact with ease and maintain preimpact level of health,<br>2) See noticeable but limited and localized improvements to health conditions | Local; small limited impact to households |
| **High (2)** | (+/-) moderate benefits or risks to illness or injury patterns (intervention needed, if negative) | Medium-term: 1 to 6 years | Those impacted will:<br>1) Be able to adapt to the health impact with some difficulty and will maintain preimpact level of health with support, or<br>2) Experience beneficial impacts to health for specific population some maintenance may still be required | Entire PACs; village level |
| **Very High (3)** | (+/-) severe benefits or risks: marked change in mortality and morbidity patterns (intervention needed, if negative) | Long-term: more than 6 years/life of project and beyond | Those impacted will:<br>1) Not be able to adapt to the health impact or to maintain pre-impact level of health<br>2) See noticeable major improvements in health and overall quality of life | Extends beyond PACs; regional and state-wide levels |

Source: ADHSS, 2015a

* Duration refers to the duration of the potential impact or risk of impacts, not necessarily the duration of the Project.

** Extent does not necessarily refer to project-wide impacts at the local and PAC level (e.g., impact level score may be high even for potential impacts to a few PACs, not all PACs, if the impact would affect an entire PAC).

**Table 37. Step Risk Assessment Matrix (Steps 2, 3, and 4 of 4)**

| Step Risk Assessment Matrix (Steps 2, 3, and 4 of 4) | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Step 2: Severity Rating (Magnitude + Duration + Geographic Extent + Health Effect)** | **Step 3: Likelihood Rating** | | | | | | |
| | **Extremely Unlikely < 1%** | **Very Unlikely 1–10%** | **Unlikely 10–33%** | **About as Likely as Not 33–66%** | **Likely 66–90%** | **Very Likely 90–99%** | **Virtually Certain > 99%** |
| Low (1–3) | ♦ | ♦ | ♦ | ♦ | ♦♦ | ♦♦ | ♦♦ |
| Medium (4– 6) | ♦ | ♦ | ♦ | ♦♦ | ♦♦ | ♦♦ | ♦♦♦ |
| High (7– 9) | ♦♦ | ♦♦ | ♦♦ | ♦♦♦ | ♦♦♦ | ♦♦♦ | ♦♦♦♦ |
| Very high (10–12) | ♦♦♦ | ♦♦♦ | ♦♦♦ | ♦♦♦♦ | ♦♦♦♦ | ♦♦♦♦ | ♦♦♦♦ |
| **Step 4: Impact Rating** | Key: Low = ♦ Medium = ♦♦ High = ♦♦♦ Very High = ♦♦♦♦ | | | | | | |
| Sources: ADHSS, 2015a | | | | | | | |

Potential health impacts related to large projects, such as the Alaska LNG Project, are described in the next sections. The U.S. Army Corps of Engineers (USACE) Supplemental Environmental Impact Statement (SEIS) prepared for the Alaska Stand Alone Pipeline (ASAP) Project contains a summary of impacts for a similar project and is referenced here. Of note, the risk assessment completed for the Alaska LNG Project has been prepared independently of the ASAP SEIS; however, the impacts are very similar for each HEC. Potential impacts are summarized in Table 38.

**Table 38. Types of Effects and Impacts on Public Health**

| **Type of Effect** | **Proposed Action Causing Potential Impact** | |
|---|---|---|
| | **Construction** | **Operations** |
| **Social Determinants of Health (SDH)**<br>Positive or negative change in:<br>• Maternal Health Status<br>• Depression/anxiety prevalence<br>• Substance abuse rate<br>• Suicide rate<br>• Teen pregnancy rates<br>• Domestic violence and family stress<br>• Economy and employment | • Worker camps, increase rail and truck traffic—presence of outside workers and traffic could exacerbate social problems or stress and impact mental health for residents of PACs<br>• Employment opportunities could alleviate family stress by improving family income, and the local economy | • Presence of gas in the pipeline—residents of PACs could experience fear of catastrophic incident linked to the proposed Project and/or perceptions that the proposed Project threatens a way of life<br>• Employment opportunities could alleviate family stress by providing jobs and family income, improving the local economy and reducing unemployment |

| Type of Effect | Proposed Action Causing Potential Impact | |
|---|---|---|
| | **Construction** | **Operations** |
| **Accidents and Injuries**<br>• Increase in unintentional injury (e.g., drowning, falls, snow machine, ATB injury) rates<br>• Increase in roadway incidents and injuries<br>• Decrease in safety during subsistence activities<br>• Increase (positive effect) of behavior-based and other safety culture programs implemented in the project | Fatal and nonfatal injuries due to:<br>• General construction activities<br>• Increased rail transport (e.g., rail-auto collisions, trespassing, train accidents and highway-rail crossing accidents)<br>• Increased trucking- injuries to truck drivers, other motorists and pedestrians from trucks hauling pipes; transportation of materials; bussing construction workers to camps; and additional truck deliveries and pickups linked to construction<br>• Seaborne transit-related injuries<br>• Increase in truck and rail traffic in PACs along the rail line and highways<br>• Increased trucking- injuries to truck drivers, other motorists and pedestrians from trucks hauling pipes; transportation materials; bussing construction workers to camps; and additional truck deliveries and pickups linked to construction | • Fatal and nonfatal injuries due to leaks, fires, or explosions |
| **Exposure to Hazardous Materials**<br>• Increase in physiologic contaminant levels such as fugitive dust, criteria pollutants, persistent organic pollutants, and VOCs | Human exposure linked to air emissions (fugitive dust, criteria pollutants, VOCs):<br>• Diesel-powered mobile equipment<br>• Increase in truck and rail traffic in PACs along the rail line and highways<br>• Fugitive dust due to vehicle traffic on unpaved roads and general construction activities (especially during summer) | • Potential fugitive emissions from pipeline connections<br>• Operations of GTP would emit combustion related pollutants, such as NOx, CO, PM, VOCs and $SO_2$<br>• Potential for other toxic / hazardous substances – components of natural gas and natural gas liquids (NGLs) (e.g., isobutene, pentanes, hexanes, hydrogen sulfide, butane, and ethane) as well as paints, solvents, petroleum products and fertilizers<br>• Operation would result in various emissions when the natural gas is consumed in Fairbanks, Anchorage and other cities |

| Type of Effect | Proposed Action Causing Potential Impact | |
|---|---|---|
| | **Construction** | **Operations** |
| **Food, Nutrition, and Subsistence Activity**<br>• Decrease in amount of dietary consumption of subsistence resources<br>• Change (positive or negative) in composition of diet<br>• Change (positive or negative) in food security | Construction activities (e.g., construction noise, traffic, human presence, barging, water use requirements) causing:<br>• Removal or disruption of subsistence use areas<br>• Temporary decrease in resource availability<br>• Temporary reduction in harvester access to the proposed Project Area<br>• Contamination (real or perceived)<br><br>Positive impacts could include:<br>• Increased food security related to increased in employment and income | Operations could lead to a decrease in dietary consumption of subsistence resources, resulting in a change in diet composition and a decrease in food security due to:<br>• Cleared ROW and construction of new access roads attracting new harvesters<br>• New access roads, and increased traffic and noise from aerial and ground-based pipeline inspections, which could displace or reduce availability of terrestrial wildlife for subsistence uses<br>• Resource availability could be reduced in the unlikely event that a leak in the pipeline led to a forest fire<br><br>Positive impacts could include:<br>• Increased food security related to increased employment and income |
| **Infectious Disease**<br>Positive or negative change in:<br>• Transmission of pediatric or adult respiratory disease rates<br>• STD rates, gastro intestinal outbreaks, and antibiotic-resistant staph skin infections | Transmission of disease by infected resident or nonresident construction workers (often coming from out of state) stationed at worker camps or in PACs | Transmission of disease by infected resident or nonresident operations and maintenance workers stationed at worker camps or in PACs |

| Type of Effect | Proposed Action Causing Potential Impact | |
|---|---|---|
| | **Construction** | **Operations** |
| **Water and Sanitation**<br>• Change in potable water access<br>• Positive or negative change in water quantity or quality<br>• Change in demand on water and sanitation infrastructure due to the influx of non-resident workers | Change in water quality due to:<br>• Solid waste generated due to construction activities<br>• Domestic waste water produced from worker camps<br>• Hazardous materials from construction activities<br><br>Change in potable water access due to use of surface water for construction activities as well as for hydro-testing and horizontal directional drilling<br><br>Change in demand on water and sanitation infrastructure due to demand on existing services while construction work camps are being utilized | Potential effects to water quality from spills |
| **Non-Communicable and Chronic Disease**<br>Positive or negative change in:<br>• Cardiovascular disease rates<br>• Type 2 Diabetes rates<br>• Chronic lower respiratory disease rates<br>• Cancer rates | Asthma, Chronic Obstructive, Pulmonary, Cardiovascular Disease:<br>• Project emissions of criteria pollutants, particularly $PM_{2.5}$<br><br>Diabetes:<br>• Change in diet if there was loss of subsistence resources | Positive changes in air quality in Fairbanks and potential reduction of the rate of exceedances of the National Ambient Air Quality Standard (NAAQS)<br><br>This change depends on expansion of the gas distribution network in Fairbanks (discussed in cumulative impacts for Air Quality) |
| **Health Services Infrastructure and Capacity**<br>Increase in:<br>• Number or quality of clinics and staff<br>• Accessibility of health care<br>• Utilization/clinic burden from non-resident influx | Potential increased use of health infrastructure resources / clinic burden due to resident or worker injuries or illness during construction | Impacts only to the degree that operations could result in increased injuries from pipeline accidents or increased need for medical services |
| Source: USACE, 2018 | | |

## 4.1. HEC 1: Social Determinants of Health (SDH)

See Sections 5.4.2 and 5.4.3 of Resource Report No. 5 for details of the socioeconomic impacts. As described in Section 5.4.1.1.1 of Resource Report No. 5, local spending has a stimulus effect on the state's economy, thereby increasing the number of jobs and amount of labor income.

### 4.1.1. Potential Construction Impacts

The employment opportunities generated by the building of the Project facilities may constitute an economic net benefit to Alaska residents if the new jobs are taken by current residents who were previously unemployed or under-employed and/or if the new jobs result in an increase in wage rates within industrial sectors affected by the Project (USACE, 2012). It is possible there would be an increase in median household income in the PACs (see Section 5.4.1.1.1 of Resource Report No. 5).

Potential impacts on subsistence and subsistence lifestyle arising in selected PACs, including Minto, Nenana, Four Mile Road, Alexander Creek, Tyonek, and Beluga, are of concern (see Section 4.4, HEC 4: Food, Nutrition, and Subsistence Activity), although extensive conditions are being put in place consistent with regulatory and permitting requirements to minimize those impacts. Subsistence is important in several contexts including health and sociocultural impacts.

Project construction and work camps could potentially exacerbate existing problems that impact SDHs within individual households, for the duration of construction. The presence of outside workers could exacerbate social problems or stress and impact mental health for PACs, particularly in smaller communities. Households impacted would be expected to adapt with some difficulty but could maintain pre-impact level of health with support from community, regionally-based, and existing federal support of native health, public health programs. PACs located within the rail belt and on a highway, would be expected to be impacted by the increase in traffic during construction, which could cause mental stress and anxiety regarding the real or perceived issues of safety and environmental health associated with the increased rail and truck traffic. This impact would be mitigated by implementing traffic control plans and by keeping communities aware of the Project schedule.

Employment opportunities could alleviate family stress by improving family income, and the local economy during construction (Table 38).

Overall, potential adverse impacts to the SDHs would be medium during construction, with individual impact criteria ratings as follows:

- Health Effect: Medium (1), minor risks.
- Duration: High (2), medium-term, 2-4 years, 6-8 years, for the duration of construction in the region of a PAC.
- Magnitude: High (2) moderate risk, individuals, and households would be expected to adapt to with some difficulty, but could maintain pre-impact level of health with support.
- Extent: Medium (1), potential impact to individual households.
- Likelihood: Likely that construction would impact the SDHs within a given PAC.

- Potential positive impacts to SDHs would be high during construction from the potential change in employment and median household income for individuals and households involved with Project construction.

### 4.1.2. Potential Operations Impacts

Potential health impacts to each of the individual sub-categories of SDH during operations are presented in Section 5.4 of Resource Report No. 5, including impacts to demographics and economic indicators (employment, wages, etc.). Primary adverse impact to SDHs during proposed Project operations could result from the possible fear and anxiety within PACs over the real or perceived potential for increased gas leaks, fires, and explosions from the introduction of a new Project and associated facilities, although the areas impacted by the Project generally already have similar facilities (e.g., North Slope, Nikiski) and a major pipeline. A limited number of workers would be required during the 30-year operations and maintenance period, thus the potential adverse effects on SDHs would be negligible during this period.

The potential impact of the operations of the proposed Project on SDH is estimated to be medium with individual impact criteria ratings as follows:

- Health Effect: Medium (1), minor risks to SDH, such as anxiety from the presence of the Mainline and other gas facilities and the possibility of gas leaks, fires, or explosions. There are also localized improvements including employment and income.
- Duration: Very High (3), long-term, 30 years.
- Magnitude: Low (0), minor adverse impacts to SDH and localized improvements.
- Extent: Medium (1), local, limited to individuals or households located near the Project.
- Likelihood: About as likely as not.
- Potential positive impacts to SDH would be high during operations from changes in employment and median household income for individuals and households involved with Project operations and maintenance.

## 4.2. HEC 2: Accidents and Injuries

The accidents and injuries health effect category describes changes to fatal and non-fatal injury statistics that can be either intentional (suicide, homicide, assault, self-harm) or unintentional (motor vehicle crashes, falls).

This category includes impacts related to both fatal and non-fatal injury patterns for individuals and communities. Changed patterns of accidents and injuries may arise due to:

- Influx of non-resident personnel (increased traffic on roadways, rivers, air corridors).
- Distance of travel required for successful subsistence.
- Project-related income and revenue used for improved infrastructure (e.g., roadways) and improved subsistence equipment/technology.

### 4.2.1. Potential Construction Impacts

Construction of the proposed Project and associated infrastructure would result in the possibility of accidents and injuries. Accidents/injuries could occur in two primary populations: those who construct (and later operate) the proposed Project (occupational injuries) and the general population (non-occupational injuries). It is conventional practice to address only non-occupational health effects. However, occupational injuries (fatal and nonfatal) are considered here because these could place demands on existing health care facilities (see section on health infrastructure and capacity) and, moreover, some data (such as for highway fatalities) do not distinguish between those occupationally injured and others.

Occupational injuries include those for proposed Project construction workers and those for workers that support the construction activity, such as those that could occur to employees of the Alaska Railroad or trucking companies, who transport pipe sections to storage locations, etc.

The potential impact of the construction of the proposed Project on Accidents and Injuries is estimated to be medium with individual impact criteria ratings as follows:

- Health Effect: Medium (1), although the effect may be serious to those affected, the expected number of fatal and nonfatal injuries is very low (and might be zero).
- Duration: High (2), medium-term, 2-4 years, 6-8 years, for the duration of construction in the region of a PAC.
- Magnitude: Medium (1), although those impacted will not be able to adapt, there is a moderate risk to the overall accident and injury rate. Safety in the workplace and the introduction of a safety culture beyond the workplace will offset the risks of accidents and injuries of individuals and households.
- Extent: Low (0), limited to individual cases.
- Likelihood: Extremely unlikely

### 4.2.2. Potential Operations Impacts

The potential impact of the operations phase of the proposed Project on Accidents and Injuries is estimated to be medium with individual impact criteria ratings per Tables 36 and 37, as follows:

- Health Effect: Medium (1), although the effect would be serious to those affected, the expected number of fatal and nonfatal injuries is very low.
- Duration: Very high (3), the potential for risk is long-term, 30 years.
- Magnitude: Medium (1), the expected number of fatal and nonfatal injuries is very low (or close to zero). Those impacted will not be able to adapt; however, there may be limited and localized improvement to safety from the introduction of a safety culture beyond the workplace that will offset the risks of accidents and injuries of individuals and households.
- Extent: Low (0), limited to individual cases.

- Likelihood: Extremely unlikely

## 4.3. HEC 3: Exposure to Potentially Hazardous Materials

This category includes Project emissions and discharges that lead to potential exposure. Exposure pathways include:

- Food - quality changes in subsistence foods (risk based on analysis of foods or modeled environmental concentrations);
- Drinking water;
- Air - respiratory exposures to fugitive dusts, criteria pollutants, VOCs, mercury, and other substances;
- Work - secondary occupational exposure such as a family member's exposure to lead on a worker's clothing; and,
- Indirect pathways, such as changing heating fuels/energy production fuels in communities

### 4.3.1. Potential Construction Impacts

Resource Report No. 9 describes the fugitive dust, criteria pollutants, and VOCs that would be generated by the proposed Project. As described therein, emissions from construction equipment combustion, fugitive dust, and open burning would be controlled to the extent required by the ADEC. As a result, AGDC would comply with applicable regulations, and the emissions from proposed Project construction-related activities would not significantly affect local or regional air quality. Therefore, construction of the proposed Project should not significantly increase exposure of the PACs to these substances.

Fugitive dust, for example, is one of the materials that would be generated as part of construction activities. Fugitive dust results from vehicle traffic on unpaved roads and construction activities. People most at risk from breathing particulate pollution are children, the elderly, and people with respiratory or heart disease proximate to the construction work areas. Healthy people can be affected as well, especially outdoor exercisers (USACE, 2012).

Other toxic and hazardous substances that could be used during construction of the proposed Project include some pesticides, paints, solvents, petroleum products, and fertilizers. The proposed Project would be subject to extensive state and federal regulations regarding the use of toxic and hazardous materials, including, but not limited to:

- Pipeline Safety Regulations (49 CFR Parts 190-199).
- Resource Conservation and Recovery Act (42 USC 3251 et seq.).
- Comprehensive Environmental Response, Compensation and Liability Act and the Superfund Amendments and Reauthorization Act (42 USC 9601).
- Emergency Planning and Community Right-to-Know Act (42 USC 9601; 40 CFR 255, 370, and 372);
- Toxic Substances Control Act (15 USC 2601).

- Hazardous Materials Transportation Act (49 USC 1801-1819).
- Occupational Safety and Health Administration (29 USC §§651-678).

In addition to complying with these regulations, the proposed Project would also follow several plans intended to ensure the proper handling and disposal of hazardous and nonhazardous wastes, including the waste management plan, spill prevention and response plan, etc. Therefore, construction of the proposed Project should not lead to significant exposure of the PACs to these substances.

The potential impact of the construction of the proposed Project from the Exposure to Hazardous Materials is estimated to be low, with individual impact criteria ratings as follows:

- Health effect score: Low (0), effects unlikely to be perceptible.
- Duration: High (2), medium-term, 6 to 8 years.
- Magnitude: Low (0), minor to moderate risk of exposure to hazardous materials in the PACs, with intervention potentially needed to mitigate the impacts of spills and leaks associated with increased truck and rail traffic.
- Extent: Low (0), limited to individual cases.
- Likelihood rating: Unlikely that the exposure to hazardous materials within individual households would increase during construction.

### 4.3.2. Potential Operations Impacts

Resource Report No. 9 describes the fugitive dust, criteria pollutants, and VOCs that would be generated by the proposed Project operations. Other than compressor station emissions, which are covered under regulatory permits, the pipeline alone, during operations, generally do not have any significant air emissions associated with its operation. There could be fugitive emissions from pipeline connections (i.e., valves). Such emissions would be generally very minor in nature and are not subject to the requirement to obtain a permit. Industry best practices to control fugitive emissions from valves and other mechanical equipment will be utilized during operations.

Operations of the GTP and liquefaction facility would emit combustion-related pollutants such as NOx, CO, PM, VOCs, and $SO_2$. Preliminary emission estimates trigger the need for those facilities to obtain prevention of significant deterioration (PSD) and Title V operating permits. As discussed in Resource Report No. 9, upon meeting the permit requirements, the proposed Project as permitted by ADEC would not cause or contribute to a violation of any federal, state, or local air quality standards. Therefore, operation of the proposed Project should not significantly increase exposure of the PACs to these substances.

Other toxic and hazardous substances that would be generated by proposed Project operations include some components of natural gas and NGLs (isobutene, pentanes, hexanes, hydrogen sulfide, butane, and ethane), as well as pesticides, paints, solvents, petroleum products, and fertilizers (USACE 2012). The proposed Project would be subject to regulations regarding the use of toxic and hazardous materials. Therefore, operation of the proposed Project should not lead to exposure of the PACs to these substances.

Finally, operation of the Project would result in various emissions when the natural gas was ultimately consumed in Fairbanks, Anchorage, and other communities. Compared to present emission levels, these emissions are expected to be much smaller.

The potential impact of the operations of the proposed Project from the Exposure to Hazardous Materials is estimated to be low, with individual impact criteria ratings as follows:

- Health effect score: Low (0), effects unlikely to be perceptible assuming compliance with NAAQS.
- Duration: Very High (3), long-term, 30 years.
- Magnitude: Low (0), minor risk of exposure to hazardous materials in the PACs.
- Extent: Low (0), limited to individual cases.
- Likelihood rating: Extremely unlikely

## 4.4. HEC 4: Food, Nutrition, and Subsistence Activity

This category considers health impacts related to food security, adequate nutrition, and availability of subsistence resources.

- This section depends on the subsistence analysis and nutritional surveys completed in Resource Report No. 5, Appendix D as well as ADF&G baseline subsistence data provided as an attachment and filed in response to FERC on submitted on December 1, 2017 (see accession no. 20171201-5211), and considers:
- Effect on Diet: This pathway considers how changes in wildlife habitat, hunting patterns, and food choices will influence the diet of and cultural practices of local communities. While nutritional surveys are the most effective way to assess dietary intake, conclusions can be drawn if certain assumptions are accepted.
- Effect on Food Security: This discussion considers Project-specific impacts that may limit or increase the availability of foods needed by local communities to survive in a mixed cash and subsistence economy present in rural Alaska.

### 4.4.1. Potential Construction Impacts

Impacts to subsistence during the construction phase are expected to be temporary in duration. The timing of pre-construction and construction activities would have direct effects on subsistence activities. Subsistence impacts would be most acute in the area around Minto Flats, and in communities along the Mainline route and near Cook Inlet that rely on subsistence resources that are of high importance.

The introduction of invasive species (both fish and/or aquatic plants) could impact fish habitat and/or productivity and impact fish availability to subsistence users. Unlike the other construction impacts which are expected to be short-term, the introduction of invasive species could become a long-term impact if their spread is uncontrolled, thus potentially signaling a long term reduced fish availability for subsistence users and users downstream of the impacted areas. Reduced fish availability could potentially occur and

affect subsistence uses in all regions of the Project and have the greatest effect on communities in the Interior (where fish account for over 70% of harvest) and Southcentral (where fish account for over 50% of harvest) with less impact on communities in the North Slope (where fish account for less than 20% of the harvest) (USACE 2012).

User access to subsistence areas could be temporarily reduced due to both physical and regulatory barriers related to the use of water extraction efforts, pipe laydown, noise, traffic, and other construction activities.

Potential concern related to subsistence resources during construction is the possibility that workers might compete with subsistence users resulting in either diminished harvests or greater subsistence effort. The Project will prohibit workers from hunting or fishing while on the job or when company transportation has been used to bring them to a remote site.

Impacts to individuals and households (see information filed in response to FERC and submitted on December 1, 2017; Accession No. 20171201-5211) are primarily based on the long-term effect of increased access and competition from a cleared right-of-way (ROW) and access roads to areas previously undeveloped or with limited access options. Summary impact ratings of moderate are primarily a result of the proximity of PACs to the Project and high likelihood for effects to subsistence activities from construction (subsistence use area overlap). Summary impact ratings of minor are due to the lower potential for impacts during construction and operation. PACs that have a summary impact rating of negligible are communities that are generally located farthest from the Project, are in nonsubsistence areas and/or nonrural, and any potential effects would be unlikely and temporary.

The potential impact of the proposed Project construction on food, nutrition, and subsistence activity within each PAC would likely be low, with individual criteria ratings as follows:

- Health effect score: Medium (1), effect results in annoyance, minor injuries, or illnesses that do not require intervention.
- Duration: High (2) medium-term, 6–8 years.
- Magnitude: High (2), minor, moderate, or major severity, depending on the PAC, those impacted will be able to adapt to the health impact with some difficulty and will maintain pre-impact level of health with support.
- Extent: Medium (1), potential to affect individuals and households that rely on access and reduced competition for subsistence resources. Subsistence plans of cooperation and coordination with communities on construction activity are intended to reduce community-level impacts.
- Likelihood rating: Likely chance of impact to subsistence, which would in turn impact food security and nutrition.

### 4.4.2. Potential Operation Impacts

The potential impact of the proposed Project operations on food, nutrition, and subsistence activity within each PAC would likely be low, with individual criteria ratings as follows:

- Health effect score: Medium (1).
- Duration: Very high (3), long-term, 30 years.
- Magnitude: Medium (1), operations impacts overall are minor, and those impacted will be able to adapt with ease and maintain preimpact level of health.
- Extent: Medium (1), potential to affect individuals and households that rely on access and reduced competition for subsistence resources. Some communities may be impacted and would be able to adapt to the impact with some difficulty and will maintain preimpact level of health with support.
- Likelihood rating: Unlikely.

## 4.5. HEC 5: Infectious Diseases

This HEC considers health impacts from infectious disease transmission and the development of new infectious diseases due to the Project. As described previously, influx can occur due to job seeking, commercial opportunities, small-scale trading, or extended-family in-migration. Influx can lead to changes in infectious disease prevalence (Neiderud, 2015). This category includes the Project's influence on patterns of infectious disease: The pathways include:

- Influx of non-resident personnel from outside the region.
- Crowded or enclosed living and working conditions and the mixing of low and high prevalence populations due to influx can create an increased risk for transmission of STIs such as syphilis, HIV, and chlamydia.

The public health concern with respect to evaluating proposed development Projects is that these diseases can be transmitted by infected construction workers (potentially from outside the area). In the Alaska context, the diseases of particular concern include infectious respiratory diseases (e.g., pneumonia, influenza) and STIs (AIDS, syphilis, gonorrhea, and chlamydia) (USACE, 2012).

### 4.5.1. Potential Construction Impacts

The interest in STIs in connection with proposed pipeline development Projects partially reflects experience and/or concerns with similar Projects in Canada (see e.g., Goldenberg et al. 2008a, b, c; Shandro et al. 2011), anecdotal reports from gas developments in the "'lower 48" (AP 2011; Farnham 2012; Kulesza 2011; Schechter 2011), and less developed countries and partially because of concerns related to TAPS impacts (CEE Bankwatch Network, Gender Action 2006; Jobin 2003; Pacific Environment 2011; Sakhalin Environmental Watch 2011; for TAPS see e.g., anecdotal information presented in Cole 1997). A recent HIA on oil and gas development on Alaska's North Slope concluded that contact between oil workers and previously isolated Inupiat villages could result in increased rates of HIV and syphilis (Wernham 2007).

Moreover, as noted earlier is this section the rates of STIs in Alaska are relatively high, particularly for Chlamydia, but also for gonorrhea. Although there are effective tests for STIs, known methods for

reducing the likelihood of transmission, and effective cures (if diagnosed), STIs are a valid public health concern (USACE 2012).

Other infectious diseases that could affect the worker population and potentially affect other persons include hepatitis (A, B, and C) and bacterial pneumonia (each of these conditions is reportable to public health authorities in Alaska). These diseases differ in the how they are spread, whether or not vaccination is possible, types of treatment required, and seriousness. Hepatitis A, B, and C, for example, can be spread by sexual activity, eating or drinking contaminated food or water (hepatitis A only), or sharing needles among drug users (hepatitis B and C). There are vaccines for hepatitis A and B, but not C. Bacterial pneumonia can be transmitted via inhalation of bacteria (contact with others) or by aspiration of the secretions from the throat, mouth, or nose. Bacterial pneumonia is treated using antibiotics. Because these diseases are contagious, isolation or removal of infected workers from camps would be required (USACE 2012).

It is anticipated that a rotational scheme would be employed wherein workers are transported by aircraft or bus from selected locations (e.g., Prudhoe, Fairbanks, and Anchorage) to camps. There they would work for a defined period (e.g., two weeks) and, upon shift completion, be transported back to their starting points. A work shift would typically be 12 hours, so the worker would have to use the remaining 12 hours for attending to personal chores, eating, and sleeping. While at the camps, there would be little opportunity for interaction (e.g., sexual contact) with other persons outside the camps. This is a policy designed (among other things) to lower opportunities to transmit STIs, particularly with persons living in the general area of the camps (USACE 2012).

In most cases the mitigation strategies proposed or implemented for dealing with STIs on mineral development Projects have included attempting to minimize the size of the transient workforce (generally determined to be infeasible) and provision of a health education and outreach program. As a practical matter, feasible mitigation measures are limited to an education and outreach program, which might also include providing condoms and test kits for STIs. More stringent alternatives (such as mandatory STI testing, or certain access restrictions) are unlikely to be feasible, or even legal in the U.S. (USACE, 2012).

Construction contractors would be required to have health and safety programs that provide adequate health and medical equipment and staff to respond to and prevent medical emergencies.

The potential impact of the proposed Project construction on infectious diseases would be medium, with individual criteria ratings as follows:

- Health effect score: High (2), moderate risk to injury or illness that may require intervention, primarily to minimize the transmission of STIs.
- Duration: High (2) medium-term, 6–8 years.
- Magnitude: High (2), those impacted will be able to adapt to the health impact with some difficulty (e.g., requiring testing and treatment for STIs) and will maintain pre-impact level of health and support.
- Extent: Medium (1), individual cases or households.

- Likelihood rating: About as likely as not that the infectious disease rate would increase.

### 4.5.2. Potential Operations Impacts

For operations, the number of workers is significantly less during operations and so too would be the possible impacts. Moreover, unlike the case with the construction phase, where workers might include those from out of state, it is likely that all or nearly all of the workers would be Alaska residents.

The potential impact of the proposed Project operations on infectious diseases would be medium, with individual criteria ratings as follows:

- Health effect score: High (2), because those affected may require medical treatment in the event they develop an infectious disease.
- Duration: Very high (3), long-term, 30 years.
- Magnitude: High (2), affected individuals should be able to adapt, but may require medical intervention.
- Extent: Low (0), limited to individual cases.
- Likelihood rating: Very unlikely because the number of workers involved in operations is smaller than the number of construction workers and there are fewer outside (non-resident) workers.

## 4.6. HEC 6: Chronic and non-communicable diseases

Increase in morbidity and mortality data for chronic diseases, such as obesity, diabetes, and hyperlipidemia. This category considers how the Project might change patterns of chronic diseases. The pathways include:

- Nutritional changes that could eventually produce obesity, impaired glucose tolerance, diabetes, cardiovascular disease.
- Pulmonary exposures that lead to tobacco related chronic lung disease, asthma; in-home heat sources; local community air quality; clinic visits for respiratory illness.
- Cancer rates secondary to diet changes or environmental exposures.
- Increased rates of other disorders, specific to the contaminant(s) of concern.

### 4.6.1. Potential Construction Impacts

The leading causes of death attributable to non-communicable chronic diseases in the proposed Project area are cancers, heart disease, and COPD. Following cancer, the most common chronic diseases statewide and within the proposed Project area are COPD, cardiac disease, vascular disease, and type-2 (adult onset) diabetes. Asthma should be included in the list of chronic respiratory diseases of concern because, although fatality rates are lower than for many of the other diseases included here, asthma results in a large number of hospitalizations and emergency department visits (ADHSS, 2001). Risk factors

for cancer depend upon the type of cancer. Ranked in terms of mortality in Alaska the four leading types of cancer are lung and bronchus, female breast, prostate, and colorectal (ADHSS, 2006):

- Lung cancer risk factors are primarily related to smoking (including secondhand smoke), but also include medical conditions (fibrotic lung diseases), age, and exposure to certain toxic substances, such as asbestos and possibly PM (EPA, 2010; Wood, 2011).
- Reported risk factors for breast cancer include: age; number of first-degree relatives with breast cancer; ages at menarche (first menstrual cycle), first birth, and menopause; and prior breast biopsy for benign breast disease (Chlebowski et al., 2005).
- Reported risk factors for prostate cancer include age, race/ethnicity (African Americans have higher rates), high fat diet, lack of exercise, and family history (Zangwill, 2011).
- Reported risk factors for colorectal cancers include age, heredity, race/ethnicity (Alaska Natives have lower incidence rate compared to most other ethnicities (in particular Caucasians) diet, obesity, being a long-time smoker, alcohol use, and having type-2 diabetes (CDC, 2010; American Cancer Society, 2011).
- Reported risk factors for diabetes include weight, fat distribution, inactivity, family history, race, and age (ADHSS, 2003; Mayo Clinic, 2011).

Exposure to criteria pollutants can exacerbate and perhaps even cause several of the important chronic diseases, including asthma, COPD, and cardiovascular diseases. Thus, if the concentrations of criteria pollutants, particularly fine particulates ($PM_{2.5}$), were to exceed the NAAQS, adverse health effects would result. As noted previously, proposed Project construction activity has the potential to emit PM. However, these emission levels are unlikely to lead to exceedances of NAAQS. Although the potential exists for a negative effect, it would be limited and unlikely.

Changes in diet that might result from loss of subsistence resources have the potential to increase obesity, one of the risk factors for diabetes.

The potential impact of the proposed Project construction on chronic and non-communicable diseases would be low, with individual criteria ratings as follows:

- Health effect score: Low (0), while increases in prevalence of the chronic diseases listed here could result in loss of life (from certain chronic illnesses) severe injuries, or chronic illness that requires intervention, the linkages between these and construction of the proposed Project are weak. Note that this assessment is consistent with results of the HIA for Point Thomson, which rated this “low” reflecting the possibility that a change in diet due to possible subsistence losses might lead to increased obesity (ADHSS, 2011).
- Duration: High (2), medium-term, 6–8 years.
- Magnitude: Low (0), those impacted will not be able to adapt to the health impact or to maintain pre-impact level of health, which would justify a high rating, but the linkage between proposed Project construction and increases in chronic diseases is weak.

- Extent: Low (0), limited to individual cases.
- Likelihood rating: Very unlikely 1–10%.

### 4.6.2. Potential Operations Impacts

It is likely that any impacts of operation of the proposed Project on non-communicable diseases would be positive, chiefly because of improvements in air quality resulting from probable decreases in the frequency of exceedances of the $PM_{2.5}$ NAAQS. However, realization of these benefits would require expansion of the gas distribution network in Fairbanks, etc.

The potential impact of the proposed Project operations on chronic and non-communicable diseases would be low, with individual criteria ratings as follows:

- Health effect score: Low (0), while increases in prevalence of the chronic diseases listed here could result in loss of life (from certain chronic illnesses), severe injuries, or chronic illness that requires intervention, the linkage between these and operations and maintenance of the proposed Project is weak.
- Duration: Very High (3), long-term, 30 years.
- Magnitude: Low (0), those impacted will not be able to adapt to the health impact or to maintain pre-impact level of health, which would justify a high rating, but the linkage between proposed Project operations and increases in chronic diseases is weak.
- Extent: Low (0) limited to individual cases.
- Likelihood rating: Very unlikely.

Note that this assessment changes when the benefits associated with the expansion of the gas distribution system are included.

## 4.7. HEC 7: Water and Sanitation

This category includes the changes to access, quantity, and quality of water supplies. The pathways include the following:

- Lack of adequate water service is linked to the high rates of lower respiratory infections observed in some regions, and to invasive skin infections.
- Revenue from the Project that supports construction and maintenance of water and sanitation facilities.
- Increased demand on water and sanitation infrastructure secondary to influx of non-resident workers.
- Increased potential for negative impacts to water quality.
- Increase in morbidity and mortality due to conditions affected by limited water access, quality or quantity of water, and sanitation facilities.

### 4.7.1. Potential Construction Impacts

Water diseases are often strongly related to the absolute per capita volume of water available for personal hygiene, e.g., bathing, hand washing, etc. The lack of clean running water and proper sewage disposal is a leading cause of preventable disease in rural Alaska villages and is directly linked to certain infectious diseases. Respiratory, gastrointestinal, and skin diseases are common in areas without safe water supplies.

AGDC would obtain (and comply with provisions of) the necessary permits prior to water withdrawal, thereby minimizing any potential adverse effects to existing water rights and water supplies.

Camps would require food service, drinking water, wastewater treatment, and solid waste management. The Applicant would need to obtain the necessary permits and comply with relevant regulations (e.g., 40 CFR 122; 18 AAC 31.020; 18 AAC 72.010, 200, and 215; AAC 80.200; 18 AAC 60), and would manage waste according to the waste management plan. Therefore, an increased demand on water and sanitation infrastructure due to camps would be managed and mitigated accordingly through permits obtained from the ADEC, and contracts with local service providers.

The use of hazardous materials is not anticipated to affect water quality. Construction is expected to have no or negligible effect on Cook Inlet water quality through the use of hazardous materials. Other water quality impacts in Cook Inlet from pipe trenching and dredging would be localized and short term. Domestic wastewater produced from camps would be treated and discharged in accordance with applicable permits (i.e., domestic waste stream is covered under a required Alaska Pollutant Discharge Elimination System [APDES] permit). Construction of the proposed Project would therefore have negligible effects on water quality.

Operation of the proposed Project is not likely to affect water quality through the exposure of hazardous materials (see construction impacts scoring below and in the exposure to hazardous materials section above). Under the waste management plan, which would be developed for the proposed Project, solid waste would be reused, recycled, burnt, or disposed of in accordance with applicable regulations. Operation of the proposed Project would therefore have negligible effects on water quality.

The potential impact of the proposed Project construction on water and sanitation would be low, with individual criteria ratings as follows:

- Health effect score: Low (0), unlikely to be perceptible.
- Duration: High (2), medium-term, 6–8 years.
- Magnitude: Low (0), minor intensity.
- Extent: Low (0), limited to individual cases.
- Likelihood rating: Very unlikely.

### 4.7.2. Potential Operations Impacts

The use of water for operations would require necessary permits prior to water withdrawal, thereby minimizing any potential effects to existing water rights or water supplies. It is anticipated most workers during operations would be concentrated at the facilities in Nikiski and Prudhoe Bay and in Anchorage. The increased demand on existing water and sanitation infrastructure would be negligible. Other operations impacts to water and sanitation are provided in Resource Report No. 3.

The potential impact of the proposed Project operations on water and sanitation would be low, with individual criteria ratings as follows:

- Health effect score: Low (0), Project facilities are in water service and sanitation areas.
- Duration: Very high (3), long-term, 30 years.
- Magnitude: Low (0), minor or negligible impacts.
- Extent: Low (0), limited to individual cases.
- Likelihood rating: Very unlikely.

## 4.8. HEC 8: Health Services Infrastructure and Capacity

Health services infrastructure and capacity refers to physical infrastructure, staffing levels and competencies, and technical capabilities of health care facilities. Access to health care and health care capacity is often influenced by natural resources development projects. Projects can adversely impact a community's access to care if local capacity is overwhelmed.

This category considers how the Project will influence health services infrastructure and capacity. The pathways include the following:

- Increased revenues can be used to support or bolster local/regional services and infrastructure.
- Increased demands on infrastructure and services by incoming nonresident employees or residents injured on the job, especially during construction phases.

### 4.8.1. Potential Construction Impacts

The temporary construction camps built by the Project would provide onsite healthcare to respond to minor medical needs for the construction workforce. Most construction camps would have trained medical staff and dedicated transportation (i.e., ambulances or helicopters) to handle routine and emergency response situations. An exception would be the GTP construction camp, which would have first aid capabilities only and would rely on the Fairweather Deadhorse Medical Clinic and Prudhoe Bay Operations Center in the Prudhoe Bay CDP for emergency medical response. Both medical facilities currently have excess capacity due to the decline in the oil and gas industry workforce on the North Slope. At times, the Fairweather Deadhorse Medical Clinic has been temporarily closed because of low patient volume (Stephens, 2017). Moreover, additional medical clinics on the North Slope could be available for use by the Project, such as the clinics operated by ConocoPhillips Alaska at the Alpine and Kuparuk oil

fields. Therefore, any increase in demand for emergency medical services on the North Slope resulting from Project construction would readily be accommodated by existing clinics. The Project would implement "fit-for-duty" screenings of incoming construction workers to decrease the number of Project non-related injuries/illnesses requiring medical treatment at worksite facilities or community medical facilities.

Illness or injuries requiring advanced medical care would be treated in existing hospitals, including those located in Barrow, Fairbanks, Palmer, Anchorage, and Soldotna. In the event of an accident at a Project construction site, and if local hospitals are at capacity, medical evacuation to another hospital would be provided by the Project. Existing larger medical facilities, such as those in Fairbanks and Anchorage, are adequate to handle the increase in the demand for medical services during Project construction, including the increase resulting from the influx of in-migrants seeking work, and the additional families that may move to areas of the State. However, some smaller health care facilities are currently sometimes operating at full capacity. As described in Section 5.3.4.2 of Resource Report No. 5, the medical/surgical floor at Central Peninsula Hospital in Soldotna has been at capacity in recent years. An unplanned increase in demand would necessitate either expensive transfers to Anchorage or building more bed capacity. Moreover, the hospital's emergency department could handle a moderate increase in volume, but anything substantial would require expansion of the department. Therefore the Project would have to transport any personnel requiring hospital care to the nearest available hospital with capacity.

Another concern is that some economic in-migrants would have no regular health care provider and would use hospital emergency rooms as primary care access points (Information Insights 2004). In addition to experiencing overburdened emergency rooms, healthcare facilities may encounter an increase in uncollectable debt as the number of uninsured patients increases. Moreover, given that many in-migrants would have transient living situations, an increase in unreimbursed care could result due to an inability to bill patients because of inaccurate billing information.

These impacts to medical facilities and services may be mitigated by impact payments as described in Section 5.4.2.6.1 or Resource Report No. 5. If municipal impact aid grants are available, they may fund projects that address impacts to hospitals, clinics, emergency medical facilities, alcohol and drug abuse facilities, and mental health facilities. For example, potential grant funds could be used for expanding the capacity of medical facilities or hiring additional medical personnel during the period of Project construction. The Applicant will initiate discussions with the Alaska State Hospital and Nursing Home Association and the ANTHC to identify ways to minimize impacts.

The Liquefaction Facility worksite would be largely self-sufficient with respect to emergency response services, including medical facilities and small-scale fire response. Resource Report No. 11 provides additional information on Project impacts on local fire departments and emergency response agencies and mitigation measures addressing those impacts.

A rise in emergency ambulance and fire calls is possible as a result of an increase in auto accidents and injuries that result from Project-related traffic on area roads, and from Project-related population change. As shown in Table 5.4.2 1 of Resource Report No. 5, the Municipality of Anchorage, the MSB and KPB are expected to experience significant population increases during Project construction.

As discussed in Section 5.3.4.3 or Resource Report No. 5, during many days, EMS services in Nikiski, Seward, Kenai, and Soldotna are currently understaffed relative to the number of calls received, and the KPB's multi-agency 911 dispatch center is shorthanded. Any increase in call volume during Project construction would exacerbate these understaffing problems. Moreover, as discussed above, ambulance services and fire departments may find it more difficult to retain and recruit volunteers as a result of the high-paying jobs created during Project construction. The Nikiski Fire Department, which provides fire protection and emergency medical services for the community, has a high percentage of volunteer personnel. Central Mat-Su Emergency Services, which provides EMS services in the MSB outside of Palmer and Wasilla, also relies heavily on volunteers. Should the workload of EMS service providers increase as a result of emergencies related to Project construction, they may be compelled to hire full-time paid professionals, rather than continuing to rely on volunteers.

Consultations would be held with local emergency response services prior to construction. Any adverse impacts to these services may be mitigated by impact payments as described in Section 5.4.2.6.1 of Resource Report No. 5. The impacts might be eligible if there are municipal impact aid grants and they include impacts to search and rescue, fire protection, and emergency medical services. Potential grant funds could be used for hiring additional fire fighters and emergency medical service personnel during the period of construction. The Applicant will also initiate discussions with the State Emergency Response Commission to identify ways to minimize impacts.

The potential impact of the proposed Project construction on health services infrastructure and capacity would be low, with individual criteria ratings as follows:

- Health effect score: Low (0), effects unlikely to be perceptible.
- Duration: High (2), medium-term, 6–8 years.
- Magnitude: Low (0), minor intensity.
- Extent: Low (0), limited to individual cases.
- Likelihood rating: Very unlikely.

### 4.8.2. Potential Operations Impacts

The effect of Project operation on health care services and facilities would depend on the number of persons that migrate into affected communities during operation. As shown in Table 5.4.3 1 of Resource Report No. 5, the MSB and the KPB are expected to experience significant population increases during Project operation. As discussed in Section 5.4.2.6.3 of Resource Report No. 5, Central Peninsula Hospital in Soldotna is sometimes at capacity for certain services, and a larger population in the KPB would further increase the number of times when the hospital is at capacity. The Mat-Su Regional Medical Center in Palmer would also experience an increase in patients with the significant population growth in the MSB.

These impacts to medical facilities and services may be mitigated by payments in lieu of property tax as described in Section 5.4.3.5.1 of Resource Report No. 5. If payments are available, they may fund projects that address impacts to hospitals, clinics, emergency medical facilities, alcohol and drug abuse facilities,

and mental health facilities. For example, potential payments could be used for expanding the capacity of medical facilities or hiring additional medical personnel during the period of Project operation.

The effect of Project operation on emergency services, including EMS and fire response, would depend on the number of households that migrate into the affected communities during operation, and the additional traffic generated by the Project. As shown in Table 5.4.3 1 in Resource Report No. 5, the MSB and the KPB are expected to experience significant population increases during Project operation.

As discussed in Section 5.3.4.3 in Resource Report No. 5, during many days, EMS services in Nikiski, Kenai, and Soldotna are understaffed relative to the number of calls received. Any increase in call volume would exacerbate these understaffing problems. In addition, should the workload of EMS service providers increase as a result of population increases related to Project operation, they may be compelled to hire full-time paid professionals, rather than continuing to rely on volunteers.

Any adverse impacts to emergency services may be mitigated by payments in lieu of property tax as described in Section 5.4.3.5.1 in Resource Report No. 5. For example, potential payments could be used for hiring additional fire fighters and emergency medical service personnel during the period of Project operation.

The potential impact of the proposed Project operation on health services infrastructure and capacity would be low, with individual criteria ratings as follows:

- Health effect score: Low (0).
- Duration: Very high (3), long-term, 30 years.
- Magnitude: Low (0), effects are of minor intensity.
- Extent: Low (0), limited to individual cases.
- Likelihood rating: Extremely unlikely.

- Page Intentionally Left Blank -

# 5. SUMMARY OF POTENTIAL IMPACTS AND MITIGATION MEASURES

The Tables 39 through 46 provide summaries of potential impacts and mitigation measures to reduce impacts.

**Table 39. HEC 1: Social Determinants of Health**

| Construction Health Impacts | +/- | Effect | Duration | Magnitude | Extent | Total | Likelihood | Rating |
|---|---|---|---|---|---|---|---|---|
| Increase in depression and anxiety | (-) | Medium (1) | High (2) | High (2) | Medium (1) | 6 | Likely | Medium ♦♦ |
| Change in employment and median household income | (+) | High (2) | High (2) | High (2) | Medium (1) | 7 | Likely | High ♦♦♦ |
| **Operations Health Impacts** | **+/-** | **Effect** | **Duration** | **Magnitude** | **Extent** | **Total** | **Likelihood** | **Rating** |
| Perceptions that the Project threatens a way of life | (-) | Medium (1) | Very High (3) | Low (0) | Medium (1) | 5 | About as likely as not | Medium ♦♦ |
| Changes in long-term employment and median household income | (+) | Medium (1) | Very High (3) | Low (0) | Medium (1) | 5 | About as likely as not | Medium ♦♦ |
| **Mitigation Measures** | | | | | | | | |
| Potential adverse impacts during construction would be reduced by keeping camps closed to reduce the presence of outside workforce in communities; keeping local communities and their leaders informed of the Project schedule; and, providing community-based participatory monitoring and community engagement to stay aware of and respond to community concerns. Employment opportunities during construction could alleviate family stress by improving family income and the local economy during construction (see descriptions provided in Table 38).<br><br>Potential adverse impacts during operations would be reduced by maintaining community engagement in order to keep operators aware of and respond to community concerns. | | | | | | | | |

**Table 40. HEC 2: Accidents and Injuries**

| Construction Health Impacts | +/- | Effect | Duration | Magnitude | Extent | Total | Likelihood | Rating |
|---|---|---|---|---|---|---|---|---|
| Potential for fatal and nonfatal injuries from construction activity; and increased rail, truck, and sea transport activity | (-) | Medium (1) | High (2) | Medium (1) | Low (0) | 4 | Extremely Unlikely | Low ♦ |
| **Operations Health Impacts** | **+/-** | **Effect** | **Duration** | **Magnitude** | **Extent** | **Total** | **Likelihood** | **Rating** |
| Potential for fatal and nonfatal injuries due to leaks, fires, or explosions | (-) | Medium (1) | Very High (3) | Medium (1) | Low (0) | 5 | Extremely Unlikely | Low ♦ |
| **Mitigation Measures** | | | | | | | | |
| Potential adverse impacts during construction would be reduced by providing training for drivers and requiring transportation equipment to meet legal requirements and be in working order; following systematic approaches to transportation safety such as having written safety plans, safety meetings, and accident investigation and driver retraining procedures; and developing and implementing emergency response plans and drills for accidents, injuries, or hazardous material release events. Health and safety are taken very seriously both on the job and at home by those in the industry. Potential adverse impacts during operations would be reduced by implementing a systematic contractor oversight program that addresses equipment and maintenance standards. Maintenance requires ongoing inspections of equipment. AGDC would promptly notify applicable regulatory agencies of any fires on, or which may threaten any portion of the Project and facilities. AGDC would take measures necessary for the prevention and suppression of fires in accordance with applicable law. | | | | | | | | |

**Table 41. HEC 3: Exposure to Potentially Hazardous Materials**

| Construction Health Impacts | +/- | Effect | Duration | Magnitude | Extent | Total | Likelihood | Rating |
|---|---|---|---|---|---|---|---|---|
| Human exposure linked to air emissions (e.g., fugitive dust, criteria pollutants, VOCs) from increased diesel-powered mobile equipment and truck and rail traffic in PACs along the rail line and highways.<br><br>Fugitive dust due to vehicle traffic on unpaved roads and general construction activities (especially during summer). | (-) | Low (0) | High (2) | Low (0) | Low (0) | 2 | Unlikely | Low ♦ |
| **Operations Health Impacts** | **+/-** | **Effect** | **Duration** | **Magnitude** | **Extent** | **Total** | **Likelihood** | **Rating** |
| Potential fugitive emissions from pipeline connections, operations of GTP would emit combustion related pollutants, such as NOx, CO, PM, VOCs, and $SO_2$.<br><br>Potential for other toxic / hazardous substances – components of natural gas and NGLs (e.g., isobutene, pentanes, hexanes, hydrogen sulfide, butane, and ethane) as well as paints, solvents, petroleum products and fertilizers. | (-) | Low (0) | Very High (3) | Low (0) | Low (0) | 3 | Extremely unlikely | Low ♦ |
| Potential decrease in harmful emissions from other sources other than those from natural gas when natural gas is used in Fairbanks, Anchorage, or other communities. | (+) | Medium (1) | Very High (3) | Medium (1) | Medium (1) | 6 | About as likely as not | Medium ♦♦ |
| **Mitigation Measures** | | | | | | | | |
| Potential adverse impacts during construction would be reduced by implementing BMPs that mitigate fugitive dust; meeting regulatory requirements that mitigate fugitive dust and reduce PM emissions; and, implementing BMPs that manage the use of hazardous substances, including tracking and reporting. AGDC will follow the Project Fugitive Dust Control Plan and the Unanticipated Contamination Discovery Plan.<br><br>Potential adverse impacts during operations would be reduced by implementing the best available control technology (BACT) as defined under the ADEC air permitting process. | | | | | | | | |

**Table 42. HEC 4: Food, Nutrition, and Subsistence Activity**

| Construction Health Impacts | +/- | Effect | Duration | Magnitude | Extent | Total | Likelihood | Rating |
|---|---|---|---|---|---|---|---|---|
| Construction activities (e.g., construction noise, traffic, human presence, barging, and water use requirements) causing removal or disruption of subsistence use areas; temporary decrease in resource availability; temporary reduction in harvester access; and contamination (real or perceived). | (-) | Medium (1) | High (2) | High (2) | Medium (1) | 6 | About as likely as not | Low ♦ |
| **Operations Health Impacts** | **+/-** | **Effect** | **Duration** | **Magnitude** | **Extent** | **Total** | **Likelihood** | **Rating** |
| Potential decrease in consumption of subsistence resources and decrease in food security due to competition from increased access; and increase in traffic and noise that could displace or reduce availability of subsistence resources. | (-) | Medium (1) | Very High (3) | Medium (1) | Medium (1) | 6 | Unlikely | Low ♦ |
| **Mitigation Measures** | | | | | | | | |
| Potential adverse impacts during construction would be reduced by developing a subsistence plan of cooperation to minimize work during times when subsistence activities would occur to the extent practicable; keeping local communities and their leaders informed of the Project schedule; and, providing community-based participatory monitoring and community engagement to stay aware of and respond to community concerns. The AGDC Wildlife Avoidance and Interaction Plan would be developed in consultation with ADF&G and USFWS.<br><br>Potential adverse impacts during operations would be reduced by maintaining community engagement in order to keep operators aware of and respond to community concerns. | | | | | | | | |

**Table 43. HEC 5: Infectious Disease**

| Construction Health Impacts | +/- | Effect | Duration | Magnitude | Extent | Total | Likelihood | Rating |
|---|---|---|---|---|---|---|---|---|
| Potential increases in the transmission of pediatric or adult respiratory disease rates.<br><br>Increases in STI rates, gastro intestinal outbreaks, and antibiotic-resistant staph skin infections. | (-) | High (2) | High (2) | High (2) | Medium (1) | 7 | About as likely as not | High ♦♦♦ |
| **Operations Health Impacts** | **+/-** | **Effect** | **Duration** | **Magnitude** | **Extent** | **Total** | **Likelihood** | **Rating** |
| Potential increases in the transmission of pediatric or adult respiratory disease rates.<br><br>Increases in STI rates, gastro intestinal outbreaks, and antibiotic-resistant staph skin infections. | (-) | High (2) | Very High (3) | High (2) | Low (0) | 7 | Very Unlikely | Medium ♦♦ |
| **Mitigation Measures** | | | | | | | | |
| Potential adverse impacts during construction would be reduced by reducing opportunity for interaction with other persons outside the camps; and providing health education and outreach programs. Construction contractors would be required to have health and safety programs that provide adequate health and medical equipment and staff to respond to and prevent medical emergencies.<br><br>Potential adverse impacts during operations would be reduced by continuing health education and outreach programs. The number of workers is significantly less during operations (as compared to construction) and so too would be the potential impacts. Moreover, unlike the case with the construction phase, where workers might include those from out of state, it is likely that all or nearly all of the workers would be Alaska residents. | | | | | | | | |

**Table 44. HEC 6: Non-Communicable Chronic Disease**

| Construction Health Impacts | +/- | Effect | Duration | Magnitude | Extent | Total | Likelihood | Rating |
|---|---|---|---|---|---|---|---|---|
| Potential increased rates of asthma, chronic obstructive, pulmonary disease, and cardiovascular disease from project emissions of criteria pollutants, particularly $PM_{2.5}$.<br><br>Potential increased rates of diabetes from change in diet from loss of access to or opportunity to harvest subsistence resources. | (-) | Low (0) | High (2) | Low (0) | Low (0) | 2 | Very Unlikely | Low ♦ |
| **Operations Health Impacts** | **+/-** | **Effect** | **Duration** | **Magnitude** | **Extent** | **Total** | **Likelihood** | **Rating** |
| Potential increased rates of asthma, chronic obstructive, pulmonary disease, and cardiovascular disease from project emissions of criteria pollutants, particularly $PM_{2.5}$. | (-) | Low (0) | Very High (3) | Low (0) | Low (0) | 3 | Very Unlikely | Low ♦ |
| Changes in air quality in Fairbanks and other places of expansion of the gas distribution network. | (+) | Medium (1) | Very High (3) | Medium (1) | Low (0) | 5 | About as likely as not | Medium ♦♦ |
| **Mitigation Measures** | | | | | | | | |
| There is a low potential for adverse impacts.<br><br>Any adverse impacts during construction would be reduced by the implementation of regulatory requirements regarding the mitigation of fugitive dust and reduction of particulate matter emissions.<br><br>Potential adverse impacts during operations would be reduced by the implementation of the BACT for combustion equipment to mitigate emissions of NOx and CO. | | | | | | | | |

**Table 45. HEC 7: Water and Sanitation**

| Construction Health Impacts | +/- | Effect | Duration | Magnitude | Extent | Total | Likelihood | Rating |
|---|---|---|---|---|---|---|---|---|
| Change in potable water access.<br><br>Positive or negative change in water quantity or quality.<br><br>Change in demand on water and sanitation infrastructure due to the influx of non-resident workers. | (-) | Low (0) | High (2) | Low (0) | Low (0) | 2 | Very Unlikely | Low ♦ |
| **Operations Health Impacts** | **+/-** | **Effect** | **Duration** | **Magnitude** | **Extent** | **Total** | **Likelihood** | **Rating** |
| Change in water quantity or quality.<br><br>Change in demand on water and sanitation infrastructure due to the influx of non-resident workers. | (-) | Low (0) | Very High (3) | Low (0) | Low (0) | 3 | Very Unlikely | Low ♦ |
| **Mitigation Measures** | | | | | | | | |
| There is a low potential for adverse impacts. Any adverse impacts during construction would be reduced by the implementation of regulatory requirements and BMPs. | | | | | | | | |

**Table 46. HEC 8: Health Services Infrastructure and Capacity**

| Construction Health Impacts | +/- | Effect | Duration | Magnitude | Extent | Total | Likelihood | Rating |
|---|---|---|---|---|---|---|---|---|
| Potential increased use of health infrastructure resources / clinic burden due to resident or worker injuries or illness. | (-) | Low (0) | High (2) | Low (0) | Low (0) | 2 | Very Unlikely | Low ♦ |
| **Operations Health Impacts** | **+/-** | **Effect** | **Duration** | **Magnitude** | **Extent** | **Total** | **Likelihood** | **Rating** |
| Potential increased use of health infrastructure resources / clinic burden due to resident or worker injuries or illness. | (-) | Low (0) | Very High (3) | Low (0) | Low (0) | 3 | Extremely Unlikely | Low ♦ |
| **Mitigation Measures** | | | | | | | | |
| There is a low potential for adverse impacts. Any adverse impacts during construction would be reduced by the implementation of regulatory requirements and BMPs. | | | | | | | | |

In addition, the following measures were developed as part of AGDC's ASAP Project and were included in the SEIS prepared by USACE (USACE, 2018). The ASAP Project shares the same alignment as the Alaska LNG Project's 807-mile Mainline pipeline for the first 670 miles (83%), including 350 miles within the approved Dalton Highway utility corridor. These proposed mitigation measures and/or BMPs would apply to public land use Project areas as incorporated into ROW lease, as required by the State Pipeline Coordinator's Section (SPCS) or a federal ROW grant from the Bureau of Land Management (BLM).

1. Surveillance and Monitoring – a surveillance and monitoring program for the proposed pipeline would be approved prior to start-up of the proposed pipeline per SPCS and BLM ROW lease and grant. The program shall be designed, at a minimum, to provide for and protect public health and safety. AGDC would develop education programs on pipeline damage prevention.
2. Hazards and Incidents – As required by the SPCS and BLM, AGDC would implement measures necessary to protect the health and safety of persons affected by its activities performed in connection with the construction, operation, maintenance, or termination of the pipeline. AGDC, or the appropriate contracting party, would immediately notify the appropriate regulatory agency of all serious accidents, as required, which occur in connection with such activities.
3. Pesticides, Herbicides, Preservatives, and Other Chemicals – AGDC would use only non-persistent and immobile types of pesticides, herbicides, preservatives, and other chemicals. Each chemical to be used and its application constraint would be approved by regulatory agencies (as applicable) prior to use. The use of pesticides and herbicides are regulated by ADEC's Environmental Health Division through 18 AAC 90 and may require a permit.
4. Public Access – AGDC would work with applicable agencies to manage public access and vehicular traffic on roads on state land, which are not managed or owned by the ADOT&PF, as required for activities in the immediate vicinity of the Mainline and Project facilities. AGDC would provide appropriate warnings, flagging, barricades, and other safety measures. AGDC would work with applicable agencies to make provisions for suitable crossings for the public, where the leasehold or access roads cross existing roads, foot trails, winter trails, easements, or other ROW, unless otherwise authorized and per any regulatory requirements.
5. Off-ROW Traffic – AGDC would not operate mobile ground equipment off of any leased area, access roads, state highways, or authorized areas, unless approved or when necessary to prevent harm to any person.
6. Fire Hazards – AGDC would promptly notify regulatory agencies (according to the emergency response plan) of any fires on, or which may threaten any portion of the Project and shall take measures necessary for the prevention and suppression of fires in accordance with applicable law. Use of open fires in connection with the pipeline activities is prohibited on state land unless approved and performed in accordance with state law.

Management of air quality impacts will be done consistent with ADEC legal requirements, including extensive permitting obligations.

# 6. REFERENCES

Adams, Elizabeth J., Laurence Grummer-Strawn, and Gilberto Chavez. "Food insecurity is associated with increased risk of obesity in California women." The Journal of nutrition 133.4 (2003): 1070-1074.

Ahern M, Brown C, Dukas S. A national study of the association between food environments and county-level health outcomes. The Journal of Rural Health. 2011; 27:367-379.

Alaska Department of Commerce. 2016. Community and Regional Affairs: Community Database Online. [Online]: https://www.commerce.alaska.gov/dcra/DCRAExternal/

Alaska Department of Environmental Conservation (ADEC). 2016. Alaska Water and Sewer Challenge. [Online]: https://dec.alaska.gov/water/watersewerchallenge/pressCoverage.html

ADEC, Division of Spill Prevention and Response. 2014. Contaminated Sites Program: Site Summaries: Arness Septage. [Online]: https://dec.alaska.gov/spar/csp/sites/arness_septage.htm

Alaska Department of Health and Social Services, Indicator-Based Information System for Public Health (AK-IBIS). 2016. [Suicide]. Retrieved on [June 27, 2016] from Alaska Department of Health and Social Services, Indicator-Based Information System for Public Health (AK-IBIS) website: http://ibis.dhss.alaska.gov/

Alaska Department of Health and Social Services, Office of Child Services (ADHSS, OCS). 2016. Alaska Office of Children's Services Statistical Information. [Online]: http://dhss.alaska.gov/ocs/Pages/statistics/default.aspx

Alaska Department of Health and Social Services, Public Health, Section of Chronic Disease Prevention and Health Promotion. 2019. Behavioral Risk Factor Surveillance System. [Online]: http://ibis.dhss.alaska.gov/indicator/complete_profile/PhysAct.html

Alaska Department of Health and Social Services (ADHSS). 2016a. Reportable Infectious Diseases in Alaska. 2011-2015 Summary. Website: http://dhss.alaska.gov/dph/Epi/id/SiteAssets/ID_Summary.pdf

ADHSS. 2015a Alaska Technical Guidance for Health Impact Assessment, Version 2.0. Prepared by State of Alaska Health Impact Assessment Program, Department of Health and Social Services. 59 pp

ADHSS. 2015b. Alaska Vital Statistics 2015 Annual Report. Website: http://dhss.alaska.gov/dph/VitalStats/Documents/PDFs/VitalStatistics_Annualreport_2015.pdf

ADHSS. 2011. Health Impact Assessment – Point Thomson Project. Appendix R. State of Alaska HIA Program. Department of Health and Social Services. June 2011. Website: http://www.pointthomson Projecteis.com/documents/DEIS11_2011/Appendices/Appendix%20R%20-%20Health%20Impact%20Assessment%20web.pdf

ADHSS. 2006. Cancer Incidence and Mortality in Alaska, 1996-2001. Section of Chronic Disease Prevention and Health Promotion – Alaska Cancer Registry. February 2006. Department of Health & Social

Services. Website: http://hss.state.ak.us/dph/chronic/cancer/assets/cancerRegistry 1996-2001.pdf

ADHSS. 2001. Publication - 24. Respiratory Disease. Department of Health & Social Services. Website: http://hss.state.ak.us/dph/targets/ha2010/PDFs/24_Respiratory_Disease.pdf

Alaska Department of Health and Social Services, Section of Epidemiology (ADHSS, SOE). 2016b. Chlamydia Infection Update -Alaska, 2015. Bulletin No. 16, June 23, 2016. Online]: http://www.epi.alaska.gov/bulletins/docs/b2016_16.pdf

ADHSS, SOE. 2016c. Drug Overdose Deaths in Alaska, 2009–2015. Bulletin No. 6, March 24, 2016. [Online]: http://www.epi.alaska.gov/bulletins/docs/b2016_06.pdf

ADHSS, SOE. 2016d. Gonococcal Infection –Alaska, 2014. Bulletin No. 10, April 30 2015. [Online]: http://dhss.alaska.gov/dph/Epi/Pages/default.aspx

ADHSS, SOE. 2015d. Health Impacts of Heroin Use in Alaska. Bulletin No. 17 July 14, 2015. [Online]: http://dhss.alaska.gov/dph/Epi/injury/Documents/01-Internal/rr2015_01.pdf

ADHSS, SOE. 2015e. Interactive Display of Alaska Chlamydia and Gonorrhea Data, by Region. [Online]: http://www.epi.alaska.gov/bulletins/docs/b2015_10.pdf

ADHSS, SOE. 2014. Vitamin D Deficiency and Rickets among Alaska Native Children. Bulletin No. 6 May 20, 2014. [Online]: http://epibulletins.dhss.alaska.gov/Document/Display?DocumentId=68

ADHSS, SOE. 2003. The Burden of Overweight & Obesity in Alaska. April 2003. Department of Health & Social Services. Website: http://www.epi.alaska.gov/pubs/obesityburden/obesityburden.pdf

Alaska Department of Transportation and Public Facilities (ADOT&PF). 2017. Alaska Highway Safety Office, Transportation & Public Facilities Fatality Analysis Reporting System. Website: http://dot.alaska.gov/stwdplng/hwysafety/fars.shtml

Alaska Department of Public Safety, Division of Alaska State Troopers. 2015. Alaska Bureau of Investigation Statewide Drug Enforcement Unit Annual Drug Report. Website: http://www.dps.state.ak.us/ast/abi/docs/SDEUreports/2015%20Annual%20Drug%20Report.pdf

Alaska State Troopers. 2012. The Alaska State Troopers Annual Report 2012.

Alaska Department of Public Safety. 2016. Alaska State Troopers Detachments. [Online]: http://www.dps.state.ak.us/AST/detachments.aspx

Alaska Police Standards Council. 2016. Member Agencies. [Online]: http://www.dps.state.ak.us/APSC/agencies.aspx

Alaska Network on Domestic Violence and Sexual Assault. 2010-2015. Alaska Victimization Survey. [Online]: http://justice.uaa.alaska.edu/avs/alaska.html

American Cancer Society. 2016. Non-small cell lung cancer risk factors. [Online]: http://www.cancer.org/cancer/lungcancer-non-smallcell/detailedguide/non-small-cell-lung-cancer-risk-factors

American Cancer Society. 2016. Prostate cancer risk factors. [Online]: http://www.cancer.org/cancer/prostatecancer/detailedguide/prostate-cancer-risk-factors

American Cancer Society. 2015. Colorectal cancer risk factors. [Online]: http://www.cancer.org/cancer/colonandrectumcancer/detailedguide/colorectal-cancer-risk-factors

American Cancer Society. 2014. What are the key statistics about breast cancer? [Online]: http://www.cancer.org/cancer/breastcancer/detailedguide/breast-cancer-key-statistics

American Cancer Society. 2011. Circle of LifeSM: Cancer Education and Wellness for American Indian and Alaska Native Communities. Colorectal Cancer Overview. Website: http://www.cancer.org/acs/groups/cid/documents/document/acsd-007302.pdf

AN EpiCenter. 2016. Statewide Alaska Native Health Status Report, Alaska Native Epidemiology Center, Alaska Native Tribal Health Consortium. [Online]: http://www.anthctoday.org/epicenter/data/regions/statewide/index.html

AN EpiCenter. 2009. Alaska Native Health Status Report. [Online]: http://anthctoday.org/epicenter/assets/health_status_report_2009/2009_anai_health_status_report.pdf

Associated Press (AP). 2011. "Small towns see increase in crime amid gas drilling boom." Post-Standard (Syracuse, NY), posted October 26, 2011. Website: http://www.syracuse.com/news/index.ssf/2011/10/small_towns_see_increase_in_cr.html

Berman Matthew and Hull Theresa. 1997. Community Control of Alcohol in Alaska. Alaska Review of Social and Economic Conditions, April 1997 Vol. XXXI, No. 1. [Online]: http://www.iser.uaa.alaska.edu/Publications/formal/arsecs/arsec31.pdf

Brooke 1989. Brook, Anderson, Bland, Peacock, Stewart. 1989. Effects on birth weight of smoking, alcohol, caffeine, socioeconomic factors, and psychosocial stress. Brook, OG, HR Anderson, JM Bland, JL Peacock, and CM Stewart. British Medical Journal Mar 25;298(6676):795-801.

Brownson RC, Haire-Joshu D, Luke DA. Shaping the context of health: A review of environmental and policy approaches in the prevention of chronic diseases. Annu Rev Public Health 2006; 27:341-70.

Brunelle JA, Carlos JP. Recent trends in dental caries in U.S. children and the effect of water fluoridation. J Dent Res 1990;69 (Spec Iss):723-727.

Community Anti-Drug Coalition of American. 2010. "Fetal Alcohol Syndrome Rate in Alaska Declines." CDC. Community Anti-Drug Coalition of American. [Online] http://www.cadca.org/resources/detail/fetal-alcohol-syndrome-rate-alaska-declines

Chandler 1998. Cultural continuity as a hedge against suicide in Canada's First Nations. Chandler, M. In Sage Journals, Transcultural Psychiatry, June 1998, vol. 35 no. 2 191-219.

Chandler 2004. Transferring whose knowledge? Exchanging whose best practices?: On knowing about indigenous knowledge and aboriginal suicide. Chandler, M. J., & Lalonde, C. In J. White, P. Maxim,

& D. Beavon (Eds.), Aboriginal Policy Research: Setting the Agenda for Change, Vol.II. (pp.111-123) Toronto: Thompson Educational Publishing.

CEE Bankwatch Network, Gender Action. 2006. Boom Time Blues, Big Oil's Gender Impacts in Azerbaijan, Georgia, and Sakhalin. Czech Republic, 52 pp. Website: http://bankwatch.org/publications/boom-time-blues-big-oils-gender-impacts-azerbaijan-georgia-and-sakhalin

Centers for Disease Control and Prevention (CDC). 2014. National Diabetes Statistics Report: Estimates of Diabetes and Its Burden in the United States, 2014. Atlanta, GA: US Department of Health and Human Services; 2014. Accessed November 30, 2015.

CDC. 2014. STD Surveillance 2014. Atlanta: US DHSS; 2015. [Online]: http://www.cdc.gov/std/stats14/default.htm

CDC. 2013. National Center for Health Statistics: National Vital Statistics Reports: Deaths: Final Data for 2013. Atlanta, GA: 2013. [Online]: http://www.cdc.gov/nchs/data/nvsr/nvsr64/nvsr64_02.pdf

CDC. 2010. Division of Reproductive Health: Maternal and Infant Health Research: Pregnancy Complications. Atlanta, GA: 2010. [Online]: http://www.cdc.gov/reproductivehealth/maternalinfanthealth/PregComplications.htm

CDC. 2010. Colorectal (Colon) Cancer - Colorectal Cancer Rates by Rates and Ethnicity – Incidence Rates by Race/Ethnicity and Sex. Website: http://www.cdc.gov/cancer/colorectal/statistics/race.htm

CDC. 2007. Best Practices for Comprehensive Tobacco Control Programs-2007. Atlanta; U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health; October 2007.

CDC. 2005. National Center for Health Statistics: National Vital Statistics Reports: Deaths: Final Data for 2005. Atlanta, GA. [Online]: http://www.cdc.gov/nchs/data/nvsr/nvsr56/nvsr56_10.pdf

CDC. 2004. CDC Surgeon General Report 2004. U.S. Department of Health and Human Services. The Health Consequences of Smoking: A Report of the Surgeon General, 2004. Centers for Disease Control and Prevention, Office on Smoking and Health, Atlanta, GA, May 2004

Chlebowski, R., Chen, Z., Anderson, G., Rohan, T., Aragaki, A., Lane, D., Dolan, N., Paskett, E., McTiernan, A., Hubbell, F., Adams-Campbell, L., and Prentice, R. 2005. Ethnicity and Breast Cancer: Factors Influencing Differences in Incidence and Outcome. JNCI J Natl Cancer Inst, 97(6): 439-448. Website: http://jnci.oxfordjournals.org/content/97/6/ 439.full.pdf+html

Cole, D. 1997. Amazing Pipeline Stories: How Building the Trans-Alaska Pipeline Transformed Life in America's Last Frontier. Epicenter Press, Fairbanks, AK.

Copper River Knowledge System. 2016. Bioregional & Watershed Profile. [Online]: http://www.crks.org/wp/?page_id=14

County Health Rankings. 2016a. Additional Measures: Limited Access to Healthy Foods-Alaska. [Online]: http://www.countyhealthrankings.org/app/alaska/2016/measure/factors/83/description

County Health Rankings. 2016. Health Factors: Drinking Water Violations. [Online]: http://www.countyhealthrankings.org/app/alaska/2016/measure/factors/124/datasource

Economic Policy Institute. 2016. Rural Alaska: The Cost of Living in Rural Alaska. [Online]: http://cost-of-living.careertrends.com/l/4/Rural

Farnham, A. 2012. "North Dakota oil boom: The dark side". ABCNews.com, posted February 2, 2012. Website: http://abcnews.go.com/Business/north-dakotas-oil-boom-dark-side/story?id=15458362

Fryar CD, Chen T, Li X. Prevalence of uncontrolled risk factors for cardiovascular disease: United States, 1999-2010. NCHS Data Brief, No. 103. Hyattsville, MD: National Center for Health Statistics, Centers for Disease Control and Prevention, US Dept of Health and Human Services; 2012

Goldenberg, S., Shoveller, J., Ostry, A, and Koehoorn, M. 2008b. Youth sexual behavior in a boomtown: implications for the control of sexually transmitted infections. Sex. Transm. Infect., 84: 220-223.

Goldenberg, S., Shoveller, J., Ostry, A, and Koehoorn, M. 2008c. Sexually transmitted infection (STI) testing among young oil and gas workers, the need for innovative, place-based approaches to STI control. Revue Canadienne de Santé Publique, 99(4): 350 354.

Gundersen, C., A. Satoh, A. Dewey, M. Kato & E. Engelhard. Map the Meal Gap 2015: Food Insecurity and Child Food Insecurity Estimates at the County Level. Feeding America, 2015

Healthy Alaskans 2020. 2014. Healthy Alaskans 2020 Health Assessment: Understanding the Health of Alaskans. [Online]: http://hss.state.ak.us/ha2020/assets/HA2020_HealthAssessment.pdf

Hollander. 2015. "Talkeetna braces for troopers post closing expected to save $80K." Alaska Dispatch News, April 18, 2015 [Online]: http://www.adn.com/mat-su/article/talkeetna-braces-troopers-post-closing-expected-save-80k/2015/04/19/

Husberg, B., Fosbroke, D., Conway, G., and Mode, N. 2005. Hospitalized Nonfatal Injuries in the Alaskan Construction Industry. Am J of Ind Med, 47: 428-433.

Indian Health Service. 2016. Alaska Area: Tribal Health Organizations. [Online]: https://www.ihs.gov/alaska/tribalhealthorganizations/

Information Insights, Inc. 2004. Stranded Gas Development Act Municipal Impact Analysis. Prepared for Municipal Advisory Group. Juneau, AK.

Jobin, W. 2003. Health and Equity Impacts of a Large Oil Project in Africa. Special Theme – Health Impact Assessment. Bulletin of the World Health Organization 81(6):420-426. Website: http://www.who.int/bulletin/volumes/81/6/jobin.pdf

Kramer MS. 1987. Determinants of low birth weight: methodological assessment and meta-analysis.

Krueger, PM and Scholl. 2000. Adequacy of prenatal care and pregnancy outcome. Journal of American Osteopathic Association, August.

Kulesza, A. 2011. "Natural disaster: How did the gas industry get so fracked up?" Philadelphia Weekly, September 14, 2011. Website: http://www.philadelphiaweekly.com/news-and-opinion/cover-story/Natural-Gas-Drilling-in-PA-Goes-From-Gold-Mine-to-Land-Mine.html

Mayo Clinic. 2014. COPD. [Online]: http://www.mayoclinic.com/health/copd/DS00916

Mayo Clinic. 2011. Type 2 diabetes. Risk factors. August 2. Website: http://www.mayoclinic.com/health/type-2-diabetes/DS00585/DSECTION=risk-factors

Mozaffarian D, Benjamin EJ, Go AS, Arnett, DK, Blaha MJ, et al. Heart disease and stroke statistics-2015 update: a report from the American Heart Association. Circulation. 2015; 131: e29-e322.

Moore LV, Thompson FE. 2015. Adults Meeting Fruit and Vegetable Intake Recommendations - United States, 2013. MMWR Morb Mortal Wkly Rep. 2015 Jul 10;64(26):709-13.

National Cancer Institute. 2016. Surveillance, Epidemiology, and End Results Program Stat Fact Sheets: Colon and Rectum Cancer. [Online]: http://seer.cancer.gov/statfacts/html/colorect.html

National Center for Chronic Disease Prevention and Health Promotion. 2018. Behavioral Risk Factor Surveillance System (BRFSS).[Online]: https://www.cdc.gov/brfss/index.html

National Council on Alcoholism and Drug Dependence. 2016. National Center for Chronic Disease Prevention and Health Promotion, Behavioral Risk Factor Surveillance System (BRFSS) About Addiction: Prescription Drugs. [Online]: https://www.ncadd.org/about-addiction/drugs/prescription-drugs

National Institute of Allergy and Infectious Diseases (NIAID). 2011. Pneumococcal Pneumonia. [Online]: http://www.niaid.nih.gov/topics/pneumonia/pages/default.aspx

National Institute of Health (NIH), National Institute on Drug Abuse. 2016. What is the scope of marijuana use in the United States? [Online]: https://www.drugabuse.gov/publications/research-reports/marijuana/what-scope-marijuana-use-in-united-states

NIH, National Institute on Drug Abuse. 2014. The Science of Drug Abuse and Addiction: The Basics. [Online]: https://www.drugabuse.gov/publications/media-guide/science-drug-abuse-addiction-basics

Newbrun E. Effectiveness of water fluoridation. J Public Health Dent 1989; 49(5):279-289.

Olshansky SJ, Passaro DJ, Hershow RC et al. A potential decline in life expectancy in the United States in the 21st century. NEJM 2005; 352(11):1138-45.

Pacific Environment. 2011. Impacts on Sakhalin Island's Society and Infrastructure. Website: http://pacificenvironment.org/article.php?id=251

Pacer M. 2016. "Nikiski voters shoot down law enforcement service area. "Homer News, October 7, 2015. [Online]: http://homernews.com/homer-news/local-news/2015-10-07/nikiski-voters-shoot-down-law-enforcement-service-area

Sakhalin Environment Watch. 2011. Sakhalin II Oil and Gas Project – Economic problems. Website: http://www.sakhalin.environment.ru/en/index.php?section=economicproblems

Schafft KA, Jensen EB, Hinrichs CC. Food deserts and overweight schoolchildren: Evidence from Pennsylvania. Rural Sociology. 2009;74:153-277.

Schecter, D. 2011. "Oil boom in North Dakota overwhelming rural towns." WFAA.com, posted November 9th, 2011. Website: http://www.wfaa.com/news/business/Oil-boom-in-North-Dakota-overwhelms-rural-towns-133493403.html

Seaquist ER. Addressing the burden of diabetes. 2014. JAMA, 311, 22.

Shandro, J. A., Veiga, M. M., Shoveller, J, Scoble, M., and Koehoorn, M. 2011. Perspectives on community health issues and the mining boom-bust cycle. Resources Policy, 36(2): 178-186.

Shanks A. 2013. Yukon-Koyukuk Census Area. *Alaska Economic Trends* 33 (3):8-11.

Shanks A. 2012. Poverty Measures in Alaska. *Alaska Economic Trends* 32 (2):11-15.

Shanks, A. and D. Rasmussen. 2010. The Kenai Peninsula. Alaska Economic Trends 30 (4):11-15.

Stephens, T. 2017. Director of Medical Services, Fairweather LLC. Personal communication with Northern Economics, Inc., March 16, 2017

Stevenson 2009. "The Suicidal Wound and Fieldwork among Canadian Inuit." In Being There: the Fieldwork Encounter and the Making of Truth. Lisa Stevenson. John Borneman, Abdellah Hammoudi, eds. California: University of California Press, 2009.

Substance Abuse and Mental Health Services Administration Behavioral Health Barometer Alaska, 2015. HHS Publication No. SMA-16-Baro-2015-AK. Rockville, MD: Substance Abuse and Mental Health Services Administration, 2015.

Taggart K. Fast food joints bad for the neighbourhood. Medical Post. 2005; 41.21:23.

Truman BI, Gooch BF, Evans CA Jr. (Eds.). The Guide to Community Preventive Services: Interventions to prevent dental caries, oral and pharyngeal cancers, and sports-related craniofacial injuries. Am J Prev Med 2002; 23(1 Supp):1-84.

U.S. Army Corps of Engineers (USACE). 2012. Final Environmental Impact Statement for the proposed Alaska Stand Alone Pipeline. Section 5.15 Public Health. Website: http://asapgas.agdc.us/pdfs/documents/eis/5_15_ASAP_FEIS_Public-Health.pdf

U.S. Army Corps of Engineers (USACE). 2018. Final Supplemental Environmental Impact Statement for the proposed Alaska Stand Alone Pipeline. Chapter 4: Environmental Consequences, Section 4.21 Public Health. Available online at: http://www.asapeis.com/documents/ASAPSEISFinalChapter4_EnvironmentalConsequences.pdf

U.S. Environmental Protection Agency (EPA). 2010. Effects of Air Pollutants – Health Effects. Air Pollution Control Orientation Course. January 29, 2010. Website: http://www.epa.gov/apti/course422/ap7a.html

U.S. Department of Agriculture (USDA), U.S. Department of Health and Human Services (USDHHS). Dietary guidelines for Americans, 2010. Washington, DC: US Government Printing Office; 2012. Available at http://www.health.gov/dietaryguidelines/2010.asp

USDHHS. 2010. Surgeon General's Report—How Tobacco Smoke Causes Disease: The Biology and Behavioral Basis for Smoking-Attributable Disease. 2010. [Online]: http://www.surgeongeneral.gov/library/tobaccosmoke/report/executivesummary.pdf

USDHHS. 2015. Dietary Guidelines for Americans 2015-2020, Eighth Edition. [Online]: http://health.gov/dietaryguidelines/2015/resources/2015-2020_Dietary_Guidelines.pdf

U.S. Public Health Service, Office of the Surgeon General. 1999. Mental Health: A Report of the Surgeon General. [Online]: https://profiles.nlm.nih.gov/ps/retrieve/ResourceMetadata/NNBBHS

Ventura et al. 2011. U.S. Teenage Birth Rate Resumes Decline. Ventura S, Hamilton B. CDC National Center for Health Statistics, NCHS Brief # 58, February 2011. [Online]: http://www.cdc.gov/nchs/data/databriefs/db58.htm

Wernham, A. 2007. Inupiat Health and Proposed Alaskan Oil Development: Results of the First Integrated Health Impact Assessment/Environmental Impact Statement for Proposed Oil Development on Alaska's North Slope. EcoHealth, 4:500-513.

Wood, D. 2011. Risk Factors for Lung Cancer. Alaska Surgery Center. Website: http://www.aksurgery.com/apps/HealthGate/Article.aspx?chunkiid=19772

World Health Organization (WHO). 1999. Report on Infectious Diseases: Removing Obstacles to Healthy Development 1999. World Health Organization. [Online]: http://www.who.int/infectious-disease-report/pages/textonly.html

WHO. 2005. Make every mother and child count. The World Health Report 2005. World Health Organization. [Online]: http://www.who.int/whr/2005/whr2005_en.pdf

WHO. 2008. Social Determinants of Health, World Health Organization. Available online at: http://www.who.int/social_determinants/thecommission/finalreport/en/index.html

Wrigley N, Warm D, Margetts B, Whelan A. Assessing the impact of improved retail access on diet in a 'food desert': A preliminary report. Urban Studies. 2002;39.11:2061-2082.

Zangwill, M. 2011. Risk Factors for Prostate Cancer. Alaska Surgery Center. Website: http://www.aksurgery.com/apps/HealthGate/Article.aspx?chunkiid=20050WHO. 2014. Physical Activity. [Online]: http://www.who.int/dietphysicalactivity/pa/en/index.html