Health Impact Assessment – Ambler Road, Alaska

Contents

Figures

Tables

Acronyms and Abbreviations

ABHP	Alaska Bureau of Highway Patrol
ABVS	Alaska Bureau of Vital Statistics
ADEC	Alaska Department of Environmental Conservation
ADF&G	Alaska Department of Fish and Game
ADHSS	Alaska Department of Health and Social Services
ADOLWD	Alaska Department of Labor Workforce Development
ADOT&PF	Alaska Department of Transportation and Public Facilities
ADNR	Alaska Division of Natural Resources
AE	Affected environment
AFN	Alaska Federation of Natives
AIDEA	Alaska Industrial Development and Export Authority
AIP	Arctic Investigations Program of the CDC
AK-IBIS	Alaska Indicator-Based Information System
ANCSA	Alaska Native Claim Settlement Act of 1971
AN EpiCenter	Alaska Native Epidemiology Center
ANMC	Alaska Native Medical Center
ANTHC	Alaska Native Tribal Health Consortium
AOI	Area of influence
AST	Alaska State Trooper
ATR	Alaska Trauma Registry
ATV	All-terrain vehicle
ATSDR	Agency for Toxic Substances and Disease Registry
BLL	Blood lead level
BLM	U.S. Bureau of Land Management
BMI	Body Mass Index
BRFSS	Behavioral Risk Factor Surveillance System
CDC	Center for Disease Control and Prevention
CFR	Code of Federal Regulations
CHAP	Community Health Aide Program
CHD	Coronary heart disease
CIL	Carbon in leach
CIRI	Cook Inlet Region, Inc.
CIS	Community Information Summaries

COPD	Chronic obstructive pulmonary disease
CT	Chlamydia trachomatis
EC	Environmental consequences
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
FAS	Fetal Alcohol Syndrome
FR	Federal Regulations
GC	Gonorrhea
GIS	Geographic information system
HA2020	Healthy Alaskans 2020
HEC	Health Effect Category
HIA	Health Impact Assessment
HIPPA	Health Insurance Portability and Privacy Act of 1996
HIV/AIDS	Human immunodeficiency virus/acquired immune deficiency syndrome
HPV	Human papilloma virus
ICD	International Classification of Diseases
IPV	Intimate partner violence
LBW	Low birth weight
Mat-Su	Matanuska–Susitna Borough
MCH	Maternal and child health
MHC	Maniilaq Health Center
MHS	Maniilaq Health Services
MMR	Measles-mumps-rubella
µg/dL	Micrograms per deciliter
mg/dL	Milligrams per deciliter
NAB	Northwest Arctic Borough
NCD	Non-Communicable Diseases
NEPA	National Environmental Policy Act
NIH	National Institutes of Health
NOA	Naturally occurring asbestos
NPS	National Park Service
OCS	Office of Children's Services
ORAC	Oxygen radical absorption capacity
PAC	Potentially affected community
PCBs	Polychlorinated biphenyls

PID	Pelvic inflammatory disease
PM	Particulate matter
ppm	parts per million
ROW	Right of way
RR	Rate ratio
SDH	Social Determinants of Health
SIDS	Sudden Infant Death Syndrome
SOE	Section of Epidemiology
STI	Sexually transmitted infection
TB	Tuberculosis
TCC	Tanana Chiefs Conference
U.S.	United States
USACE	U.S. Army Corps of Engineers
USDHHS	U.S. Department of Health and Human Services
USDA	U.S. Department of Agriculture
USGS	U.S. Geological Survey
VPSO	Village Public Safety Officer
WHO	World Health Organization
YKCA	Yukon-Koyukuk Census Area
YRBS	Alaska Youth Risk Behavior Survey
YRBSS	Youth Behavioral Risk Factor Surveillance System

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Executive Summary

This health impact assessment (HIA) informs decision-makers on potential human health impacts related to the proposed Ambler Road project. The report culminates with a ranking of these impacts according to their relative importance and provides recommended action steps and monitoring approaches for the key health impacts.

This HIA has been included as part of the National Environmental Policy Act (NEPA) Review/Environmental Impact Statement (EIS) at the request of the lead federal agency, the Bureau of Land Management (BLM). The Ambler Road HIA was developed using the strategies and methodologies described in the 2015 Alaska HIA Technical Guidance for HIA. The HIA evaluates potential project impacts on human health from the proposed action and alternatives.

Affected Environment Summary

A detailed affected environment (AE)-baseline health analysis (see Chapter 3 of Appendix N) is presented. Health data are organized within eight "Health Effects Categories (HECs)," as described in the 2015 Alaska Department of Health and Social Services (ADHSS) HIA guidance. The eight HECs are social determinants of health (SDH), accidents and injuries, exposure to potentially hazardous materials, food/nutrition and subsistence, infectious diseases, water/sanitation, non-communicable/chronic diseases, and health services infrastructure and capacity. Whenever possible, information developed in the EIS Affected Environment chapter (and appendices) is cross-referenced.

Current human health conditions are described for communities within 50 miles of the proposed road and project alternatives. Potentially affected communities are located in the Interior Public Health Region (Yukon-Koyukuk Census Area [YKCA]) and the Northern Public Health Region (Northwest Arctic Borough [NAB]).

The overall morbidity (illness) and mortality (death) indicators for the Interior and Northern Public Health Regions are generally consistent with the overall trends observed for all Alaska Natives. Morbidity is dominated by respiratory and digestive disease and injury and poisoning. Sexually transmitted infections (STIs) are a significant issue for Alaska Natives with chlamydia infection rates more than eight times greater than U.S. whites, with the greatest number of infections among Alaska Native females aged 15–34 years. Similarly, gonorrhea infection rates are almost 10 times greater than U.S. whites, again dominated by Alaska Native females aged 15–34 years. Musculoskeletal diseases are a leading cause of outpatient visits. Dental disease is a significant source of morbidity as more than 50 percent of Alaska Native adults have experienced tooth loss due to tooth decay or gum disease. Cancer incidence rates have increased significantly over the last 50 years and are strongly associated with underlying rates of smoking, alcohol use, and obesity.

The three leading causes of mortality for all Alaska Natives are cancer, heart disease, and unintentional injury. The Northern Public Health Region has higher cardiovascular and unintentional injury mortality rates than the Interior Public Health Region. Chronic obstructive pulmonary disease (COPD) mortality rates have significantly increased and are consistent with high smoking rates. Alaska Native males had significantly higher mortality rates for cancer, heart disease, unintentional injury, suicide, COPD, and alcohol abuse compared to Alaska Native females. Alaska Native females had significantly higher rates of mortality due to cerebrovascular disease and chronic liver disease compared to Alaska Native males. Alaska Native infant mortality rates have decreased significantly since the 1980s. Life expectancy for Alaska Native people has been increasing since the 1980s and is now 70.7 years. At a smaller geographic level than the public health region, there are significant health outcome differences between YKCA and

NAB. YKCA has a significantly higher unintentional injury death rate, cardiovascular/respiratory mortality, cancer mortality, diabetes, and binge-drinking rates versus NAB. However, YKCA adult smoking rates are lower than NAB. STI rates are similar. Naturally occurring asbestos (NOA) is present in multiple geographic areas within the Interior Public Health Region. Functioning health care clinics are available across all study communities.

Environmental Consequences Summary

The environmental consequences (EC) analysis (see Chapter 4) is based on the rating and ranking methodology presented in the 2015 ADHSS HIA guidance. Information developed in the EIS EC chapter (and appendices) is cross-referenced and, as appropriate, also used as a technical basis for the ratings and rankings for the proposed action and alternatives. The summary impact rankings are shown by HEC in Tables 47 - 64.

The health consequence analysis considered road impacts and other indirect and cumulative impacts of growth (a future mining development scenario). The health analysis considered the No Action Alternative and Alternatives A, B, and C. A full description of the alternatives is provided in EIS Chapter 2. From a health perspective, Alternatives A, B, and C are quite similar and overlapping. Hence, a category "Impacts Common to All Alternatives" was used as per the EIS. Alternative C has a somewhat different soils profile related to NOA and this is noted and separately evaluated. Indirect and cumulative effects are based on a long-term commercial mining district development scenario described in EIS Sections 2.1 and 2.2 in Appendix H. Potential health impacts are summarized across eight defined HECs per Alaska DHSS HIA Guidance.

Road Impacts

Analysis of the road impacts included impacts from the No Action Alternative and Alternative C as well as impacts common to all alternatives.

No Action Alternative

This alternative would likely maintain the current baseline trends in regional mortality and morbidity. Respiratory, digestive, dental, musculoskeletal disease, injury/poisoning, and STI trends are likely to continue to dominant the burden of illness and injury. Cancer, heart disease, and unintentional injury are likely to continue to be the leading causes of mortality. Underlying rates of smoking, alcohol use, and obesity will continue to be significant drivers of morbidity and mortality.

Impacts Common to All Alternatives

The most important potential impacts that emerged from the rating and ranking process are summarized by HEC. Detailed tables that present the full rating and ranking process are in Chapter 4 of the HIA.

SDH. Some potential impacts are related to socioeconomic improvements in household income and employment during active construction. As discussed in the AE-Baseline (Chapter 3 of the HIA), improvements in income and employment can have a variety of effects and subsequent health consequences. Not all households will experience (or choose to experience) direct income/employment changes which can produce a "have and have not situation" with increases in psychosocial stress. Increases in goods and service distribution could occur (access to better and cheaper building and supply materials). Similarly, increases in substance abuse due to greater alcohol and tobacco product distribution could also occur via the road. Changes in intimate partner violence and suicide rates could worsen (or improve) depending upon whether family/community cohesion declines or strengthens. Sudden changes in income/employment are often seen when large projects occur in remote, rural settings, which is known

as a "boom and bust cycle." Boom and bust is typically associated with marked changes in substance abuse use, a phenomenon noted during the recent shale oil boom in rural parts of the U.S. This cycle is further discussed in the analysis of the "other indirect and cumulative impacts of growth" scenario. Psychosocial effects can have consequences that persist well after road construction completion.

Accidents and Injuries. Improvements in surface and air (new landing strips associated with road construction and maintenance) infrastructure could facilitate improved emergency response times and evacuation efficiency. The potential increase in interaction between community members and commercial road traffic could result in increased serious accidents and injuries. There is already a significant burden of unintentional injury in the PACs (see Baseline Chapter 3, HEC#2). Additional interaction between community members and construction vehicles could result in additional accidents and injuries.

Exposure to Potentially Hazardous Materials. Road construction could increase distribution and consequent exposure to NOA materials. The experience with NOA in the general Ambler area is well documented in Section 3.23. NOA materials can be safely handled and managed; however, this requires a significant effort and careful development of detailed management plans. Management/mitigation plans are discussed in Chapter 5 of this HIA. Increases in accidental releases (such as fuels or construction materials) could impact land and water resources, although the geographical extent is potentially limited. Despite numerous stakeholder concerns/comments, the HIA Team believes that impacts on flora (plants) and fauna (animals) are likely to be very geographically restricted without major impacts to individuals or communities.

Food, Nutrition, and Subsistence Activity. The HIA ratings are primarily based on the analysis per the Subsistence Uses and Resources analysis (EIS Section 3.4.7). Impacts are mixed. For example, increased economic benefits could decrease the number of food-insecure households, as there would be more disposable income to buy commercial food products. If limited commercial road access is provided, transportation costs associated with commercial food product delivery could fall. Conversely, as described in the Subsistence Uses and Resources analysis, there are potential impacts to access, quantity, and quality (real or perceived) related to construction activities (such as NOA and other dusts), noise, physical barriers, habitat fragmentation, and competition for resources.

Changes in diet composition (a decline in subsistence and concomitant rise in commercial foodstuffs) could occur as a function of both rising incomes and access to commercial food products combined with decreased per capita subsistence. Changes in subsistence can have numerous cascading health effects on psychosocial wellbeing, community cohesion, and long-term non-communicable disease rates.

Infectious Diseases including STIs. Changes in overall burden of STIs above baseline are a concern. Changes in communicable respiratory diseases are considered to be unlikely given the limited number of construction workers, locations of construction camps (not close to PACs), and a closed camp strategy that will be in effect. Changes in underlying vector-borne, parasitic, and zoonotic disease rates are considered as unlikely. While there is likely to be some movement and mixing between workers from the PACs and "outside workers," this is unlikely to generate meaningful changes in underlying non-STI infectious disease rates over the duration of construction. However, a communicable infectious disease outbreak is always a risk in a work camp setting and has been well documented in the medical literature.

Water and Sanitation. Potential improvements due to improved access and lower distribution costs for industrial materials could occur. Historically there is significant underinvestment in water and sanitation services and maintenance at the community level. This observation was clearly made during the HIA workshop by regional health professionals. Therefore, improvements in incomes for households and regional corporations could result in tangible improvements in water/sanitation services and maintenance.

Non-Communicable and Chronic Diseases. Changes in diet composition (increased access to and lower costs for processed foods) in addition to impacts on per capita subsistence could produce long-term increases in non-communicable disease (NCD) rates. Changes in cardiovascular NCD rates do not occur within short time frames (days or weeks); however, changes in the level of obesity, hypertension, and diabetes can be seen over shorter time periods (months).

Health Services Infrastructure and Capacity. There are potential improvements due to access to fiber optic cable infrastructure (faster and more stable internet/telecommunications). There could also be improved access and lower distribution costs for clinic supplies. Improvements in access for medical staff and greater efficiency for emergency evacuations are a potential outcome. During the HIA workshop, the consensus among attending health professionals was that the proposed project would likely improve health services infrastructure and capacity during construction and operations.

Alternative C

Impacts for Alternative C are identical to Alternatives A and B with some exceptions: (1) exposure to NOA materials is likely to be less of an issue as the geographical distribution of known NOA is generally avoided and (2) Hughes community would be closer to the road and would be more likely to experience the suite of identified impacts. However, the overall non-NOA impacts associated with Alternative C are otherwise not materially different from Alternatives A and B.Mining, Access and other Indirect and Cumulative Impacts

The growth impact analysis identified other indirect and cumulative impacts common to all the action alternatives as well as specific impacts from Alternative C.

Impacts Common to All Action Alternatives

SDH. Potential impacts are related to socioeconomic changes in household income and employment during active construction. Increases in psychosocial stress and community social cohesion at either a household or individual level are possible. A “fly-in-fly out” workforce could have mixed effects on community cohesion (employed adults may relocate to urban areas but send remittances) and psychological stress (difficulties with scheduling time off work with local subsistence activities). Increases in goods and service distribution could result in access to better and cheaper building and supply materials. Increases in substance abuse due to greater distribution of alcohol and tobacco products are a possibility and concern. Changes in intimate partner violence and suicide rates could worsen (or improve) depending upon whether family/community cohesion declines or strengthens.

The mining development scenario is much more likely to generate a “boom and bust” cycle across PACs. After more than 40 years of study in various locations, the potential social and health impacts arising from rapid natural resource development are widely recognized. The effects can vary based on the nature of the resource activity, the stage or phase of activity, and the characteristics of the affected communities. The existing literature provides a useful background in the types of effects to consider. Chapter 3 of the HIA provides an overview of the “boom and bust” literature.

Accidents and Injuries. Improvements in surface and air (new landing strips associated with road construction and maintenance) infrastructure could facilitate improved emergency response times and evacuation efficiency. Possible increased interaction between community members and commercial road traffic could result in increased serious accidents and injuries. Experience with major extractive industry projects in generally remote rural settings indicates that a rise in unintentional injuries should be anticipated.

Exposure to Potentially Hazardous Materials. Road development could increase the distribution and consequent inadvertent exposure to NOA materials. Increases in accidental releases (such as fuels or construction materials) could impact land and water resources. Community members believe that future mining activities, regardless of whether state and federal environmental standards are met, will result in significant release of toxic metals to local soils and rivers, resulting in flora and fauna uptake with adverse health impacts. In recent major U.S. extractive industry projects (shale/oil), there have been numerous issues raised regarding hazardous materials impacts and exposures. The suite of chemicals and process that potentially generate chemical releases and exposures are different with oil and gas development versus mining. Regardless of these process differences, stakeholders clearly expressed numerous concerns regarding the general environmental impacts of extractive industry development. Hence, these stakeholder concerns were considered in the overall ratings.

Food, Nutrition, and Subsistence Activity. The overall ratings were informed by the analysis in the Subsistence Uses and Resources analysis (EIS Section 3.4.7). Increased economic benefits may decrease the number of food-insecure households. Improved incomes may allow for purchase of better snowmachines and hunting/fishing supplies that would facilitate subsistence activities. There may be potential impacts to access, quantity, and quality (real or perceived) related to increased competition for resources (induced access), negative changes in large animal migration patterns, and habitat fragmentation related to physical structures and linear features development. Impacts on the overall quantity of subsistence harvesting can have cascading effects on long-term non-communicable disease rates, such as diabetes. There is a consistently expressed stakeholder concern that mining activities could impact subsistence quality ("toxic contamination"), particularly related to fish resources, but also affecting mammals and critical plants.

Infectious Diseases including STIs. Increases in STIs related to in-migration and increased incomes (transactional sex) are a concern and often associated with the "boom and bust" cycle. Changes in zoonotic, vector-borne disease transmission are considered unlikely. Increases in vaccine preventable diseases are possible in association with large construction work camps.

Water and Sanitation. Potential improvements due to improved access and lower distribution costs for industrial materials could occur. There will likely enhanced opportunities for sustainable community level infrastructure investments and improvements.

Non-Communicable and Chronic Diseases. Changes in diet (increased access to and lower costs for processed foods) in addition to impacts on per capita subsistence are associated with long-term increases in NCD rates, particularly cardiovascular/stroke. Changes in levels of obesity, hypertension, and diabetes could be experienced across the PACs.

Health Services Infrastructure and Capacity. There are potential improvements due to access to fiber optic cable infrastructure (faster and more stable internet/telecommunications). Improved access and lower distribution costs for clinic supplies could occur. Improvements in access for medical staff and greater efficiency for emergency evacuations are a potential outcome. During the HIA workshop, the consensus among attending health professionals was that the mining development scenario would likely improve overall health services infrastructure and capacity.

Alternative C

Impacts are identical to Alternatives A and B with some exceptions:

- Exposure to NOA materials is likely to be less of an issue as the geographical distribution of known NOA is generally avoided; hence, the long-term potential exposure effects to NOA are less likely.
- Hughes community would be closer to the road and would be more likely to experience the same suite of described impacts. However, the overall non-NOA impacts associated with Alternative C are otherwise not materially different from Alternatives A and B.

Recommendations

The outcomes of the ratings and rankings process have been used to establish potential actions that can manage identified impacts. Potential mitigation strategies include participatory monitoring and health education and promotion, along with other strategies presented in in Chapter 5, Section 5.2. These strategies are all well established and recognized in the preventive medicine and public health literature.

1. Introduction and Project Overview

The proposed project is a right-of-way (ROW) application from the Alaska Industrial Development and Export Authority (AIDEA) to construct and operate a 211-mile-long, all-season, industrial access road to the Ambler Mining District, located in the Brooks Range of Alaska. According to AIDEA, the road would provide access for mineral exploration, mine development, and mining operations at the mining district. The road would originate at the Dalton Highway near Prospect Creek and end at the Ambler Mining District, and would have no public access. The proposed project crosses state lands (61 percent) and Native corporation lands (15 percent), but also crosses federal lands (24 percent) managed by the U.S. Bureau of Land Management (BLM) and the National Park Service (NPS). AIDEA has submitted a permit application to request ROW across BLM-managed lands.

AIDEA intends for the access road to facilitate further mining exploration and development. AIDEA has not directly proposed mining-related development activities in the district, but others would pursue these activities, requiring separate National Environmental Policy Act of 1970 (NEPA) and permitting decisions. The BLM considers these activities and developments to be connected actions pursuant to NEPA (40 Code of Federal Regulations [CFR] 1508.25). The BLM has documented these reasonably foreseeable mineral exploration and development actions in Appendix E of the Draft Environmental Impact Statement (EIS).

The Ambler Mining District is located within the Northwest Arctic Borough (NAB), along the southern foothills of the Brooks Range in north-central Alaska. There is currently no surface access to this region from the existing transportation network. Figure 1-1 in Appendix A shows the location of the Ambler Mining District boundary and the concentrated, mineral-rich area also known as the "Ambler mineral belt."

Chapter 1 of the Ambler Road Draft EIS presents a detailed discussion of the project background and history; hence, this information will not be repeated.

This health impact assessment (HIA) has been developed to provide information to decision-makers about potential human health impacts related to the proposed Ambler Road and alternatives.

1.1. Legal, Administrative and Legislative Requirements for Health Impact Assessment

Chapter 1 of the Ambler Road Draft EIS discusses, in detail, key anticipated authorizing laws, regulations and anticipated permits for the project. At the request of BLM, the lead federal agency, this HIA is included as part of the NEPA Review/EIS. The BLM has not yet authorized this project, which is currently in the NEPA Review/EIS process. This project will also require federal authorizations from the U.S. Army Corps of Engineers (USACE) and U.S. Coast Guard.

The State of Alaska has developed an HIA Toolkit (Alaska Department of Health and Social Services [ADHSS] 2015) to guide HIA practitioners in the state. This HIA has been developed as a standalone document that will be incorporated into the EIS as Technical Appendix N. Where appropriate, the HIA refers to detailed technical sections and appendices of the EIS that contain descriptions of the affected environment (AE), project-specific engineering, and a comprehensive analysis of the potentially affected communities (PAC).

1.2. HIA Framework and Methodology

This section defines what an HIA is and the methodology used for HIAs.

1.2.1 HIA Definition

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

The Ambler Road HIA is designed to:

- Review proposed project plans;
- Review the physical and general environmental setting of the proposed project;
- Identify PACs;
- Analyze the AE and provide a detailed baseline profile of health for the PACs;
- Analyze the environmental consequences (EC) of the proposed project and alternatives using both input from stakeholder meetings and a set of Alaska-specific health effects categories (HEC) established by the ADHSS in their 2015 "Technical Guidance for Health Impact Assessment in Alaska";
- Conduct semi-quantitative impact rating and importance ranking for the proposed project and alternatives considering direct, indirect, and cumulative scenarios; and
- Propose a series of recommendations tied to the most important potential impacts.

1.2.3 HIA Scope

The HIA team extensively reviewed literature and documents; closely coordinated with the EIS team; reviewed the extensive community observations, stakeholder comments, and household surveys conducted by the EIS team; and participated in a detailed technical workshop for cooperating agencies conducted by the EIS team under BLM auspices. The HIA team also held a further rating and ranking working session with HIA-experienced ADHSS professionals from the Section of Epidemiology (SOE).

1.2.4 Areas Outside the Scope of the HIA

The study does not address classic occupational health concerns (such as physical hazards or environmental hazards encountered by potential project workers), which are referred to as "inside the fence" and are addressed by State of Alaska and federally mandated health and safety regulations.

1.2.5 HIA Limitations

This HIA has limitations. As noted, it does not address "inside the fence" occupational health concerns. However, "cross-over" issues, such as health issues that arise as workers move back and forth between the worksite and communities, are considered. For example, naturally occurring asbestos (NOA) exposures that could occur at work and generate community exposures via inadvertent transport of fibers on clothing are considered. This HIA was executed with data gaps in the available community-level morbidity and mortality databases: (1) published health databases typically "lag" calendar dates by

approximately 2-3 years—the most current 2019 data typically represents information collected from 2016/17—and (2) due to a combination of confidential concerns for small communities and small reported case numbers at an individual community level, morbidity and mortality data are typically aggregated and only available at the public health regional level.

1.2.6 Alaska HECs

The ADHSS HECs are listed in Table 1. HECs have been developed and discussed in the 2015 ADHSS "Technical Guidance for Health Impact Assessment in Alaska."

Table 1. Health Effects Categories

Health Effects Category	Pathway Description
HEC#1 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 and between countries. 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.
HEC#2 Accidents and Injuries	This category contains health outcomes and determinants related to accidents and injuries. 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 the presence of law enforcement, traffic patterns, alcohol involvement, distance to emergency services, and the presence of prevention programs.
HEC#3 Exposure to Potentially Hazardous Materials	This category contains health outcomes and determinants that may arise from exposure to hazardous materials. 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.
HEC#4 Food, Nutrition, and Subsistence Activity	This category includes health outcomes and determinants related to food security, dietary choices, and subsistence food consumption. The key health outcomes considered are nutrient levels; malnutrition or improvements in nutrient intake; and the subsequent increases or decreases in related diseases. The key determinants include diet composition, food security, and subsistence food consumption.

Health Effects Category	Pathway Description
HEC#5 Infectious Disease	This category includes health outcomes and determinants that result from infectious diseases. 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.
HEC#6 Water and Sanitation	This category includes changes to access, quantity, and quality of water supplies. 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 a self-service laundry.
HEC#7 Non-Communicable and Chronic Diseases	This category includes health outcomes and determinants related to chronic disease. 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, and cancer screening rates.
HEC#8 Health Services Infrastructure and Capacity	This category considers health outcomes and determinants related to health care access and health care infrastructure. Important outcomes include the increase or decrease in the number of medical evacuations, clinic 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 aides, and the frequency of physician visits to the area.

HECs have been developed to identify the full spectrum of possible health impacts related to a project and alternatives. All HECs are systematically analyzed for the potential for direct, indirect and cumulative project related impacts

2. Potentially Affected Communities (PACs)

As defined in the ADHSS HIA Toolkit (ADHSS 2015), a PAC is a defined area, community, or village where project-related health impacts may reasonably be expected to occur. The HIA is aligned with the Subsistence PACs.

2.1. Background

The project Area of Influence (AOI) is comprised of communities located within 50 miles of one of the alternatives and is used as a basis for the health-related PAC analysis. These communities are described in Table 2 and Table 3 and shown in Appendix A of the EIS.

Table 2. Communities Within a 50-Mile Radius of an Alternative

Community	Distance from Nearest Alternative (mi) *("as the crow flies")*	Nearest Alternative (A, B or C)
Kobuk	1.3	C
Hughes	3.3	C
Shungnak	5.6	C
Evansville	8.1	A/B
Bettles	8.5	A/B
Coldfoot	13.0	A/B
Rampart	18.3	C
Ambler	22.2	A/B
Wiseman	23.6	A/B
Tanana	28.4	C
Allakaket	33.8	A/B
Alatna	33.9	A/B
New Allakaket	35.3	A/B
Manley Hot Springs	41.3	C
Huslia	46.5	C

Table 3. Alaska Boroughs, Census Areas, Cities, Census Designated Places, and Alaska Native Village Statistical Areas in the PACs

Borough	Community	Subsistence	Transportation Corridor	Logistical and Supply Center
YKCA	Bettles	Yes	No	No Data [1]
YKCA	Coldfoot	Yes	Dalton Highway; Airport	No Data
YKCA	Evansville	Yes	No	No Data
YKCA	Wiseman	Yes	Dalton Highway	No Data
YKCA	Alatna	Yes	No	No Data
YKCA	Allakaket	Yes	No	No Data
YKCA	New Allakaket	Yes	No	No Data
YKCA	Rampart	Yes	No	No Data
YKCA	Manley Hot Springs	Yes	No	No Data
YKCA	Tanana	Yes	No	No Data
NAB	Ambler	Yes	No	No Data
NAB	Kobuk	Yes	No	No Data
NAB	Shugnak	Yes	No	No Data
NAB	Huslia	Yes	No	No Data
NAB	Hughes	Yes	No	No Data
Fairbanks North Star Borough	Fairbanks North Star Borough	No	Yes	No Data

[1] No data has been provided regarding locations for logistics and supply centers

If additional PACs are identified in the final EIS, they will be evaluated through a health lens during the Final Draft of the HIA. Baseline health data are further evaluated by HEC and by community as appropriate and available

2.2. Demographic Summary of PACs

Demographic summaries of the PACs are provided in the EIS Chapter 3 and in Appendix F.

2.3. Geographic Profiles

Geographic profiles have been developed as part of the baseline health data compilation. Data from the Alaska Division of Community and Regional Affairs Alaska Community Database; custom data queries and Alaska Community Database community information summaries; and the Alaska Department of Labor Workforce Development (ADOLWD), Research and Analysis Section—Alaska Local and Regional Information (workforce information) served as input.

2.4. Stakeholder Engagement and Concerns – Health

The HIA process includes an analysis of the health-related comments obtained during Stakeholder Scoping meetings held by the proponent and the lead federal agency. Results of stakeholder meetings related to health issues and concerns by HEC are included in this section.

2.4.1 Issues and Concerns by HEC

Table 4 lists the issues and concerns for each HEC. There are multiple stakeholder references that are concerned with contamination of air, water, soils, flora and fauna related to road construction / operation and future development of mining activity. The 1928 Thomas Theorem, “If men define situations as real, they are real in their consequences” is applicable to stakeholder contamination concerns. The HIA team understands that the outcome of a situation, particularly for potentially affected stakeholders, often depends on an individual’s perception of it, and not the situation by itself. The importance of perception and its consequences and its ability to generate concrete, tangible changes in behavior, is recognized in the rating and ranking of impacts.

Table 4. Issues and Concerns by HEC

HEC	Issue/Concern
HEC#1 SDH	• Significantly greater alcohol use.
HEC#2 Accidents and Injuries	• Determine how emergencies would be handled. • There should be funding for an additional state trooper to patrol the road and for search and rescue/emergency response.
HEC#3 Exposure to Potentially Hazardous Materials	• Fugitive dust (particularly asbestos in western portions of the route). • HIA and air and water quality impacts (from dust and asbestos). Metals or chemicals from dust on plants metabolizes into tissue and may then be eaten by animals, including caribou, birds, and fish. Some of these animals may then be eaten by other animals or used as our subsistence foods, so we would like an analysis of such impacts. • We recommend baseline studies and exposure pathway studies, including human blood (for lead, cadmium and other metals) and other elements that may arise during construction of the road and/or mine. • Health and visibility effects; road sourced dust. • Minimize the chances of an accidental release; the emergency measures that will be implemented should such an event occur. • Volcanogenic massive sulfide deposits are likely (in addition to the known ores of copper, zinc, lead, silver, and gold) and minor amounts of cadmium, mercury, arsenic, and antimony. These pose risks to aquatic life and human health. • When toxic materials leach into the surrounding land and water, or when tailings dams fail, communities pay the cost with their people's health. • Potential mines in the Ambler Mining District could produce copper, cobalt, and zinc—metals that are vital to public safety (zinc strengthens steel alloys used as guardrails along our public highways) and human health (zinc is added to fertilizers to replace zinc nutrients in soils, whereas copper and cobalt are both required to combat climate change). • Evaluate NOA in the gravel. • Heavy machinery and equipment operation during construction and operations will be accompanied by the emission of fossil fuel combustion exhausts always associated with such equipment. Such exhausts will include oxides of nitrogen, oxides of sulfur, ozone, carbon monoxide, and particulates. • Fugitive dust emissions may be generated from road construction and operation as well as reasonably foreseeable mining activities. In addition to human health effects, dust blown from the roadway can settle onto vegetation or waterbodies, impairing their health as well. • Hazardous air pollutants may result from fuel combustion and ore processing. The National Air Toxics Assessment asserts that many human epidemiology studies show increased lung cancer associated with diesel exhaust and significant potential for non-cancer health effects (see http://www.epa.gov/ttn/atw/nata). Also, the Control of Emissions of Hazardous Air Pollutants from Mobile Sources Final Rule (66 Federal Regulation 17230) lists 21 compounds emitted from motor vehicles that are known or suspected to cause cancer or other serious health effects. In addition, some mining and ore processing activities may result in mercury emissions, which can lead to mercury deposition and potentially toxic mercury methylation in adjacent water bodies. The Environmental Protection Agency (EPA) recommends the EIS disclose whether hazardous air pollutant emissions would result from project construction and operations; discuss the cancer and non-cancer health effects

HEC	Issue/Concern
	associated with air toxics and diesel particulate matter; and identify sensitive receptor populations and individuals who are likely to be exposed to these emissions. • Building this road requires asbestos-laden gravel be mined from nearby soils, harming our lands, waters, and air, and our health. • Chemicals, heavy metals, and toxins produced that will further hurt the health of local communities. • Air pollution from the asbestos-laden gravel and soil/dust in the region. • Noise from gravel and mineral mine blasting, and potential water quality changes. • Contaminant exposure. • Effects of copper, asbestos, lead and other contaminants on people, workers and tourists. • Asbestos, taconite health problems. • An HIA can analyze Asbestos monitoring and mitigation for worker health. • Asbestos health impacts.
HEC#4 Food, Nutrition, and Subsistence Activity	• Opening the road to public use; pressure on subsistence. • Health and food security. • Changes in diet and nutrition. • Use scientific and traditional knowledge to describe the potential health effects and the effects on the perceived palatability of eating contaminated foods. • Competition for resources relating to food security. • Project the cost of a reduced subsistence harvest and health impacts, and weigh this against the long-term economic benefits. • Health risks associated with asbestos and subsistence. • Sheefish, salmon, and caribou—health and wellbeing of the area. • Kotzebue cultural nutritional and spiritual connection. • Loss of subsistence use areas affecting nutrition. • Subsistence, primary source of nutrition – access.
HEC#5 Infectious Disease	• Included in the Issues/Concerns covering all HECs section of this table.
HEC#6 Water and Sanitation	• Included in the Issues/Concerns covering all HECs section of this table.
HEC#7 Non-Communicable and Chronic Diseases	• Included in the Issues/Concerns covering all HECs section of this table.
HEC#8 Health Services Infrastructure and Capacity	• Broader public use—accident response. • Public and community health services. • Use of health and emergency services in remote communities. • Scope potential partnerships with village clinical services. • It would provide villagers with alternative access to emergency medical services when weather prohibits flying.

HEC	Issue/Concern
Issues/Concerns Covering all HECs	• Public health and wellbeing. • This overly strict timeline (for the EIS) limits the chance for multiple-year surveys that have yet to be conducted, but are needed to understand impacts to wildlife populations and habitat, recreational use trends, economic impacts, adverse health impacts on local communities, and subsistence impacts inherent in this proposed project. • Assess effects to the human environment, including community and clinical health. • This road is not in line with the BLM mission "to sustain the health, diversity, and productivity of America's public lands for the use and enjoyment of present and future generations." • Red Dog has resulted in $1.7 billion in proceeds; paid NANA with over $1 billion of these payments redistributed to other Alaska Natives as 7i and 7j distributions as required by the Alaska Native Claims Settlement Act (ANCSA). In addition, Red Dog has also made payments in excess of $1 billion to the State of Alaska (General Fund) and AIDEA directly as the owner of the DeLong Mountain Transportation System infrastructure. In addition to these payments to the State of Alaska, the local NAB and School District have received in excess of $175 million in payments to support local health, education, and welfare. Red Dog employment and contracting support over 650 jobs totaling $30 million in annual wages to Alaskans with over 50% of jobs going to NANA shareholders. At a national level, Red Dog provides 70% of the U.S. domestic production of zinc—a metal that is vital to a modern life. • Our people and the environment may be affected because of exposure to one or more environmental stressors such as chemicals, land change, disease. • Identify and address disproportionately high and adverse human health effects on minority populations, low-income populations, and Native American tribes. • Impacts to public health could result through changes in diet and nutrition. • Exposures to contaminants from construction and mining. • Health implications such as the introduction of new diseases. • Damaged water and sanitation infrastructure. • Increase in anxiety and depression. • Consider the health impacts of this project in the context of the changing climate. • An HIA should be conducted. • Conduct a robust discussion and analysis of potential health impacts. • Determine the direct, indirect, and cumulative impacts to health. • Cancer risks. • Income from new jobs resulting in health impacts. • Project-related HIA, and mitigation options analyzed not only to reduce asbestos exposure but also to handle health claims. • Potential village health impacts. • Human and behavioral health impacts.

3. Affected Environment – Health

The AE baseline conditions form a fundamental context for the overall HIA process. The AE baseline health summary creates a point of reference for the overall health profile for the public health regions that would host the proposed project. The health profile can inform decision-makers about health vulnerabilities in a region as well as 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 State of Alaska, the Alaska Native Tribal Health Consortium (ANTHC), and occasionally local, borough, and tribal entities. This chapter focuses on a review of existing public health surveillance data. All health information is presented according to the requirements of the Health Insurance Portability and Privacy Act of 1996 (HIPPA) and the published 2015 State of Alaska HIA technical guidance.

3.1. Background

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 (such as 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 (for example, less than 6). As a result, the information in the baseline summary, when developed for a number of parameters, represents entire boroughs and/or areas and does not report community-level data. There are differences in the public health regions as described by ADHSS and ANTHC. ADHSS describes seven public health regions, which are based upon ADOLWD's six economic regions: Anchorage and Mat-Su, Gulf Coast, Interior, Northern, Southeast, and Southwest. For public health purposes, the Matanuska-Susitna Borough is reported separately from the Municipality of Anchorage. There are three Ambler-project relevant ADHSS Public Health Regions Boroughs/Census Areas:

- Interior Region
  - Denali Borough (02068)
  - **Fairbanks North Star Borough** (02090)
  - Southeast Fairbanks Census Area (02240)
  - **YKCA** (02290)
- Northern Region
  - Nome Census Area (02180)
  - North Slope Borough (02185)
  - **NAB** (02188)

Within the Interior Region, the YKCA is the critical project-relevant area; however, the Fairbanks North Star Borough is also potentially Ambler project relevant. Similarly, the NAB is the critical Northern Region Ambler project-relevant reporting unit.

The Alaska Native Epidemiology Center within the ANTHC has divided Alaska into 12 tribal health regions. The boundaries of the tribal health regions do not always follow those of boroughs and census areas. For example, the ANTHC Interior Tribal Health Region Census Area/Borough is identical to the ADHSS Interior Public Health Region with some exceptions—addition (Anatuvak Pass) and subtraction

(Cantwell, Grayling, Anvik, Shagoluk, and Holy Cross) of some villages. The ANTHC Northwest Arctic Region is composed of the NAB. In ANTHC health regions, the Nome Census Area is in the Norton Sound Tribal Health Region and the North Slope Borough is in the Arctic Slop Tribal Health Region.

3.2. Key Sources of Information

A large number of databases were accessed to create a robust baseline. The following key databases were accessed:

- ANTHC
- National Patient Information Reporting System
- 2000 and 2010 U.S. Census
- Alaska Bureau of Vital Statistics (ABVS)
- Alaska Department of Epidemiology
- Government Performance and Results Act
- Alaska Trauma Registry (ATR)
- 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
- ADOLWD
- Behavioral Risk Factor Surveillance System (BRFSS)
- Youth Behavioral Risk Factor Surveillance System (YRBSS)
- Alaska Indicator-Based Information System (AK-IBIS)

Peer-reviewed published studies were also reviewed and cited as appropriate within specific HECs. In addition, health relevant reports and studies published by state and federal agencies were also reviewed, such as the Agency for Toxic Substances and Disease Registry (ATSDR) and NPS. The Healthy Alaskans 2020 (HA2020) report is also a key resource. This statewide report was developed by a coalition of public health groups led by ADHSS and ANTHC.

Current human health conditions are described for communities within 50 miles of the proposed road and project alternatives. Potentially affected communities are located in the Interior Public Health Region (YKCA) and the Northern Public Health Region (NAB). The study communities for health are identical to the communities described in Section 3.4.5 Socioeconomics and Communities.

3.3. Demographic and Socioeconomic Profiles of PACs

Demographic and socioeconomic profiles of the affected communities are presented in the Affected Environment and Environmental Consequences chapter of the EIS (specifically, Section 3.4.5, Socioeconomics, Appendix F Table 11, and Section 3.4.6, Environmental Justice). Hence, this information is not repeated in the health baseline. The socioeconomics section contains tables of information for PACs, including population, ethnicity, age, education, income, and unemployment statistics. Some of the key indicators from Appendix F, Table 11 of the EIS are listed in Table 5.

Table 5. Key Demographic and Economic Measures Data

Affected Community	Total Pop	AN%	% Unemployed	Median Household Income (4)	% Below Poverty Line
Alaska	738,565	19.6	7.7	76,114	10.2
Fairbanks North Star Borough	100,031	11.5	8.0	76,250	7.7
NAB	9,757	57.6	9.5	61,533	25.3
YKCA	5,453	76.3	19.7	37,819	25.5

The demographic and economic measures data, even at the borough and census area level, illustrate the significant differences between the rural potential project areas and both the more urban Fairbanks North Star Borough and the overall State of Alaska. Many individual villages, particularly in YKCA, have percentages of individuals below the poverty line that exceed 40 percent (see EIS Section 3.4.5, Socioeconomics, Appendix F, Table 11).

3.4. Overview Morbidity and Mortality

The overall morbidity (illness) and mortality (death) indicators for the interior and northern public health regions are generally consistent with the overall trends observed for all Alaska Natives. Morbidity is dominated by respiratory and digestive disease and injury and poisoning. STIs are a significant issue with chlamydia infection rates more than eight times greater than U.S. whites, with the greatest number of infections among Alaska Native females aged 15–34 years. Similarly, gonorrhea infection rates are almost 10 times greater than U.S. whites, again dominated by Alaska Native females aged 15–34 years. Musculoskeletal diseases are a leading cause of outpatient visits. Dental disease is a significant source of morbidity as more than 50 percent of Alaska Native adults have experienced tooth loss due to tooth decay or gum disease. Cancer incidence rates have increased significantly over the last 50 years and are strongly associated with underlying rates of smoking, alcohol use, and obesity.

The three leading causes of mortality for Alaska Natives are cancer, heart disease, and unintentional injury. There are significant differences in cardiovascular and unintentional injury death rates between the interior and northern public health regions. Chronic obstructive pulmonary disease (COPD) mortality rates have significantly increased and are consistent with high smoking rates. Alaska Native males had significantly higher mortality rates for cancer, heart disease, unintentional injury, suicide, COPD, and alcohol abuse compared to Alaska Native females. Alaska Native females had significantly higher rates of mortality due to cerebrovascular disease and chronic liver disease compared to Alaska Native males. Alaska Native infant mortality rates have decreased significantly since the 1980s. Life expectancy for Alaska Native people has been increasing since the 1980s and is now 70.7 years.

3.5. **Health Effect Categories (HECs)**

AE-baseline community health data are organized and presented by specific HECs. A brief introduction to each HEC is presented followed by the descriptive data and then a summary of findings. The report focuses on health data that, based on experience with past HIA projects in Alaska, are likely to be relevant for EC impact rating and ranking. The data gathering and review exercise has been extensive; however, the report is not designed to be "encyclopedic," but rather focused and relevant for both the project permit needs and development of this Draft HIA. The HIA Team did not perform active field data collection; however, field data collected by the EIS team are used wherever health relevant.

3.5.1 HEC 1: Social Determinants of Health (SDH)

The World Health Organization (WHO) and Centers for Disease Control and Prevention (CDC) define the SDH 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."

The following are key SDHs across life stages [1]:

- Children
    - Early and middle childhood provide the physical, cognitive, and social-emotional foundation for lifelong health, learning, and wellbeing. A history of exposure to adverse experiences in childhood, including exposure to violence and maltreatment, is associated with health risk behaviors such as smoking, alcohol and drug use, and risky sexual behavior, as well as health problems such as obesity, diabetes, heart disease, sexually transmitted infections (STIs), and attempted suicide.
    - Features of the environment, such as exposure to toxic materials (for example, heavy metals such as lead and mercury), can negatively affect the health and development of young children.
- Adolescents
    - Because they are in developmental transition, adolescents and young adults are particularly sensitive to environmental influences. Environmental factors, including family, peer group, school, neighborhood, policies, and societal cues, can either support or challenge young people's health and wellbeing. Addressing young people's development facilitates their adoption of healthy behaviors and helps to ensure a healthy and productive future adult population.
    - Adolescents who grow up in settings characterized by significant levels of poverty are more likely to be victims of violence; use tobacco, alcohol, and other substances; become obese; and engage in risky sexual behavior.
- Adults
    - Access to and availability of healthier foods can help adults follow healthful diets. For example, better access to retail venues that sell healthier options may have an impact on a person's diet. These venues are less available in isolated rural settings.

[1] https://www.healthypeople.gov/2020/leading-health-indicators/2020-lhi-topics/Social-Determinants/determinants

    - Longer hours, compressed work weeks, shift work, reduced job security, and part-time and temporary work can negatively affect health outcomes—higher risk of injuries, heart disease, and digestive disorders.

- Older Adults
    - The lack of community-based resources and transportation options for older adults can negatively affect health status. Studies have shown that lower levels of social support are associated with higher risk for physical disease, mental illness, and death.

The 2015 ADHSS HIA guidance suggests a broad list of SDHs, many of which are discussed in this section. Both health determinant and health outcomes data are used to establish baseline health status for the SDH HEC. A determinant is a "setting" or context that strongly influences health status while an outcome is a health event that has actually occurred.

For health determinants, general demographics, family structure, economic status, and educational attainment data are presented. In addition, the socioeconomics section (Section 3.4.5) in the EIS is cross-referenced. Regional parameters are compared to all Alaska Natives, all Alaskans, and occasionally to the U.S. population, where possible. For cases where regional data are not available, data for Alaska Natives are viewed as an indicator for the PACs as they are the majority of the population in the PACs.

The HIA reports on a large suite of outcomes as per the ADHSS HIA section on SDH. [1] Outcomes include coverage of general morbidity and mortality, maternal and child health (MCH), suicide, intimate partner violence (IPV), and substance abuse (including alcohol, tobacco, and illicit drugs).

The HIA also considers psychosocial issues within the SDH HEC. 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 since there may be a generational split. Even though the generational divide may be unrelated to the project, it may be accentuated by the project. Issues such as isolation and cultural change are important and are addressed within this context and are also cross-referenced to the Subsistence (Section 3.4.7) and Cultural Resources (Section 3.4.9) sections of the EIS.

Key Points —SDH

1. Consideration of SDHs across life stages
2. Determinants Analysis with a focus on demographics, economics, and educational attainment
3. Outcomes Analysis with a focus on MCH, suicide, and substance abuse
4. Psychosocial issues associated with loss of traditional lifestyle, cultural identity, and stability

Health Determinants

Health determinants include both economic and cultural indicators.

Economic Indicators

Economic status creates a powerful context for human health and improved income is generally associated with better health. While there are many indicators used to assess economic status, the HIA

[1] http://dhss.alaska.gov/dph/Epi/hia/Pages/sdh.aspx

reports median household income, employment, and the percentage of households living below poverty levels. The Socioeconomics section (3.4.5) and Appendix F of the EIS presents detailed PAC-level data.

Median Household Income

Median household income is a health determinant and measure of economic wellbeing. 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. There are published papers (Guettabi et al. 2016a, 2016b) that monetize per capita subsistence resource harvesting. In the EIS, the Subsistence section (3.4.7) and Appendix L also addresses this topic. Detailed median income data, by PAC village, are presented in Appendix F Table 11 and in the EIS Socioeconomics section (3.4.5).

There are marked differences in median income levels across the PACs. Overall the median income level for the YKCA is significantly below NAB: $37,819 versus $61, 533. The higher per capita income in the NAB is influenced by employment at the Red Dog Mine and the NAB and Maniiliq, Inc. Both the YKCA and NAB are below both Fairbanks North Star Borough and overall State of Alaska median income levels.

The NAB School District, Maniilaq Association (Maniilaq), and Teck Alaska are by far the largest employers in the region. Maniilaq is a non-profit corporation that provides social and health services to Native Alaskans in the NAB. Employees of the NAB School District include all of the teachers and faculty working at the 13 schools in the district. Teck Alaska is the owner and operator of the Red Dog Mine.

In general, most jobs in the YKCA are in federal, state, local, or tribal government (see Section 3.4.5, Socioeconomics of the EIS). Private industry jobs are scarce in the YKCA compared to other areas of Alaska. The Tanana Chiefs Conference (TCC) has been the largest private employer in the area since 2009, with an average monthly employment of between 100 and 250 people.

Employment

Employment is another key demographic factor that influences health. According to the 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.

In the NAB, private industries employ roughly 60 percent of the total workforce while the public sector employs the remaining 40 percent. The opposite is true in the YKCA, where roughly 60 percent of jobs are in government and 40 percent are in private industries (Cardno 2015). Again, the significant differentiator is likely employment associated with the Red Dog Mine. The unemployment rates for the key project-related borough and census areas are shown in Appendix F. Individual level unemployment rates are presented in the Socioeconomics report (see Section 3.4.5, Appendix F Table 11). Unemployment rates for many of the PACs are quite high, frequently between 20-40 percent.

Percentage of Households Living Below Poverty Line

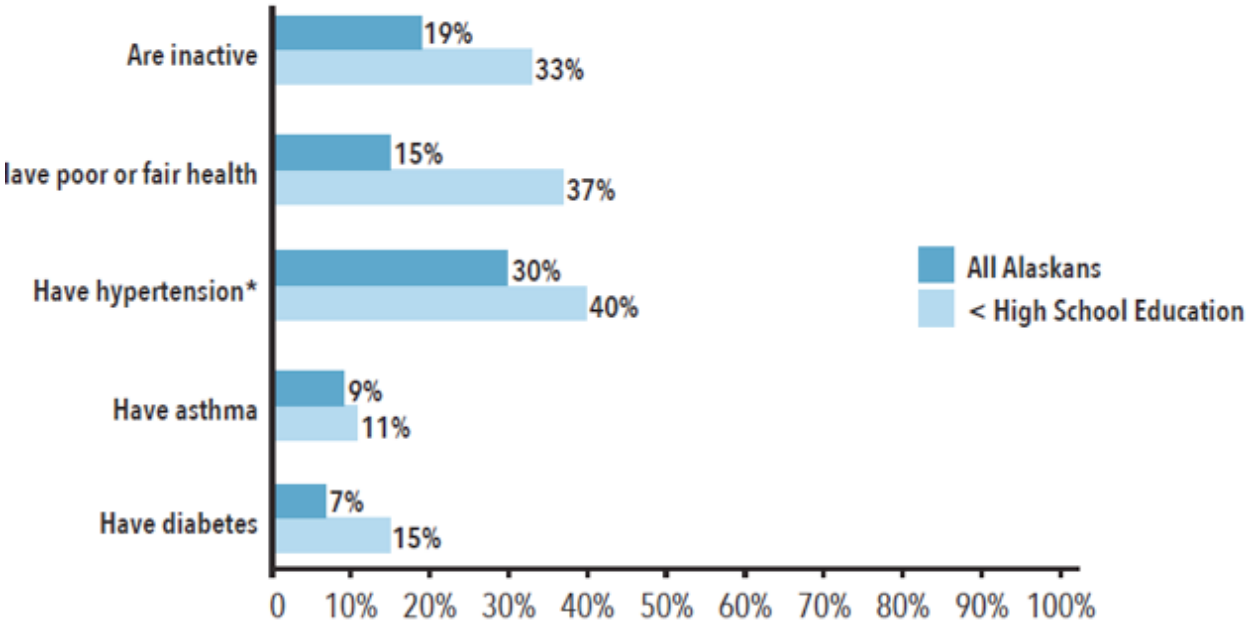
Poverty, which considers household income level as well as household size, is a powerful determinant of human health. The U.S. Census Bureau defines poverty in a complex way that does not take into account the higher cost of living in Alaska. The Department of Health and Human Services adjusts poverty 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 percent of the federal poverty threshold. The percentage of

households below the poverty line, for the key project-related borough and census areas, is shown in Table 11 Appendix F. Individual level rates by PAC village are presented in the Socioeconomics report (see Section 3.4.5, Appendix F Table 11 of the EIS). Poverty rates for many of the PACs are quite high, frequently between 20-40 percent, with the average at approximately 25 percent for both YKCA and NAB.

Educational Attainment

The level of educational attainment in a household can influence health. Internationally, the highest level of household educational attainment strongly correlates with improved overall family health status. In addition, household head educational attainment levels also predict challenges or opportunities that will occur in regard 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 (see Figure 1).

Figure 1. Prevalence of Selected Risk Factors, by Education Level (2012)*



Source: HA2020 2014
*Except 2011, where noted

Table 6 displays education indicators among PACs. 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 addition to high school dropout rates for potentially affected school districts for the 2017-2018 calendar school year. The NAB had the highest percentage of residents with a high school diploma or higher and a bachelor's degree or higher as well as the highest high school dropout rate at 6.71 percent. Fairbanks North Star Borough had the highest percentage of residents with a bachelor's degree or higher as well as the lowest high school dropout rate.

Table 6. Education Indicators among PACs (2017-2018)

District (enrollment)	High School Graduate or Higher (%) for Population 25 Years and Older	Bachelor's Degree or Higher (%) for Population 25 Years and Older	High School Drop-out Rate 2017-2018 (%)
NAB	46.4	10.7	N/A
NAB School District (70)	N/A	N/A	6.71
YKCA	41.7	12.4	N/A
Yukon-Koyukuk School District (28)	N/A	N/A	4.86
Fairbanks North Star Borough	21.7	33.1	N/A
Fairbanks North Star Borough School District (111)	N/A	N/A	3.52

Sources: Educational Attainment: 2017 American Community Survey; State of Alaska Report Card, 2017-2018 School Year
N/A = not available

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, parental monitoring, less family conflict, and more family cohesion. Good parental monitoring, in particular, results in better child physical and mental health (Proeschold 2009).

The ABVS maintains a database on divorce for the state, boroughs, and census areas. Fairbanks North Star Borough had the highest divorce rate among both males and females (see Table 7). These rates were higher than the divorce rate for Alaska statewide. YKCA had the lowest rate for both genders, followed by the North Slope Borough. Divorce rates in the NAB were also much lower than statewide rates.

Table 7. Divorce Rate by PAC (2013)

Community	Female Rate per 1,000 Population	Male Rate per 1,000 Population
NAB	3.0	2.4
YKCA	1.5	1.6
Fairbanks North Star Borough	9.4	8.7
Alaska Statewide	7.9	7.3

Source: ABVS 2019

Among the PACs, Evansville and Coldfoot had the lowest percentage of families present 16.7 percent (see Table 8). Between the 2000 and 2010 Census, the population of Evansville dropped from 28 (6 families) to 15 (2 families). Coldfoot serves primarily as a truck stop on the Dalton Highway from Fairbanks to Prudhoe Bay. North of Coldfoot, there are no services for 240 miles (400 kilometers) until

Deadhorse. The NAB had the greatest number of communities with intact family households (70 percent), exceeding the statewide percentage of 66.2 percent. Kobuk and Shungnak both had 75 percent or greater intact family households. These communities were also among the PACs with the largest average household size at 4.19 and 4.23, respectively. Livengood had the highest percentage with female heads of household, at nearly 30 percent. The NAB had the lowest percentage of two-parent households with their own children under the age of 18 living at home (24.9 percent)—almost half of the statewide percentage (45.9 percent) as illustrated in Table 8.

Table 8. Household Characteristics by PAC and Statewide

Location	Number of Households	Average Household size	Percent of Family Households	Female Headed Households (% of Family Households)	Two-Parent Households with own Children Present <18
NAB	1,919	4.01	74.4%	21.0%	24.9%
Ambler	75	3.44	72.0%	18.7%	17.3%
Kobuk	36	4.19	77.8%	27.8%	33.3%
Shungnak	73	4.23	75.8%	27.4%	33.9%
YKCA	2,217	2.51	59.4%	24.7%	41.6%
Bettles	9	1.33	33.3%	33.3%	0.0%
Coldfoot	6	1.67	16.7%	0.0%	100.0%
Evansville	12	1.25	16.7%	0.0%	50.0%
Livengood	7	1.29	28.6%	28.6%	0.0%
Manley Hot Springs	41	2.17	56.1%	26.8%	40.0%
Fairbanks North Star Borough	36,441	2.56	65.1%	18.6%	47.2%
Alaska Statewide	170,750	2.65	66.2%	20.5%	45.9%

Source: U.S. Census 2010

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, measures 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 Section 3.1, Population and Demographics of Employment and Income of the Ambler Mining Region Economic Impact Analysis (Cardno 2015). The proportion of Alaska's population aged 65+ has grown more rapidly in Alaska than in the contiguous 48 states. The rate of growth of the age 65+ population in Alaska is the highest among all age groups (Cohen et al. 2018). The YKCA has large proportions of people aged 65 or older compared to the overall State of Alaska. The out-migration of working-age adults also accounts for the high relative percentage of seniors in the YKCA (Shanks 2013). Studies have indicated that older adults in Alaska had the lowest health-

related quality of life compared to the contiguous 48 states and older adults in Alaska experience a unique set of barriers that provide challenges for successful ageing (Cohen et al. 2018). The five main barriers to healthcare in Alaska are transportation difficulties, limited health care supplies, lack of quality health care, social isolation and financial constraints (Cohen et al. 2018).

Bettles had the lowest dependency ratio at 2.8, while the highest occurred in Kobuk at 111.1, more than twice the statewide dependency ratio (46.1), as shown in Table 9. Except for Fairbanks, the PACs had dependency ratios well above the statewide ratio.

Table 9. Age Characteristics of PACs and Alaska Statewide (2017)

Location	Median Age	Age Dependency Ratio
Alaska	33.9	54.6
NAB	26.6	72.9
Ambler	28.7	88.1
Kobuk	18.3	111.1
Shungnak	22.5	110.5
YKCA	34.7	68.0
Bettles	37.6	2.8
Coldfoot	43.3	ND
Evansville	54.5	80.0
Livengood	ND	ND
Manley Hot Springs	56.2	97.4
Wiseman	41.3	80.0
Fairbanks North Star Borough	31.0	48.8
Fairbanks	28.1	46.3

Source: U.S. Census Bureau 2019

*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 median estimates falls in the lowest interval or upper interval of an open-ended distribution.

ND – No data available

Cultural Indicators

Cultural factors are also important determinants of health. Individuals 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 and Lalonde 1998; 2004). Important signifiers of community health and cultural continuity include speaking a native language and participating in subsistence activities (Stevenson 2009).

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” (https://www.nativefederation.org/subsistence). Participation in subsistence activities promotes passing traditional knowledge from generation to generation and serves to maintain people’s connection to the physical and biological environment. Subsistence is discussed in detail in Section 3.4.5 of the EIS.

In many small, rural villages in Alaska, ageing is defined by the concept of "eldership," where older adults in those communities are valued and respected by the other residents. One study found four common domains of "eldership" in rural Alaska villages: emotional well-being, community engagement, spirituality, and physical health (Cohen et al. 2018).

SDH Outcomes

SDH outcomes include life expectancy, MCH, IPV, suicide, substance abuse, tobacco use, and alcohol use.

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).

Maternal and Child Health

MCH outcomes, such as low birth weight, can profoundly influence youth and adult health status and can suggest current or future challenges (or improvements) to human health. Key performance indicators 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 are presented.

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). 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 maternal… 2010).

The Adequate Prenatal Care Utilization Index 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 percent or greater, care is considered "adequate plus" prenatal care. If the ratio is greater than 80 percent but less than 110 percent, care is considered "adequate". A ratio between 50 percent and 79 percent is considered "intermediate" and a ratio of less than 50 percent is considered "inadequate" (ibis.dhss.alaska.gov/indicator/view/PNC.APNCU.html). The categories of "adequate" and "adequate plus" were combined to create the category "adequate or better."

In 2012, approximately 40 percent of all pregnant women in the YKCA were documented on the birth certificate as having received adequate or better prenatal care (Alaska Bureau of Health Analytics and Vital Records 2019). This is considerably less than in the State of Alaska, where around 60 percent of all pregnant women reported experiencing adequate or better prenatal care (see Table 10). Less than half of pregnant Alaska Native women had received adequate or better prenatal care in the NAB and YKCA. These discrepancies indicate that fewer Alaska Native women within these regions were receiving proper prenatal care.

In 2013, just over half (54.5 percent) of mothers of Alaska Native infants had documented adequate prenatal care (www.anthctoday.org/epicenter/healthdata.html). 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 percent in 2008 but has been increasing since 2008 (see Figure 2). During 2009-2013, the proportion of mothers receiving documented adequate prenatal care varied significantly by tribal health region, ranging from 30.7 percent to 80.5 percent (see Figure 3). 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 (containing PACs).

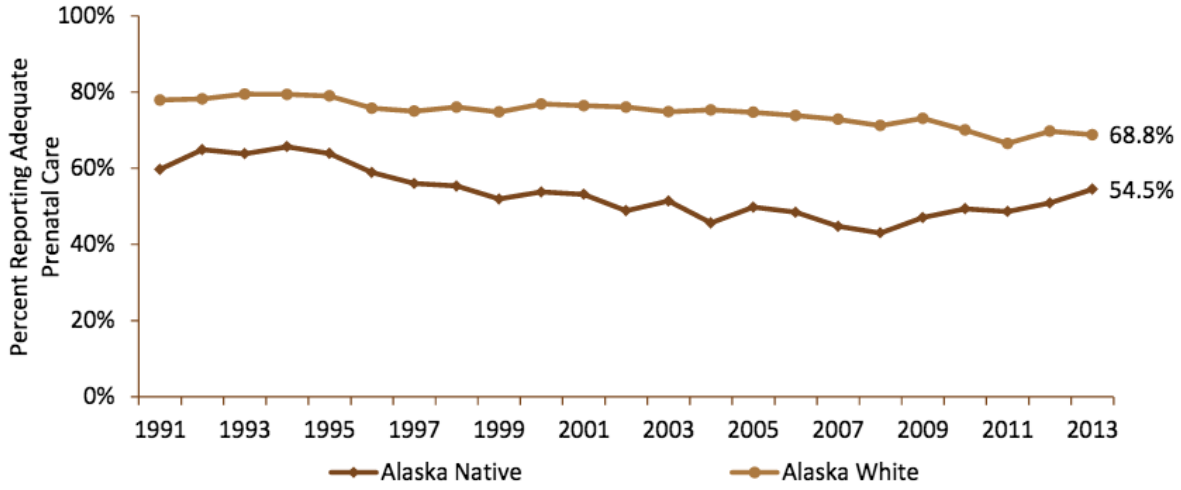
Table 10. Adequacy of Prenatal Care for Females by Potentially Affected Census Area and Alaska Statewide (2012)

Location	Adequacy of Prenatal Care (APNCU Index)	All Races Number of Births	All Races % of Births	White Number of Births	White %of Births	Alaska Native Number of Births	Alaska Native % of Births
NAB	Adequate plus	43	21.5	1	10	42	22.2
NAB	Adequate	49	24.5	2	20	46	24.3
NAB	Intermediate	63	31.5	3	30	60	31.7
NAB	Inadequate	45	22.5	4	40	41	21.7
YKCA	Adequate plus	7	9.0	0	0.0	7	10.3
YKCA	Adequate	24	30.8	3	33.3	21	30.9
YKCA	Intermediate	24	30.8	3	33.3	21	30.9
YKCA	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
Fairbanks North Star Borough	Adequate	677	49.1	513	50.5	84	43.8
Fairbanks North Star Borough	Intermediate	186	13.5	133	13.1	33	17.2

Location	Adequacy of Prenatal Care (APNCU Index)	All Races Number of Births	All Races % of Births	White Number of Births	White %of Births	Alaska Native Number of Births	Alaska Native % of Births
Fairbanks North Star Borough	Inadequate	220	16.0	134	13.2	50	26.0
State of Alaska	Adequate plus	2,360	23.1	1,423	23.3	619	23.4
State of Alaska	Adequate	3,967	38.8	2,674	43.7	756	28.6
State of Alaska	Intermediate	2,134	20.9	1,217	19.9	630	23.8
State of Alaska	Inadequate	1,755	17.2	802	13.1	640	24.2

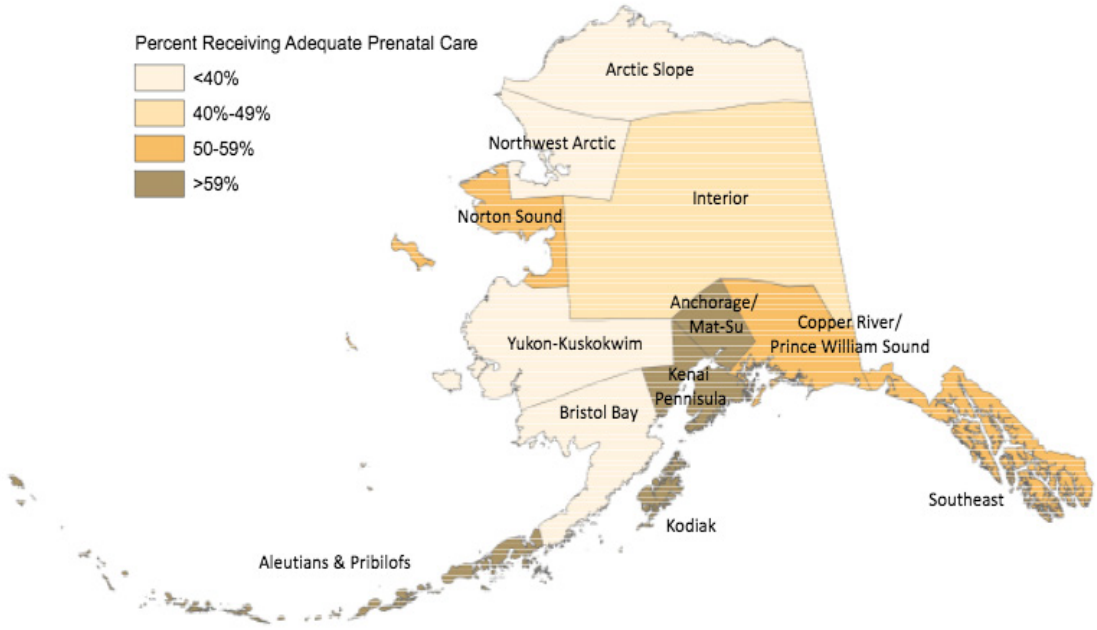
Source: Alaska Bureau of Health Analytics and Vital Records 2019

Figure 2. Adequate Prenatal Care by Alaska Native Status, 1991–2013



Source: www.anthctoday.org/epicenter/healthdata.html

Figure 3. Adequate Prenatal Care by Tribal Health Region, 2009-2013



Teen Birth Rates

Teen birth rates, defined as live births per 1,000 females age 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, and give birth as a teenager (Ventura and Hamilton 2011). Teenage mothers are less likely to receive a high school diploma, which may negatively impact their future health (CDC maternal… 2010).

In 2012, the NAB had a higher percentage of children born to teenagers compared to the state, as shown in Table 11. The rate among Alaska Native women in NAB was nearly twice that of the rate for all Alaskan women (Alaska Bureau of Health Analytics and Vital Records 2019). The teen birth rates among all mothers in the YKCA and the Fairbanks North Star Borough were similar to women statewide; however, the rates among Alaska Native women were lower than for Alaska Native women statewide.

Table 11. Teen Birth Rates by Potentially Affected Area and Alaska Statewide (2012)

Potentially Affected Area	Percent of Total Births (%) to Alaska Native Mothers < 20 Years	Percent of Total Births (%) to All Mothers <20 Years
NAB	14.2	13.4
YKCA	8.7	7.5
Fairbanks North Star Borough	10.3	6.1
State of Alaska	12.6	7.5

Source: Alaska Bureau of Health Analytics and Vital Records 2019

Low Birth Weight

Low birth weight (LBW) in infants (<5.5 pounds) has been linked to 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, LBW 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. LBW is associated with an increased risk of lifelong disability and a 20-fold increased risk of death. Therefore, LBW is both an indicator of the health of the maternal population and a determinant of the health of the infant.

In 2012, LBW was lower in the NAB and YKCA compared to LBW among Alaska Native women and all Alaskan women statewide (Alaska Bureau of Health Analytics and Vital Records 2019), as shown in Table 12. Rates in the Fairbanks North Star Borough were similar to statewide rates.

Table 12. LBW Births by PAC and Alaska (2012)

Location	Percent of Total LBW Births (%) to Alaska Native Mothers	Percent of Total LBW Births (%) to all Mothers
NAB	4.7	5.0
YKCA	4.3	5.0
Fairbanks North Star Borough	6.9	5.2
State of Alaska	6.8	5.6

Source: Alaska Bureau of Health Analytics and Vital Records 2019

Substance Use During Pregnancy

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 describe a group of physical, mental, behavioral, or learning disabilities associated with maternal alcohol use during pregnancy. Approximately 1 in 10 infants diagnosed with fetal alcohol spectrum disorders 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 (CDC Community Anti-Drug Coalition of America 2010).

Smoking during pregnancy is the single most important contributor to LBW (CDC 2004; Brooke et al. 1989; Kramer 1987). The NAB had the highest percent of mothers reporting smoking during pregnancy among all residents (40.6 percent) and Alaska Natives (43.2 percent), as shown in Table 13. The YKCA had the lowest percentage of Native Alaska women (29.0 percent) reporting smoking during pregnancy. 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 and all women living in the YKCA.

Table 13. Infants Born to Mothers Reporting Substance Use during Pregnancy by PAC Area and Alaska Statewide (2012)

Location	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
NAB	43.2	40.6	4.8	4.5
YKCA	29.0	25.0	5.9	5.1
Fairbanks North Star Borough	32.5	11.8	3.4	1.2
State of Alaska	32.0	13.8	3.7	2.6

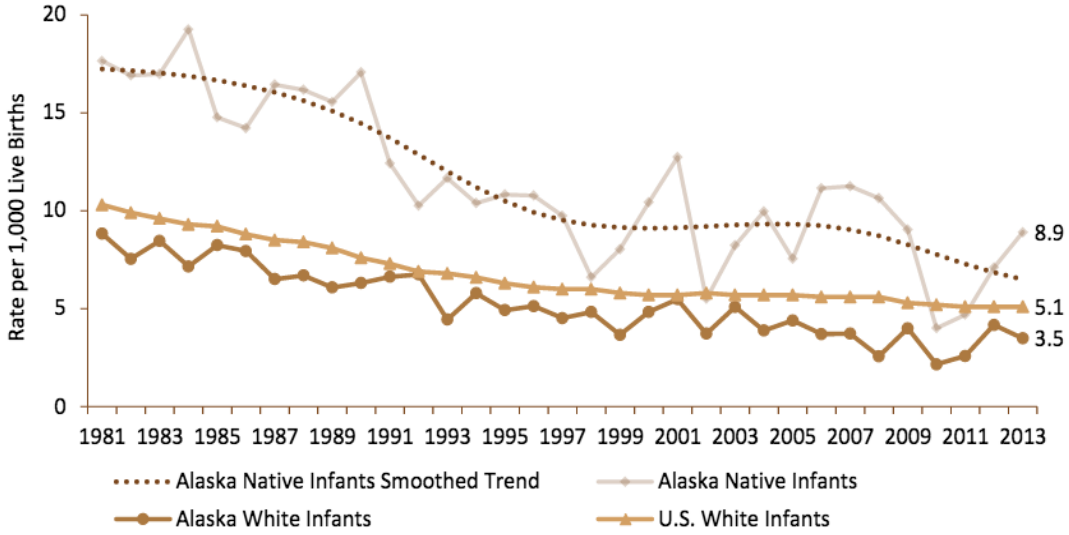
Source: Alaska Bureau of Health Analytics and Vital Records 2019

Infant Mortality

Infant mortality is another health outcome that can be used to approximate baseline health conditions in a region. 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 wellbeing of a nation because factors affecting the health of entire populations can also impact the mortality rate of infants. 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.

During 1981-2013, infant mortality declined among Alaska Native, Alaska white and U.S. white population (www.anthctoday.org/epicenter/healthdata.html), as shown in Figure 4. Within this time period, the Alaska Native infant mortality rate declined 49.4 percent, a significant decrease ($p<0.01$). Between 2009-2013, rates of infant mortality varied by tribal health region, ranging from 2.6 to 10.9 per 1,000 live births, as shown in Table 14 and Figure 5 (www.anthctoday.org/epicenter/healthdata.html). The infant mortality rate in the NAB was higher than the statewide rate; however, the data do not cover the same years. The most consistent NAB data are for the 2005-2009 time period.

Figure 4. Infant Mortality Rate 1981-2013



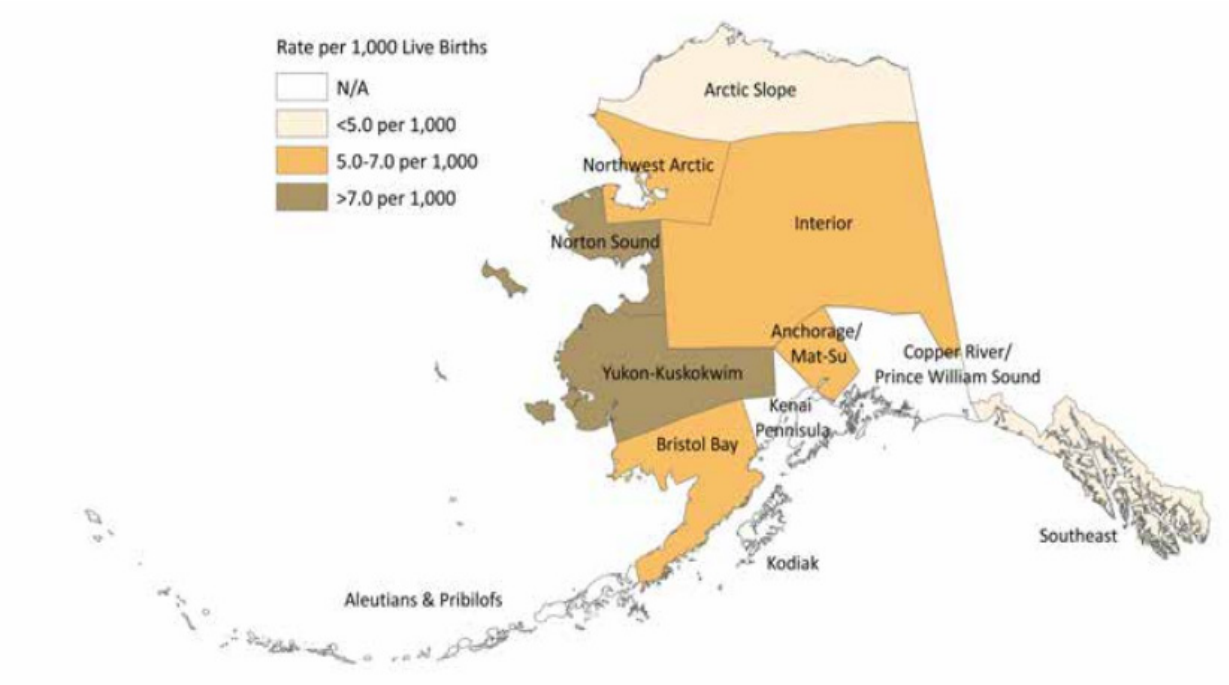
Source: www.anthctoday.org/epicenter/healthdata.html

Table 14. Infant Deaths and Infant Mortality Rates by Potentially Affected Area, Alaska, and the U.S.

Location	Neonatal Number of Deaths	Neonatal Rate per 1,000 Live Births	Post-Neonatal Number of Deaths	Post-Neonatal Rate per 1,000 live Births	Infant Mortality Rate Rate per 1,000 Live Births
Northwest Arctic Borough (2005-2009)	3	**	5	**	7.9*
YKCA (2008-2012)	0	0.0	4	**	**
Fairbanks North Star Borough (2010-2012)	14	2.8*	5	**	3.8*
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

Sources: Alaska Bureau of Health Analytics and Vital Records 2019.
Neonatal – Infants less than 28 days old
Post-Neonatal – Infants 28 days to 1 year old
*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 5. Alaska Native Infant Mortality Rates by Tribal Health Region, 2009-2013

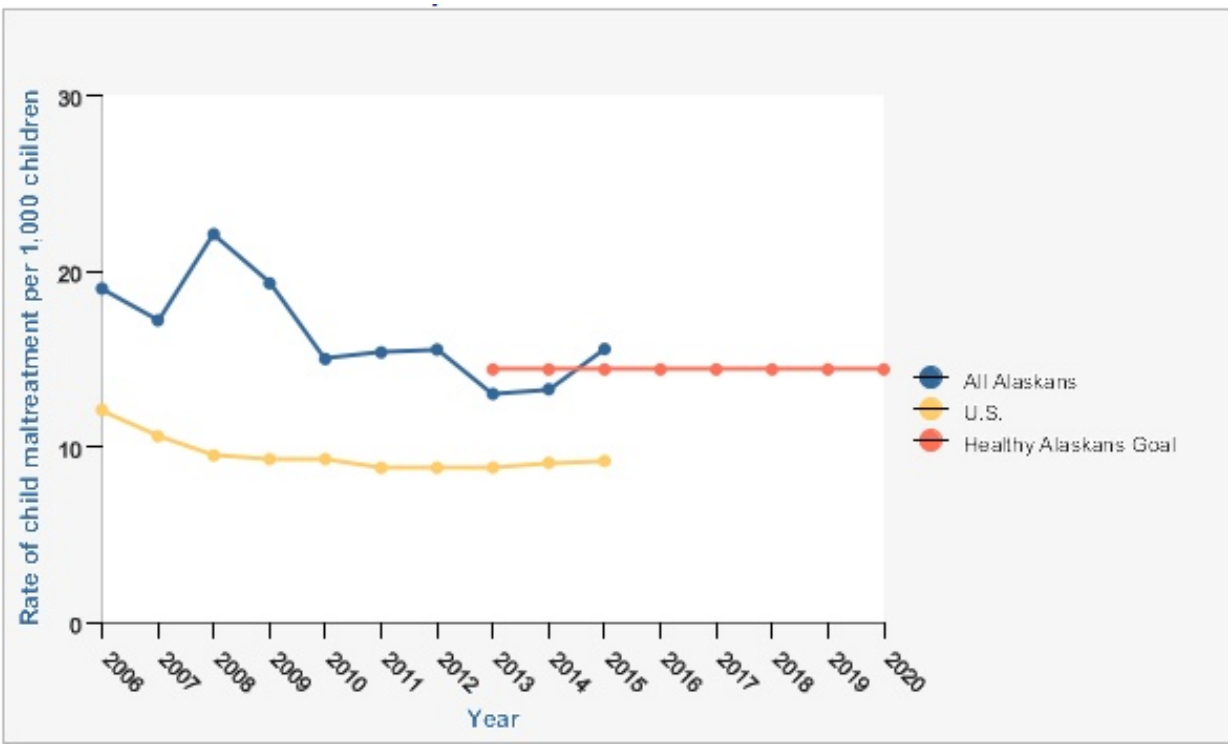


Source: www.anthctoday.org/epicenter/healthdata.html

Child Abuse

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. 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 6 shows improvement in both the Alaska and U.S. rates (per 1,000 children) of substantiated child maltreatment between 2007 and 2014; however, the Alaska rate remained more than 50 percent higher than the U.S. rate (AK-IBIS 2019). In 2015, the national rate of substantiated child maltreatment was 9.2 per 1,000 children age 0-17 years. In comparison, the rate in Alaska for the same year was 15.6 per 1,000, or 69.3 percent higher. The rate in 2015 represents an increase over the 2 preceding years. The 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 6. Child Maltreatment, All Alaskans and the U.S. (2007-2015)



Source: AK-IBIS 2019

Child maltreatment data are not specifically aggregated by community or borough, instead the Alaska OCS publishes statistics for each of five regions. The 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. The OCS has experienced an increase in the number of children in care. Table 15 shows OCS statistics on children in out-of-home care for one or more days during the calendar year.

Table 15. OCS Children in Out-of-Home Care (Calendar Year)

Region	2011	2012	2013	2014	2015
Anchorage	993	1,059	1,177	1,322	1,578
Northern Region	465	422	509	575	672
Southcentral Region	710	716	723	832	927
Western Region	327	339	243	277	281
Southeastern Region	239	245	251	255	269
Alaska Statewide	2,733	2,776	2,902	3,254	3,723

Source: ADHSS OCS 2016

Intimate Partner Violence

IPV 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 HIV/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. Exposure to high levels of IPV 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. Data are not available for the Interior Health Region. 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 16 lists past year and lifetime estimates of each form of IPV measured among women residing in those project regions included in the survey. In 2011, the Fairbanks North Star Borough had lower rates of physical violence and threats as compared to the state overall in 2010.

Table 16. Lifetime Estimates of IPV and Sexual Violence among English-Speaking Adult Women in Fairbanks North Star Borough

Estimates	Lifetime Percentage (%)	Lifetime Number	Past Year Percentage (%)	Past Year Number
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

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.

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 IPV, 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, as shown in Table 17. In 2010, 12 in 100 women had experienced IPV, sexual violence, or both in Alaska during the previous year. By 2015, that number had dropped to 8 in 100. Overall, IPV decreased by 32 percent and sexual violence decreased by 33 percent. In 2015, 6,556 fewer women experienced IPV than in 2010. Also in 2015, 3,072 fewer women experienced sexual violence than in 2010.

Table 17. Lifetime Estimates of IPV and Sexual Violence among English-Speaking Adult Women for Alaska Statewide (2013)

Estimates	Lifetime 2010	Lifetime 2015	Past Year 2010	Past Year 2015
Intimate Partner Violence[a]	47.6%	40.4%	9.4%	6.4%
Threats	31.0%	25.6%	5.8%	3.0%
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.

Suicide

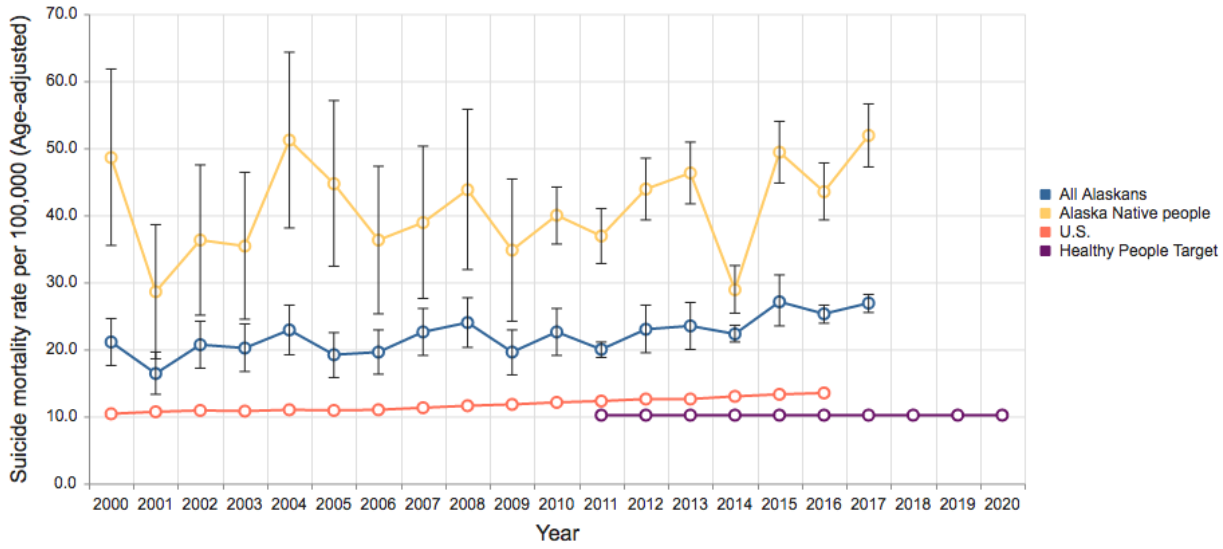
Suicide is an important health outcome that can function as one indicator for mental health wellness in a population. Mental illness and other life stressors are highly associated with suicide. The economic and human cost of suicidal behavior to individuals, families, communities, and society makes suicide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

- Previous suicide attempt(s)
- History of depression or other mental illness
- Alcohol or drug abuse
- Family history of suicide or violence

- Physical illness
- Local epidemics of suicide

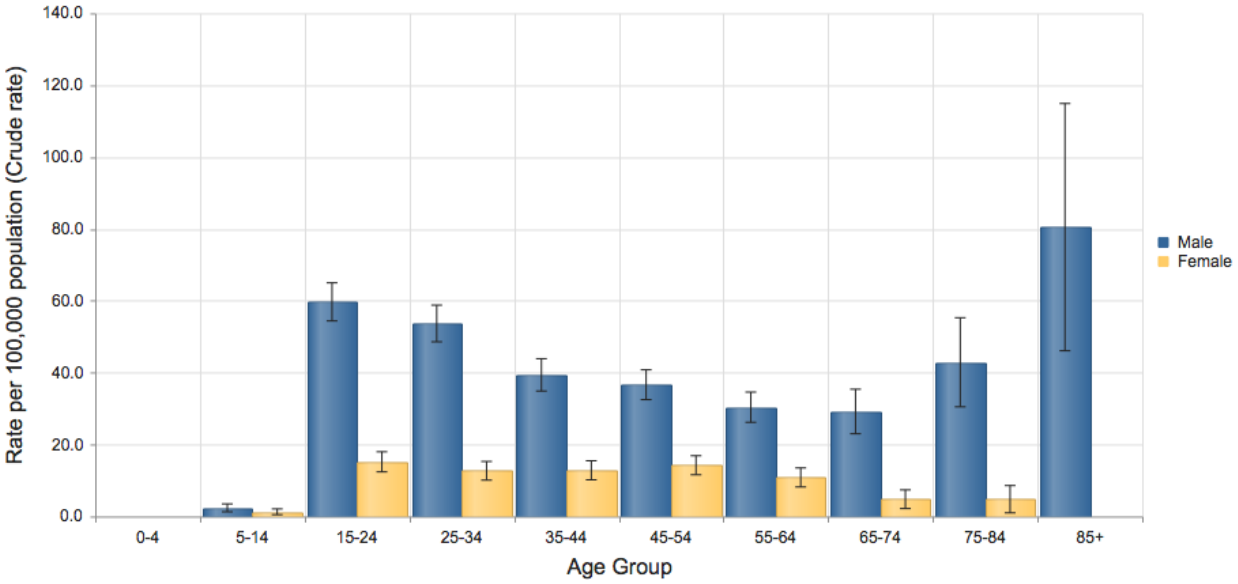
Alaska had the second highest age-adjusted suicide rate in the nation in 2017 at 26.9 per 100,000 population, the most recent year for which national data are currently available in the AK-IBIS (2019). During the 2013-2017 period, suicide was the leading cause of death among Alaskans aged 15-24 years and the fifth leading cause of death overall in Alaska (Alaska Bureau of Vital Statistics 2019). Alaska's suicide rates are highest among males, young adults, American Indian/Alaska Native people, and persons living the rural regions of the state (Figure 7, Figure 8, and Table 18). Between 2003-2017, males had a higher suicide rate in every age group (see Figure 8).

Figure 7. Suicide Mortality Rate per 100,000 Population, All Ages, All Alaskans, Alaska Natives, and U.S. (2000-2017)



Source: AK-IBIS 2019

Figure 8. Suicide Mortality Rate per 100,000 Population, by Age Group and Sex, All Alaskans, (2003-2017 [15-year average])



Source: AK-IBIS 2019

Table 18. Suicide Mortality Rate per 100,000 Population for All Ages by Potentially Affected Area, 2008-2017 (10-year average)

Potentially Affected Area	Suicide Mortality Rate per 100,000 (Age-adjusted)	Lower Limit	Upper Limit	Numerator	Denominator
NAB	52.1	46.0	58.2	42	76,628
YKCA	65.1	56.6	73.5	35	56,013
Fairbanks North Star Borough	19.5	18.5	20.5	194	981,193
Statewide (2017)	51.9	47.2	56.6	66	127,656
U.S. (2016)	13.5	NA	NA	44,964	323,127,513

Source: AK-IBIS 2019
NA – not available

Among potentially affected areas, YKCA 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 (see Table 19). The Fairbanks North Star Borough had a suicide similar to the statewide rate.

Table 19. Suicide Rates by Potentially Affected Area and Alaska Statewide (2011-2013)

Potentially Affected Area	Number of Deaths	Age-Adjusted Rate** per 100,000 Population[a]
NAB	11	47.8*
YKCA	12	72.3*
Fairbanks North Star Borough	57	19.2
State of Alaska	481	22.2

Source: Alaska Bureau of Health Analytics and Vital Records 2019.
[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.

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, 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 (tolerance and withdrawal) (National Institutes 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 (such as heroin and cocaine), alcohol addiction, and binge drinking. 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. Boarding, correspondence, home study, alternative, and correctional schools are excluded. 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:

- Behaviors that result in unintentional and intentional injuries
- Tobacco use
- Alcohol and other drug use
- Sexual behaviors that can result in HIV infection, other STDs, and unintended pregnancies
- Dietary behaviors
- Physical activity

Surveys have also been aggregated into six Public Health Regions. However, this collection of surveys is not conducted with the same scientific rigor as those producing the statewide estimates. Therefore, the resulting rates are considered indicators of the existence of specific behaviors but not necessarily the

precise prevalence estimates, which limits the utility of comparisons (YRBS 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 these exceptions (Substance Abuse and Mental Health Services Administration 2015):

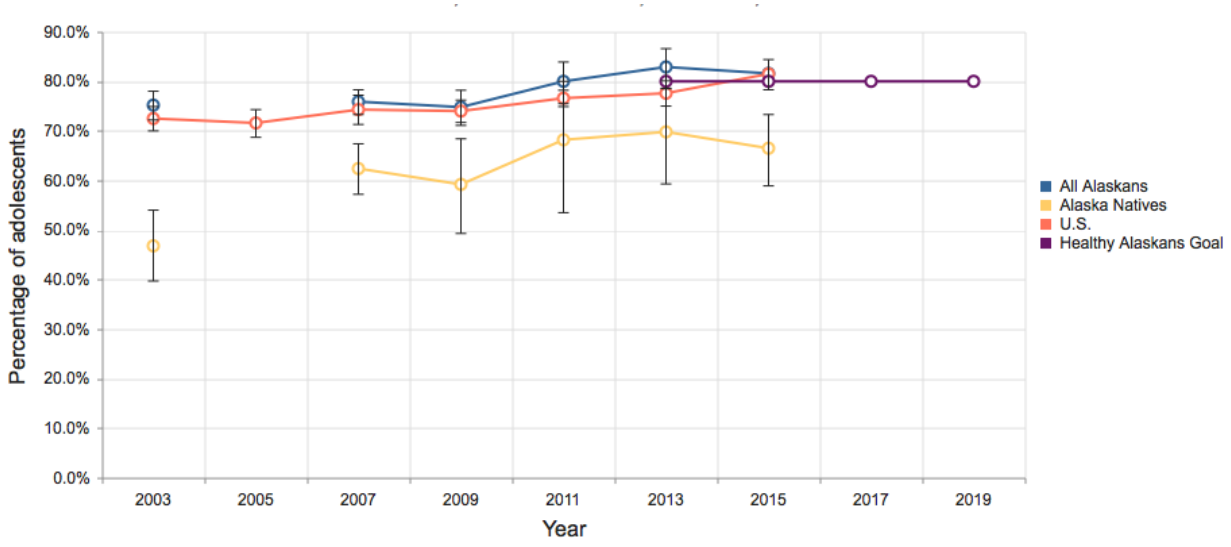
- Approximately 4 in 10 (42.4 percent) adolescents (aged 12-17) in Alaska in 2013-2014 perceived no great risk from smoking one or more packs of cigarettes a day, exceeding the national percentage (34.7 percent).
- Approximately 8 in 10 (82.9 percent) adolescents (aged 12-17) in Alaska in 2013-2014 perceived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

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 percent of all lung cancers in the U.S. In addition, smoking increases the risk of adverse pregnancy outcomes, such as miscarriage and LBW, and can lead to DNA damage in sperm that might reduce fertility (CDC 2010). Furthermore, there is no risk-free level of exposure to secondhand smoke; even brief exposure can be damaging to health.

In 2017, 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 percent) compared to all Alaskan adolescents statewide (81.6 percent) and adolescents nationally (81.5 percent), as shown in Figure 9.

Figure 9. Percentage 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 2019

The Alaska BRFSS program collects data regarding use of tobacco products and environmental exposure to tobacco smoke among Alaska adults. Table 20 shows the age-adjusted prevalence of residents who reported to be current smokers and 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 NAB had the highest prevalence of smoking among all Alaskans residing in potentially affected regions (45.5 percent). The NAB also had the highest rates among Alaska Native residents. Fairbanks North Star Borough had the lowest prevalence of smokers and users of smokeless tobacco products.

Table 20. Tobacco Use and Environmental Exposure to Tobacco Smoke by Potentially Affected Area for all Alaskans and Alaska Natives (2012-2017)

Potentially Affected Area	Percentage of Residents Who Are Current Smokers/Smokeless Tobacco Users for All Alaskans (age-adjusted prevalence) (various years)	Percentage of Residents Who Are Current Smokers/Smokeless Tobacco Users for Alaska Natives (age-adjusted prevalence) (various years)	Percentage of Residents Reporting Exposure to Smoking Inside the Home in Past 30 Days for All Alaskans (age-adjusted prevalence) (2012-2017)	Percentage of Residents Reporting Exposure to Smoking Inside the Home in Past 30 days for Alaska Natives (age-adjusted prevalence) (2012-2017)
NAB	45.5[4]/**%	46.8[4]/18.1%[1]	5.8%	5.5%
YKCA	21.6[4]/3.0[4]%	26.2[2]/16.1%[2]	6.4%	5.3%
Fairbanks North Star Borough	18.4[4]/4.8[4]%	30.0/3.5%[3]	18.0%	6.5%
Alaska Statewide (2017)	20.2/4.3%	34.9/10.8%	7.0%	7.2%

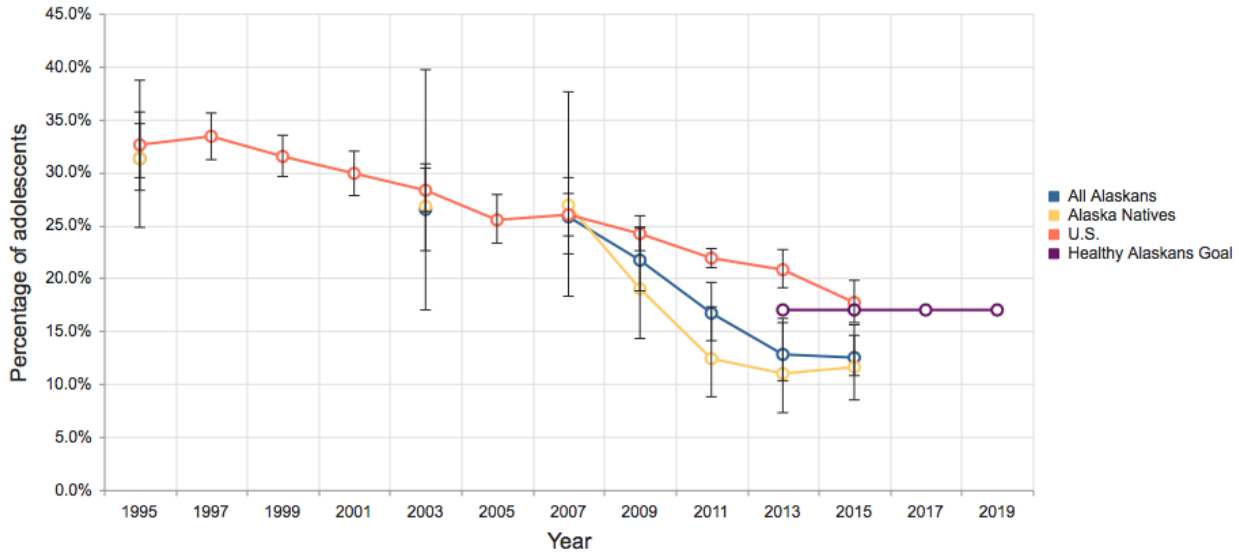
Source: AK-IBIS 2019
1 Data from 2012
2 Data from 2015
3 Data from 2013
4 Data from 2017
**Rates based on fewer than 6 occurrences are not reported

Alcohol Use

Alaska experiences a significantly higher rate of alcohol-induced mortality compared to the overall U.S. rate. Alcohol and other drug use are 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 (ibis.dhss.alaska.gov).

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 for women. Figure 10 shows a decrease in the rate of binge drinking among adolescents since 1990. In 2017, the rate of binge drinking among all Alaskans (12.5 percent) was higher than that among Alaska Natives statewide (11.6 percent).

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 2019

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 2015 and 2017 (see Table 21). Asians reported the lowest percentage of binge drinking. Among potentially affected boroughs/census areas, adult residents of the NAB reported the lowest level of binge drinking within the past 30 days among both all residents and Alaska Natives. Fairbanks North Star Borough had the second lowest reported percentage for the same groups. The highest percentage of adults that self-reported binge drinking within the past 30 days were Alaska Native adults residing in the YKCA at 31.4 percent. This percentage represents nearly twice that reported by adults living in other potentially affected boroughs/census areas (see Table 22).

Table 21. Percentage of Adults Who Reported Binge Drinking in the Past 30 Days by Race/Ethnicity and all Alaskans, 2015-2017(3-year average)

Race/Ethnicity	Percentage of Adults	Lower Limit	Upper Limit	Numerator	Denominator
Alaska Native (any mention)	21.5%	19.2%	24.0%	703	3,773
Asian (non-Hispanic)	12.2%	8.3%	17.6%	44	357
Black (non-Hispanic)	15.6%	10.2%	23.2%	33	280
Native Hawaiian/Other Pacific Islander (non-Hispanic)	21.2%	11.5%	35.9%	14	88
White (non-Hispanic)	19.2%	18.2%	20.3%	2,342	15,782

Race/Ethnicity	Percentage of Adults	Lower Limit	Upper Limit	Numerator	Denominator
Multiracial/Other (non-Hispanic)	30.8%	19.5%	45.0%	26	150
Hispanic (alone or multi)	19.4%	14.8%	25.0%	95	551
Healthy Alaskans Goal	20.00%	NA	NA	NA	NA

Source: AK-IBIS 2019
NA – not available

Table 22. Percentage of adults (18+) Who Reported Binge Drinking in the Past 30 days by Potentially Affected Area for all Alaskans and Alaska Natives, 2015-2017 (3-year average)

Ethnicity	Borough/Census Area	Percentage of Adults (%)	Lower Limit	Upper Limit	Numerator	Denominator
All Alaskans	NAB	17.2%	11.0%	25.9%	43	262
All Alaskans	YKCA	26.0%	20.1%	32.9%	116	537
All Alaskans	Fairbanks North Star Borough	18.5%	16.6%	20.5%	503	3,394
Alaska Natives	NAB	17.4%	10.7%	27.1%	32	164
Alaska Natives	YKCA	31.4%	23.8%	40.2%	89	327
Alaska Natives	Fairbanks North Star Borough	16.7%	11.6%	23.4%	46	318
Healthy Alaskans Goal	Not Applicable	20.00%	NA	NA	NA	NA

Source: AK-IBIS 2019
NA – not available

Other Drug Use

Drug-induced deaths include all deaths for which drugs are the underlying cause. This definition includes those attributable to acute poisoning by drugs (drug overdoses) and deaths from medical conditions resulting from chronic drug use, such as drug-induced Cushing's syndrome. A drug-induced death includes illicit or street drugs (such as heroin and cocaine), as well as legal prescription and over-the-counter drugs. Alcohol is not included in the definition (Kung et al. 2008). In 2016, the drug-induced mortality rate among Alaskans statewide was 17.7 per 100,000 population, lower than the national rate of 20.8 per 100,000 population (AK-IBIS 2019). Between 2013 and 2016, overdose deaths increased by 43.5 percent nationwide; during that same period, rates increased by 21.1 percent in Alaska. In 2017, Alaska's age adjusted overdose death rate reached the highest level for Alaska in 10 years at 19.3 deaths per 100,000 people (AK-IBIS 2019).

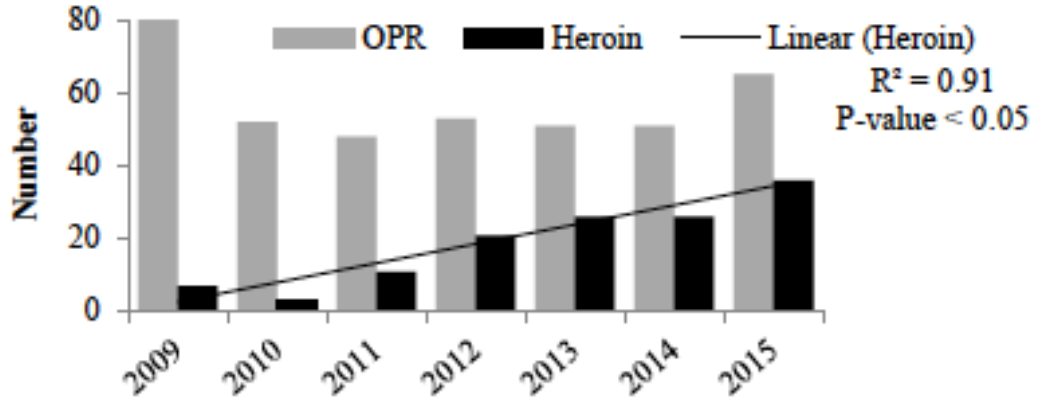
Marijuana is the most commonly used illicit drug in the U.S. (NIH 2016). Chronic marijuana use can: (1) alter perception and mood, (2) disrupt learning and memory, and (3) cause thinking and problem-solving difficulties. In 2017, 21.8 percent of all Alaskan in grades 9-12 had reported using marijuana within the past 30 days, as compared to 31.0 percent of Alaska Natives statewide and 19.8 percent of all adolescents in grades 9-12 nationally (AK-IBIS 2019). In Alaska, marijuana was the primary drug of abuse among about one-third of adolescents (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 2016). In 2015, 6.4 percent 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 percent).

Heroin and Opioid Pain Reliever (OPR) Use

The Alaska Epidemiology Section reported in 2015 that the rate of heroin poisoning resulting in hospital admissions doubled between 2008 and 2012 and "during 2008–2013, the number of heroin-associated deaths more than tripled in Alaska, and in 2012, the rate of heroin-associated deaths in Alaska was 42% higher than that for the U.S. overall (2.7 per 100,000 vs. 1.9 per 100,000, respectively)." The number of heroin-associated overdose deaths increased more than 10-fold from fewer than five 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

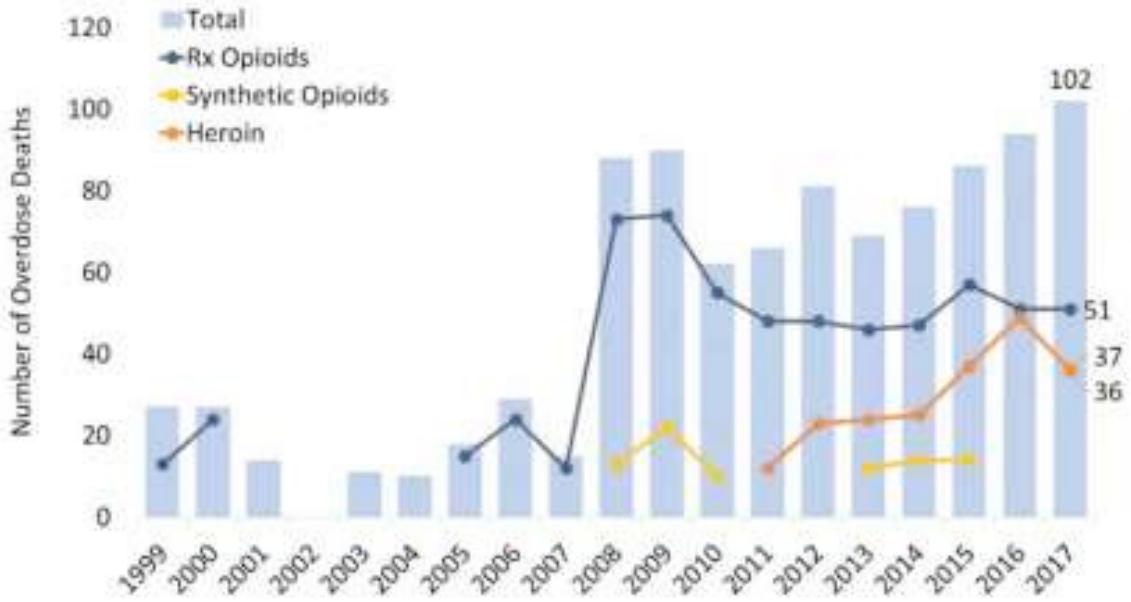
Admissions to publicly funded substance use disorder treatment for heroin dependence increased 58% between 2009 and 2013. The majority of those individuals seeking treatment were age 21-29 (ADHSS SOE 2015b).

In 2012, Alaska's prescription OPR overdose rate was more than twice the U.S. rate (10.5 versus 5.1 per 100,000 population, respectively). Between 2009 and 2015, there were 774 drug overdose deaths in the Alaska mortality database (ADHSS SOE 2016). Prescription drugs were noted as a primary or contributing cause in 66 percent of these deaths.

In 2017, there were 102 overdose deaths involving opioids in Alaska—a rate of 13.9 deaths per 100,000 persons compared to the average national rate of 14.6 deaths per 100,000 persons. Cases involving heroin decreased slightly in 2017 to 36 deaths following an increasing trend through 2016. Deaths involving synthetic opioids other than methadone (mainly fentanyl) have not been consistently reported but 37 deaths were recorded in 2017. Deaths involving prescription opioids have remained level since 2010, with 51 cases reported in 2017.[1] The overall trend in overdose deaths by opioid category is shown Figure 12.

[1] https://www.drugabuse.gov/drugs-abuse/opioids/opioid-summaries-by-state/alaska-opioid-summary

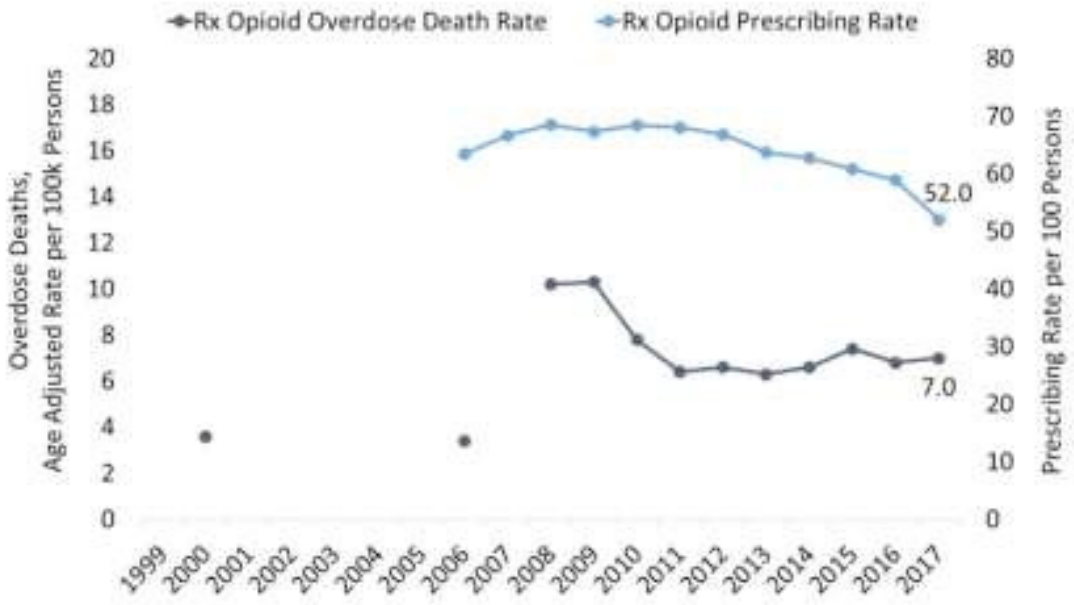
Figure 12. Number of Overdose Deaths Involving Opioids in Alaska, by Opioid Category



Source: CDC WONDER 2019

In 2017, Alaska providers wrote 52.0 opioid prescriptions for every 100 persons (see Figure 13). The average U.S. rate in the same year was 58.7 prescriptions per 100 persons (CDC WONDER 2019). The rate of overdose deaths involving opioid prescriptions has not significantly changed since 2010 with an age adjusted rate of 7.0 deaths per 100,000 persons in 2017.

Figure 13. Alaska Rate of Overdose Deaths Involving Prescription Opioids and the Opioid Prescribing Rate



Source: CDC WONDER 2019

Summary: Key SDH Findings

A summary of composite data of key SDH outcomes is shown in Table 23.

Table 23. Summary of Key SDH Outcomes

Subject	YKCA All	YKCA AN	NAB All	NAB AN	Alaska All	Alaska AN
Inadequate Prenatal Care (percent births)	29.5	27.9	22.5	21.7	17.2	23.8
Teen Birth Rates	7.5	8.7	13.4	14.2	7.5	12.6
Low Birth Weight Births	5.6	6.8	5.0	4.7	5.6	6.8
Percent of AK Mothers Reporting Smoking during Pregnancy	25.0	29.0	40.6	43.2	13.8	32.0
Percent of AK Mothers Reporting Drinking during Pregnancy	5.1	5.9	4.5	4.8	2.6	3.7
Neonatal Deaths (infants less than 28 days of age) – Number of Deaths	0	NA	3	NA	36	NA
Neonatal Deaths (infants less than 28 days of age) – Rate per 1000 live births	0.0	NA	**	NA	3.2	NA
Post-neonatal (infants 28 days to 1 year of age) – Number of Deaths	4	NA	5	NA	25	NA
Post-neonatal Deaths (infants less than 28 days of age) – Rate per 1000 live births	**	NA	**	NA	2.2	NA
Infant Mortality Rate	**	NA	7.0*	NA	5.5	NA

Source: Alaska Bureau of Health Analytics and Vital Records 2019.
AN – Alaska Native
NA – not available
*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.

The following determinants and outcomes have been identified:

- **Determinants**
  - Marked differences by borough/census area and across villages for income, percentages below the poverty line, employment and educational attainment.
  - In general, the YKCA performs worse than NAB across key determinants.

- Population demographic trends indicate that a large number of adults >age 65 are likely present in villages.

- **Outcomes**
  - Overall MCH performance across key geographic units (YKCA and NAB) is generally comparable to other Public Health Regions in Alaska.
  - Rates of tobacco and alcohol use are variable with potentially significant differences between YKCA and NAB, particularly regarding tobacco usage.
  - Suicide rates are a concern.
  - There is a rising drug abuse epidemic across Alaska.

3.5.2 HEC 2: Accidents and Injuries

Accidents and injuries are an important cause of mortality and morbidity in Alaska. Unintentional injuries (UI) are preventable injuries for which harm either to oneself or others is not intended (causes of injury or death other than suicide and homicide) (Day et al. 2018). Among Alaska Native people, UIs are also the leading cause of death for persons 45–70 years, ages where chronic disease deaths supplant UI among most of the U.S. population (Day et al. 2018). More than a third (38 percent) of Alaska Natives reside in about 200 rural communities, 178 of which are not connected by roads and are separated from each other and regional hospitals by vast stretches of tundra, water, glaciers, and mountains (Day et al. 2018). The subsistence lifestyle requires significant time spent on or near water or exposed to other natural hazards in generally remote settings where emergency response times to an UI may be a significant issue and contribute to observed UI mortality rates.

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. Over the 2006-2015 time period, based on death certificate data, the five leading UI categories for Alaska Native deaths overall were poisoning, motor vehicle-traffic crashes/incidents, drowning/submersion, natural environment and transport-other (land), accounting for 73 percent (n = 811) of all Alaska Natives UI mortality (Day et al. 2018).

Alcohol use is a powerful risk factor for accidents and injuries, so alcohol-related injury events are reported. The presence of law enforcement or village public safety officers (VPSO) also influences safety in rural communities.

In the EIS, Section 3.4.2 provides an overview of the transportation and access situation for the overall study area. Table 5 in Appendix F of the EIS provides a summary of transportation facilities within the study area by community, including details on road accessibility and barge service as well as the closest airport.

Fatal Accidents and Injuries

Table 24 presents rates of fatal accidents and injuries among potentially affected areas by cause. For the more populous areas (Fairbanks North Star Borough and Alaska statewide), rates were derived based on data collected from 2013 alone. For all other areas, rates were derived from data collected between 2011 and 2013, excepting Skagway-Hoonah-Angoon, which required a rate calculation based on 5 years of data due to the small population size. It should be noted that many rates were based on fewer than 20 occurrences and are therefore statistically unreliable. The highest statistically reliable rate of fatal accidents occurred in the YKCA at 174.5 per 100,000 population. This rate was three times that of the statewide rate; however, occurrences were collected over a 2-year period.

Table 24. Major Causes of UI Death by Potentially Affected Area and Alaska (2011-2013)

Cause of Death	NAB (2011–2013) Deaths (Age Adjusted Rate[1])	YKCA (2011–2013) Deaths (Age Adjusted Rate[1])	Fairbanks North Star Borough (2013) Deaths (Age Adjusted Rate[1])	Alaska Statewide (2013) Deaths (Age Adjusted Rate[1])
Motor Vehicle Accidents[4]	6 (28.8*)	3 (**)	9 (8.6*)	67 (8.9)
Snow Machine[2]	7 (32.2*)	2 (**)	3 (**)	9 (1.2*)
ATV[3]	1 (**)	1 (**)	3 (**)	14 (1.9*)
Water Transport	ND	1 (**)	1 (**)	11 (1.4*)
Air Transport	ND	1 (**)	ND	22 (2.9)
Other Accidental Death	5 (**)	7 (44.2*)	6 (6.0*)	43 (8.0)
Falls	3 (**)	3 (**)	3 (**)	30 (5.5)
Suffocation/ Choking	1 (**)	1 (**)	ND	17 (2.6*)
Drowning and Submersion	1 (**)	3 (**)	5 (**)	24 (3.5*)
Smoke, Flame and Fire	ND	6 (30.9*)	2 (**)	9 (1.4*)
Poisoning	4 (**)	6 (29.4*)	17 (18.8*)	128 (17.7)
Total UI Deaths	**20 (88.7)**	**30 (174.5*)**	**45 (48.7)**	**354 (52.4)**

Source: ABVS 2019
ND – no data
[1] Age-Adjusted rates are per 100,000 U.S. year 2000 standard population
[2] Deaths to an operator or passenger related to the use of a snow machine
[3] Deaths to an operator or passenger related to the use of an ATV
[4] V02-V04, V090, V092, V12-V14, V190-V192, V194-V196, V20-V79, V803-V805, V810-V811, V820-V821, V83-V86, V870-V878, V880-V888
* 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

UI Deaths Among Alaska Natives

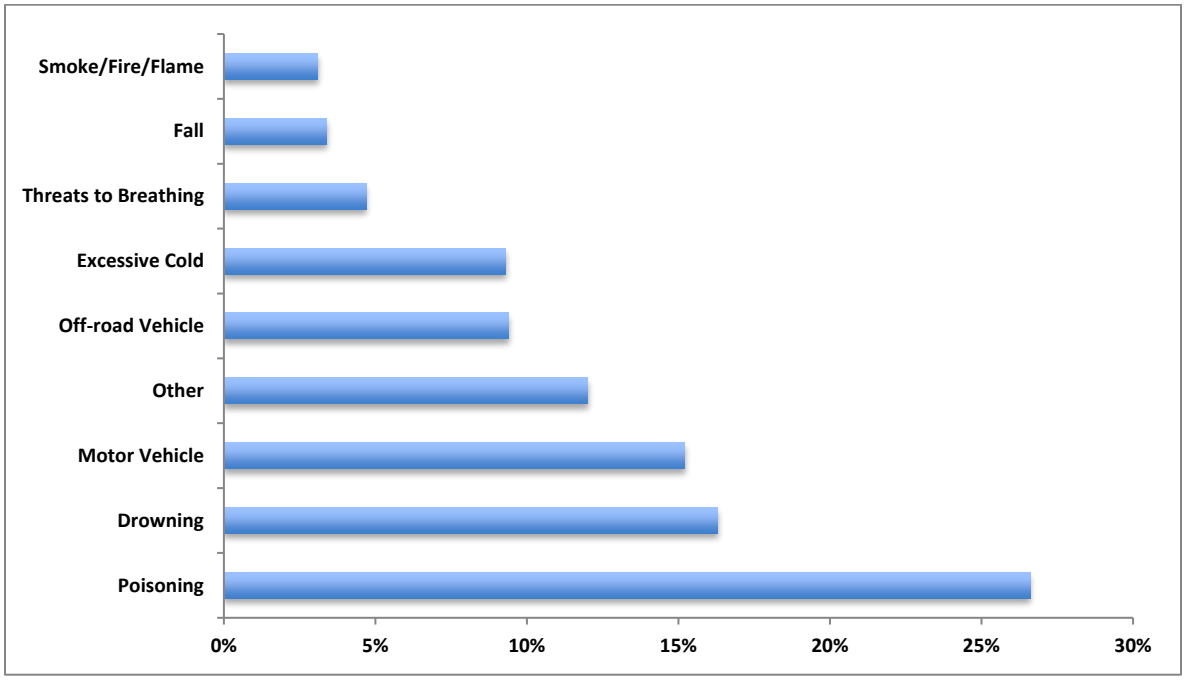
During 2008-2011, UI was the third leading cause of death among Alaska Native people, with a mortality rate of 106.9 per 100,000 during 2008-2011, and the leading cause of death people aged 25-44 years (www.anthctoday.org/epicenter/healthdata.html). Despite improvements in rates over the past 30 years, Alaska Native people had an UI mortality rate 2.2 times that of Alaska non-Natives and 2.6 times that of U.S. whites in 2008-2011 ($p<0.01$). 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 UI death rate at 150.0 per 100,000 population, while the rate in the NAB was nearly half of this value at 73.0 per 100,000 (see Table 25). Between 2002-2011, poisoning was the leading cause of unintentional injury death among Alaska Natives comprising 26.6 percent (see Figure 14). Drowning was the second leading cause, followed by motor vehicle accidents.

Table 25. Average Annual Age-Adjusted UI Death Rates per 100,000 by Potentially Affected Tribal Health Region for Alaska Natives 2012 to 2015

Tribal Health Region	Number	Rate	Range
Northwest Arctic	17	73.0	69–75
Interior	58	131.1	76–131
Statewide	401*	99.4	61–173

Source: www.anthctoday.org/epicenter/healthdata.html
* Includes 2 individuals from unknown region

Figure 14. UI Death by Type, Alaska Native People, all Ages (2002-2011)

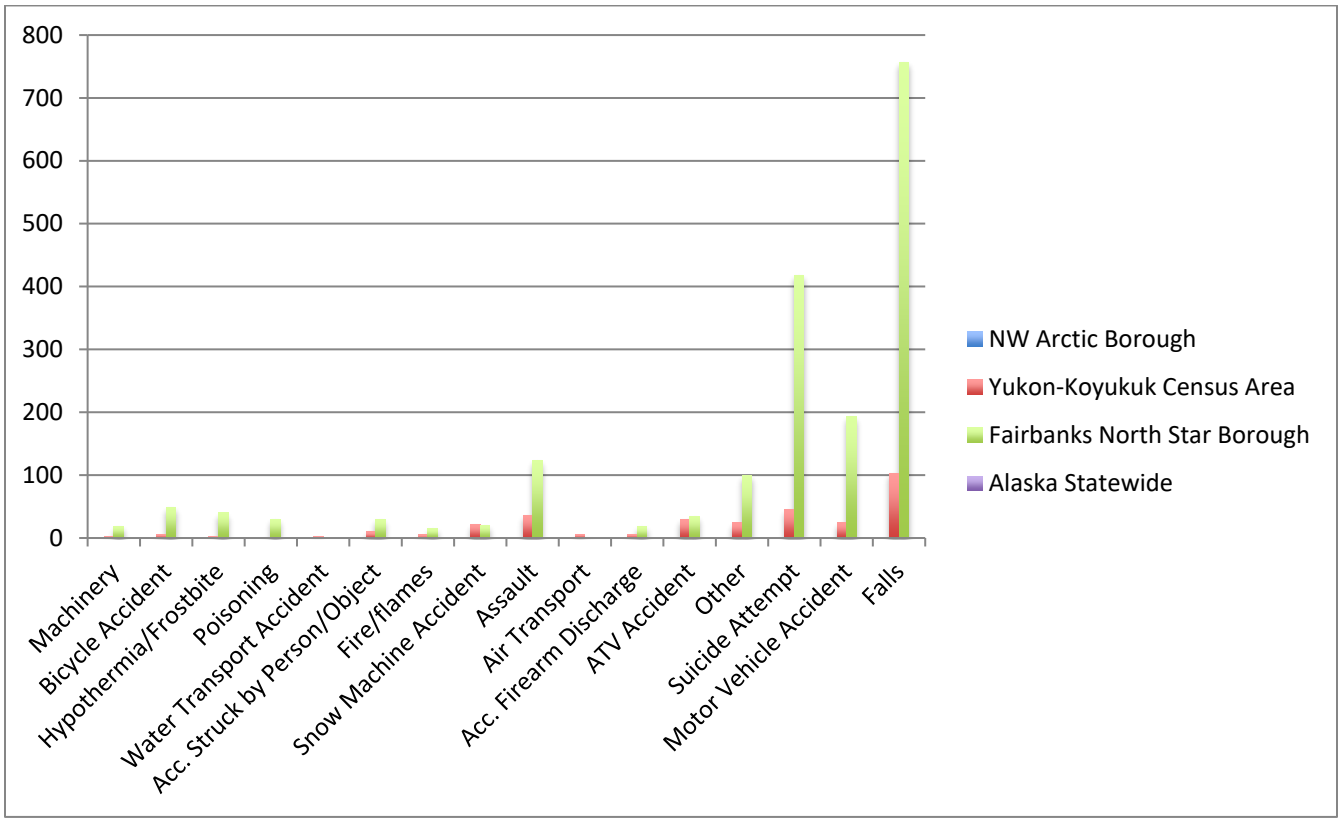


Source: www.anthctoday.org/epicenter/healthdata.html

Non-Fatal Injuries

Injury hospitalizations are collected in the ATR. The most current non-fatal injury data available is shown in Figure 15. 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 (see Figure 15).

Figure 15. Leading Causes of Non-Fatal Injury by Potentially Affected Area and Alaska Statewide (2007-2011)



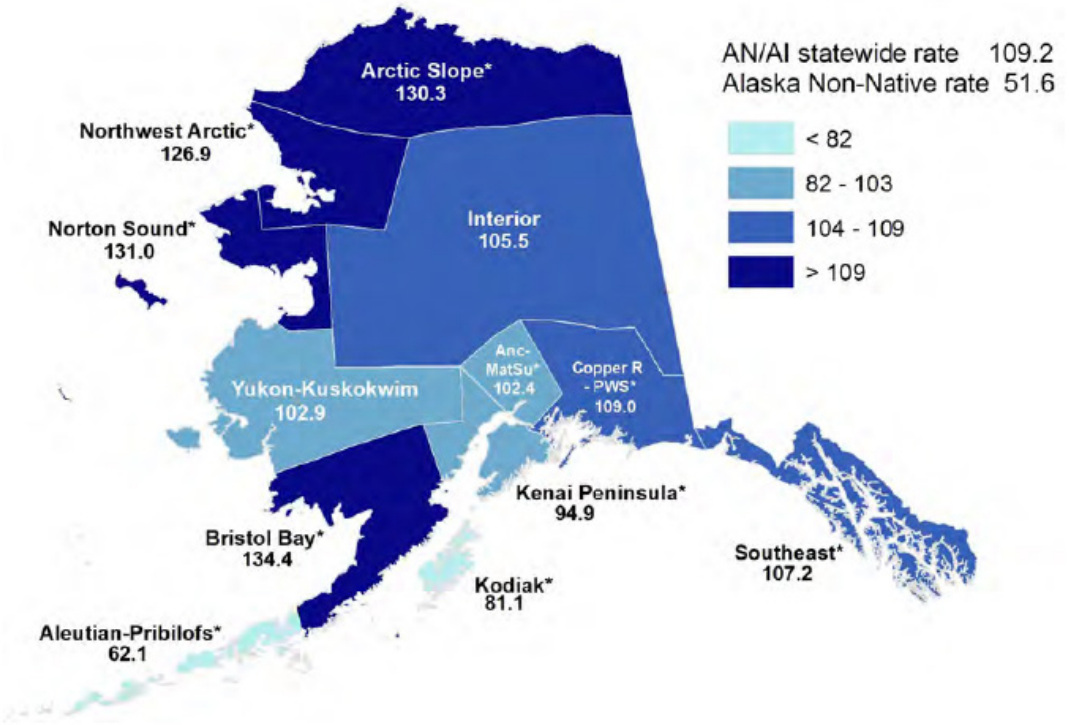
Source: http://ibis.dhss.alaska.gov/topic/databases/ATR.html

Non-Fatal UIs Among Alaska Natives

Between 2002 and 2011, there were 10,955 hospitalizations for UIs among Alaska Native people, representing 67.9 percent of all injury hospitalizations (16,141). Alaska Native people were 2.1 times more likely to be hospitalized for a UI than non-Natives statewide (2002-2011, 109.2 and 51.6 per 10,000, respectively, $p<0.05$), as shown in Figure 16. The NAB (126.9) had a higher rate of hospitalizations for UIs than both the Interior (105.5) and statewide (109.2).

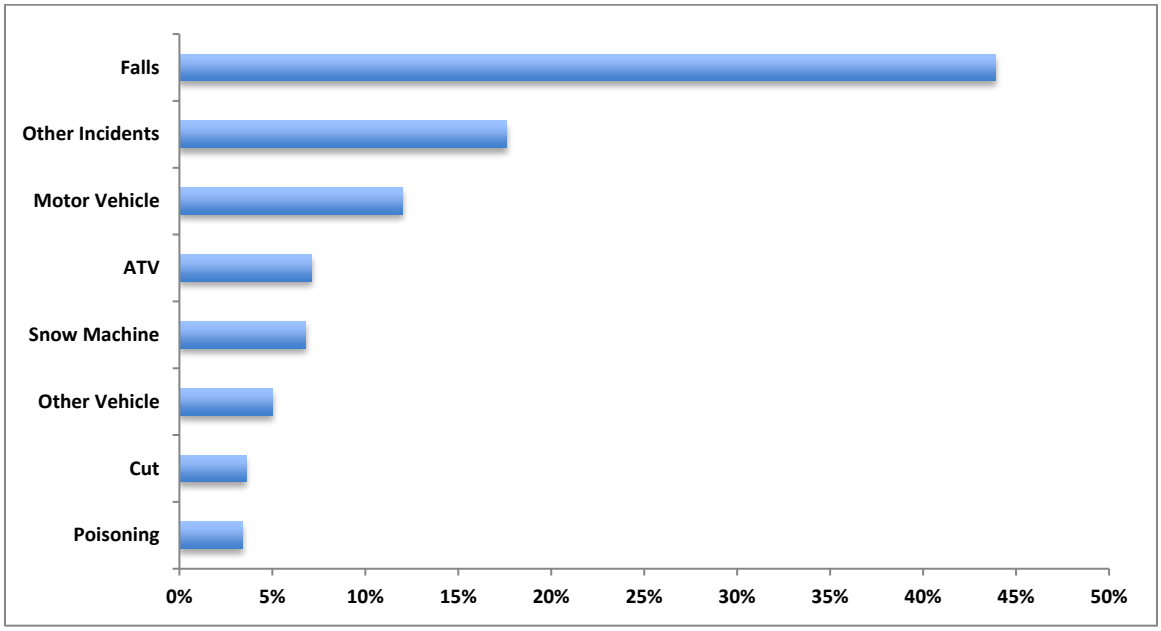
Similar to all races combined, falls were the leading cause non-fatal UI hospitalizations among all Alaska Natives statewide (43.9 percent of 10,955), as shown in Figure 17. During 2002-2011, there were 4,089 hospitalizations for fall injuries among Alaska Native people.

Figure 16. UI Hospitalization Rates by Region, Alaska Native People, 2002-2011



Source: www.anthctoday.org/epicenter/healthdata.html

Figure 17. UI Hospitalization by Type, Alaska Native People, All Ages, 2002-2011



Source: www.anthctoday.org/epicenter/healthdata.html

Traffic and Accidents

Boats, snow machines, all-terrain vehicles (ATVs), and airplanes are common modes of transportation in the area.

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 while serving as police throughout most of rural Alaska. Some cities do have local police departments; however, with the exception of Fairbanks and Anchorage, their staff 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 Department of Transportation Commercial Vehicles Enforcement section. ABHP traffic teams deploy from Fairbanks, Mat-Su West, Soldotna, and Girdwood (AST detachments… 2016).

Table 26 lists the location of AST detachments, headquarters, and posts. Posts along the project transportation corridor include Fairbanks. A post in Talkeetna was slated to close in 2015, leaving the posts in Willow and Cantwell as the closest to the community.

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 over 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. According to the 2012 Alaska State Troopers Annual Report, the D detachment had 10 VPSOs assigned to Huslia, Manley Hot Springs, Ruby, Tanana, Tetlin, Chalkyitsik, Eagle, Allakaket, Beaver, and a roving VPSO based in Fairbanks (Alaska Department of Public Safety 2012). The detachment utilizes a Fairbanks-based trooper pilot and a Caravan aircraft to support the VPSO program and rural villages.

Table 26. AST Detachments, Headquarters, and Posts

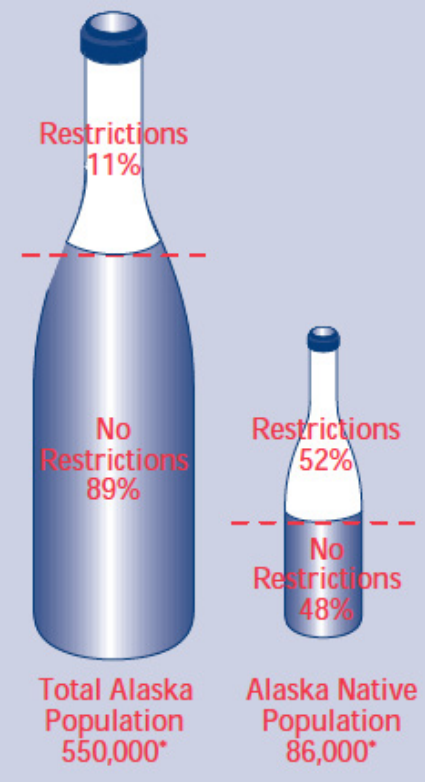
Detachment	Headquarters	Posts
A	Kechikan	Haines, Juneau, Klawock, Ketchikan, Petersburg
B	Palmer	Glenallen, Palmer, Mat-Su West
C	Anchorage	Anchorage, Aniak, Bethel, Dillingham, Emmonak, Iliamna, King Salmon, Kodiak, Kotzebue, McGrath, Nome, Saint Mary's, Selawik, Unalakleet
D	Fairbanks	Barrow, Cantwell, 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: AST detachments… 2016

Dry/Damp/Wet Community

Alaska Native village policies have been enacted that designate a community as dry (alcohol sale and consumption prohibited), damp (sale of alcohol illegal, but possession allowed), and wet (sale and possession allowed). Approximately 11 percent of the total Alaska population and 2 percent of the Native population live in places that restrict the availability of alcohol (see Figure 18). Table 26 shows the alcohol status of some of the PACs (Berman and Hull 1997).

Figure 18. Alcohol Control Status by Population



Source: Berman and Hull 1997

Table 27. Alcohol Status in PACs

Alcohol Status	Community
Ban on sale only	Hughes, Huslia
Ban on sale and importation	Ambler, Shungnak, Kobuk,
Ban on sale, importation, and possession	Allakaket, Alatna
Community license or designated private store	Rampart, Tanana
No alcohol control, but no bars or liquor stores	Wiseman
Bars	Coldfoot
Bars and liquor stores	Bettles, Manly Hotsprings, Fairbanks

Source: Berman and Hull 1997

Key Points- Accidents & Injuries

1. UIs are a critical cause of death, particularly for adults ages 45-70.
2. There are potentially significant differences in fatal and non-fatal UI rates across key boroughs and census areas.
    - Rates in YKCA are significantly higher than NAB
3. Access to medical care, emergency response times, alcohol and law enforcement are likely a significant cofactor for observed UI non-fatal and fatal rates.

3.5.3 HEC 3: Exposure to Potentially Hazardous Materials

Environmental exposure to chemicals or physical hazards through the air, soils, sediments, or ground and surface water is considered within this HEC. The available baseline data are derived from existing studies previously executed by State of Alaska and federal agencies, such as NOA mapping, and from current environmental studies developed as part of the EIS: Soils and Permafrost (Section 3.2.2), Sand and Gravel Resources (Section 3.2.3), Hazardous Waste (Section 3.2.5), Water Resources (Section 3.2.6), Air Quality and Climate (Section 3.2.7), and Acoustical Environment (Noise) (Section 3.2.8) Appendix D contains the relevant 'physical" tables). Baseline data may be qualitative in terms of proximity to known contamination sources (such as NOA), or quantitative through analytical data collection and monitoring.

Physical Hazards

Data available on non-occupational illnesses related to physical hazards, such as radiation, noise, vibration, light or wildlife interactions in the PACs are not available. Life in rural and remote regions in Alaska carry exposure risk to physical hazards, particularly during subsistence activities. Morbidity and mortality associated with physical hazards is generally in the UI data of Section 3.5.2, HEC 2: Accidents and Injuries.

Acoustic Environment (Noise)

Noise is discussed in the EIS (Section 3.2.8) and a brief summary is excerpted from this section. Sounds are considered noise when they have the potential to affect the natural acoustical environment, noise-sensitive receptors (wildlife and people who experience increased sensitivity or exposure to noise during activities), and values. The study area is remote, with a soundscape primarily characterized by natural sounds (such as wildlife, birds, flowing water, and wind). Human-made noise in the study area is intermittent, transitory, and generally concentrated at rivers. Human-made noise sources include off-highway vehicles, snowmobiles, and motorized boats used for subsistence hunting and travel; fixed-wing aircraft and helicopter overflights; aircraft/helicopter and boat activity for recreation and research; and firearms associated with hunting. BLM conducted a Geographic Information System (GIS) examination of the affected environment consisting of a buffered area 2.5 miles from proposed infrastructure.

Material Hazards

ADHSS monitors two pollutants: methyl mercury (through hair samples of pregnant women) and lead exposures.

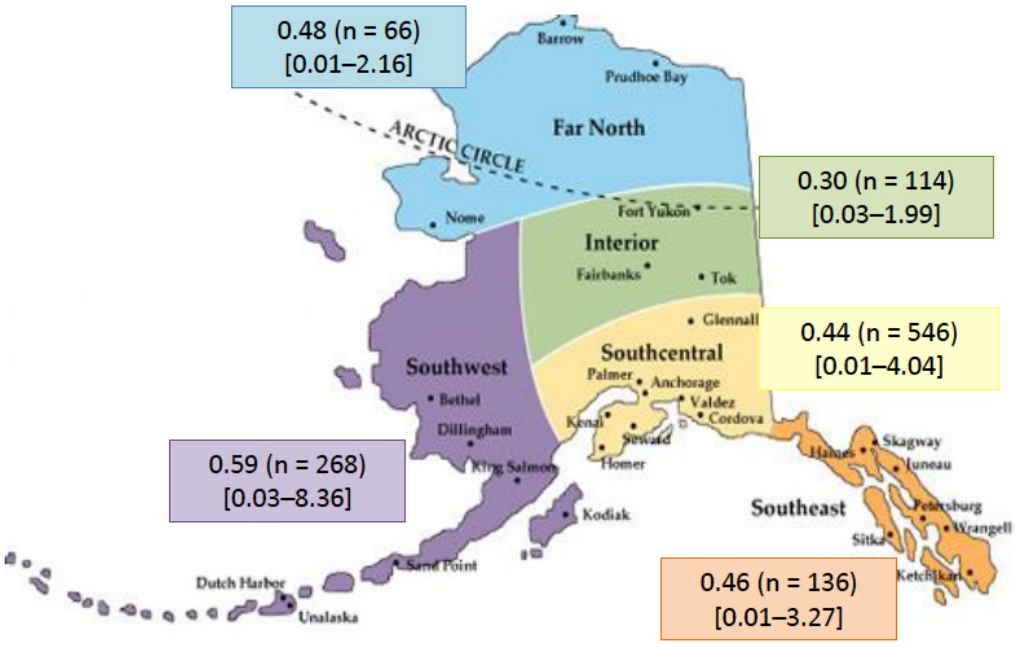
ADHSS Mercury Monitoring Program

People are most commonly exposed to mercury through consumption of fish and marine mammals. In July 2002, the Alaska SOE 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 (women aged 15–45 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 (ADHSS SOE 2010b). Regional distribution of hair mercury results is shown in Figure 19. The total mercury threshold level of concern is 5 parts per million (ppm). As illustrated in Figure 19, baseline mercury levels for the relevant project regions are low and below levels of concern. Fifty-seven percent of women above the 95th percentile hair mercury concentrations were from the Southwest region. Statewide health-based guidelines for specific fish species are established by ADHSS and indicate that salmon and sheefish (critical fish species for local subsistence) can be consumed in unrestricted amounts. Analysis of the AE-baseline for "Fish and Amphibians" is presented in the EIS (Section 3.3.2).

Figure 19. Regional Distribution of Hair Mercury Results (ppm) Among Women of Childbearing Age



Source: Hamade 2014

Alaska Blood Lead Epidemiology and Surveillance Program

Alaska has a comprehensive statewide blood lead surveillance program and targeted screening program to identify and control sources of lead exposure and assist in the medical management of patients with elevated blood lead levels (BLLs).

In Alaska, elevated lead levels are found mostly in adults, usually as a result of mining occupations, casting of lead bullets or fishing weights, or exposure in shooting ranges. Present efforts are being directed towards targeted screening of populations potentially at risk for elevated lead exposures. These include occupational and non-occupational exposures.

In Alaska, follow-up investigations are conducted for children under age 18 when the initial BLL is 5 µg/dL or higher and for adults when the initial BLL is 25 µg/dL or higher. The 2002-2012 surveillance

data for children <18 years old who were tested (1.39 percent) for elevated BLLs for YKCA and NAB were 4.15 percent and 2.58 percent, respectively (ADHSS SOE 2014).

Air Quality

Air quality is discussed in the EIS (Section 3.2.7) and a brief summary is excerpted from this section. The proposed project is in a remote area of the Northern Alaska Intrastate Air Quality Control Region, where there are few pollutant emission sources. The emissions produced are generally localized in residential populated areas and would be expected to be below applicable EPA-approved National Ambient Air Quality Standards. No monitored air pollutants are within the analysis area; therefore, sites nearest the area, in Fairbanks and Denali National Park and Preserve, are used to characterize the baseline. In remote areas like the project area, fugitive dust is a main source of particulate pollution (particulate matter less than 10 microns [PM_{10}] and $PM_{2.5}$) in the atmosphere. Particulate is often a result of wind erosion, natural and human-made (anthropogenic) fires, and vehicle travel on unpaved roads. The particulate mix can contain minerals such as asbestos and silica based on the underlying geology of the area. During the summer, increased particulate loading from forest fires is common.

Air pollution has been shown to increase the risk of or exacerbate several respiratory and cardiac conditions. The elderly, children, and those with underlying health problems are particularly vulnerable to the effects of air pollution.

According to the EPA (2016), tribes in Alaska face unique challenges to protecting air quality and reducing health risks in their communities:

- 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) conducted surveys focused on understanding the demographics, home heating practices, indoor activities, community/outdoor activities, and air quality perceptions in rural Alaska communities over 2 years. 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 (such as snow machines and ATVs).

Water Resources

Water resources are discussed in the EIS (Section 3.2.6) and a brief summary is excerpted from this section. Water resources issues are also relevant to HEC#6 Water and Sanitation and are further discussed in this section of the HIA AE-baseline.

Limited water quality information is available, other than measurements made at the water monitoring stations described in the EIS (Appendix D, Tables 3, 4, and 6). Most streams and lakes within the project area are undisturbed and have little to no human-caused impacts on water quantity. Except for elevated sediment levels in summer due to glacial melting, water quality is generally good to excellent. Due to climatic conditions, surface water and soils are frozen in winter, limiting pollution inputs into streams. Where surface-disturbing activities are or have been occurring, streams experience elevated turbidity during spring snowmelt and rainfall events. The Alaska Department of Environmental Conservation (ADEC) Division of Water maintains a list of impaired waters; none of the waters within the project area appears on that list.

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 (Health factors… 2019). 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 2016, all PACs have at least one drinking water violation.

Soils/Permafrost and Sand/Gravel

Soils/Permafrost and Sand/Gravel resources are discussed in the EIS (Section 3.2.2 and 3.2.3, respectively). In terms of human health, the key consideration is NOA.

Project Specific Hazards—NOA

Alaska has large known deposits of ultramafic and serpentine mineral ore throughout the state containing NOA. Asbestos is the name given by the United States Geological Survey to a group of different fibrous minerals that occur naturally in the environment. Asbestos fibers are microscopic, do not dissolve in water or evaporate, and are resistant to heat, fire, and chemical or biological degradation. Because of these qualities, asbestos has historically been used in many commercial products, including insulation, brake linings, and roofing shingles. Natural weathering and human activities, including road construction activities may disturb NOA-bearing rock or soil and release mineral fibers into the air, which pose a greater potential for human exposure by inhalation.

General Risks from Naturally Occurring Asbestos

Most studies regarding asbestos risk involve occupational settings, where workers are exposed to high levels of purified asbestos in an indoor setting. It is more difficult to identify risks related to exposure to NOA that is intermittent, uncontrolled, and outdoors. However, due to the prevalence of NOA in **some locations** in the Alaska environment, there is the possibility that some undetermined but low-level risk is always present from background concentrations of airborne NOA. According to the Alaska Department of Transportation and Public Facilities (DOT&PF) there are NOA areas in the project area.

A preliminary evaluation of bedrock potential for NOA in Alaska identifies that all alternatives traverse areas of medium potential for NOA and cross large swaths of surficial deposits that are unevaluated for NOA potential (Solie and Athey 2015; EIS Appendix A, Map 3-2 [Asbestos potential]). DOT&PF conducted explorations for suitable material sites in 2004 and 2013 for the Ambler Airport improvements project. Most test sites within surficial deposit areas had measurable concentrations of NOA present.

Studies have also identified NOA in the Ambler Mineral Belt near the confluence of the Kobuk and Shungnak rivers (DOWL 2011). DOT&PF issued a study on available information regarding NOA in Alaska and established interim guidance for the usage of materials with NOA (DOT&PF 2009) that provides additional information.

Human disease from asbestos is most often associated with cumulative, long-term inhalation exposure to airborne asbestos, and the risk of disease increases with increasing exposure concentration and exposure duration as well as the time that elapses since first exposure. In addition to variation in individual susceptibilities found with all such exposures, there are several factors that contribute to a person's risk of contracting an asbestos-related disease, including:

- Higher levels of asbestos fibers in the air;
- The mineral type of fibers and the size of the fibers;
- Higher frequency of exposure;
- Longer duration of exposure; and
- The time that elapses after the start of exposure.

Asbestos fibers may remain in the lungs for a lifetime without causing health-related issues, but in some cases, asbestos fibers can damage the lungs and cause asbestos-related disease, such as asbestosis, mesothelioma, or lung cancer. These diseases do not commonly appear for 20 or more years after the start of exposure. There also are other health considerations that exacerbate the risks associated with asbestos exposure, such as smoking.

NOA in Ambler

In August 2003, DOT&PF visited Ambler to check on the quantity of gravel available for an airport expansion project. As part of their assessment, they collected soil samples to identify whether asbestos was present in the source material. Test results showed the presence of a potentially harmful form of asbestos in the gravel pit—chrysotile at concentrations up to 10 percent.

These results raised concerns in the community over exposure to airborne asbestos from the road dust in particular—there was a concern that individuals using the gravel roads could be exposed to airborne asbestos fibers (ATSDR 2007). Hence, at the request of the Tribal Environmental Department of the Maniilaq Association, ATSDR performed an exposure investigation in the City of Ambler to determine if riding ATVs on gravel roads lead to significant asbestos exposures for riders and pedestrians along the side of the road. Sampling design and methods included the use of personal air samplers attached to ATV riders while riding two ATVs in tandem on a designated section of the airport road. Sampling also included stationary monitors, reference stations, and respirable dust measurements. The findings indicated:

- Dust levels of health concern.
- Asbestos levels of health concern.
- ATV riders trailing another ATV are most exposed.
- Pedestrians are exposed to asbestos and dust levels of health concern.

- Reference sampling indicated airborne asbestos in the community but at a level of risk not likely to be a public health concern.
- Asbestos was found in the gravel supplying the roads in Ambler and is suspected of being the major source of road generated asbestos.

ATSDR had the following recommendations:

- All access to the gravel pit that supplies road gravel should be closed.
- No gravel from the pit should be used on roads.
- Short-term and long-term solutions to road generated dust and asbestos needs to be developed by appropriate federal, state, city, and tribal governments.
- A barrier with clean fill should be put in place where children come into contact with contaminated soil
- Education efforts and material should be developed that target the community and health care workers.

In parallel, Perkins et al. (2008) published a report on a roadway construction project—replacing culverts and bridge abutments and adding surfacing material for approximately 20 miles of gravel road from mileposts 90 to 111 on the Dalton Highway in Alaska. Asbestos in roadway materials was discovered after some of these materials had been installed. Assessment of the situation required: (1) testing the materials used to build the gravel pad that was constructed to support operations and worker housing; (2) evaluating worker exposure by analyzing the settled dust in worker housing and taking breathing zone samples; (3) sampling the installed roadway material and determining its asbestos content; (4) monitoring the work area at the material source and along the roadway; and (5) evaluating asbestos release from the finished roadway. According to Perkins et al. (2008), the two types of asbestos found at milepost 105 were tremolite and actinolite. Tremolite is a calcium-magnesium-iron silicate, which is white to grayish green and often found in ultramafic rocks. Actinolite has a chemical formula that is similar to tremolite, but actinolite has a higher iron-to-magnesium ratio (Perkins et al. 2008).

The Perkins et al. study (2008) demonstrated that evaluating a construction situation where asbestos was discovered after the project was already underway proved quite difficult. Worker exposures from the Dalton Highway reconstruction activities indicated measurable asbestos exposures to road workers. However, concentrations were likely well below the Occupational Safety and Health Agency permissible exposure limit for most tasks associated with constructing roads with asbestos containing gravel. Critically, workers at milepost 105 did not use a rock crusher to make gravel, but if they had done so, their exposure levels would likely have been substantially higher. The study had the following key conclusions:

- Need for heightened concern/vigilance, including:
    - Information about the asbestos potential of the geology should be included in geotechnical reports used in the design process.
    - Test boreholes and testing borehole material for asbestos.
    - Asbestos management control plans including special precautions for high-risk tasks.
    - A quantitative risk assessment for workers and the general population.

Red Dog Mine Experience

Overland ore concentrate transport from the Red Dog Mine in the NAB has historically raised stakeholder concerns regarding potential impacts of fugitive dust on subsistence resources, particularly caribou (Garry et al. 2018). Studies indicated that soils and mosses close to the haul road were impacted from dust and metals from hauling activities (Kerin and Lin 2010). In a later study by different authors, the potential risks associated with subsistence consumption of caribou harvested near the road and mine were investigated. The results of this study demonstrated that dust emissions from Red Dog operations were not a significant source of metals in caribou (Garry et al. 2018).

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 (such as military fuel storage). Baseline source characterization is important so that any potential incremental project contributions can be properly assessed. Contaminant bioaccumulation in subsistence animals is a pathway of particular concern for Alaskans and frequently mentioned at stakeholder meetings. In northern regions, contaminants such as organochlorine pesticides, polychlorinated biphenyl (PCB), and heavy metals are of concern due to their persistence, toxicity, and deposition by global transport. Localized sources of contamination, such as landfills, leaking drums, and abandoned structures, also exist in some areas. While the presence of various contaminants has been documented in Alaskan fish and wildlife, potential risks of these contaminants to wildlife resources, and to the people who rely on those resources for subsistence, are not well understood. The U.S. Fish and Wildlife Service has an Environmental Contaminants Program[1]. Large-scale human bio-monitoring programs for Arctic populations have been performed for potentially persistent organic pollutants(https://www.amap.no). Biological resources data are available in EIS Section 3.3.

Key Points- Potential Exposure to Hazardous Materials

1. NOA is a potentially significant issue.
2. Based on stakeholder comments, “contamination concerns” are significant issues. There are some limited baseline data available for subsistence resources, environmental media, and via limited human biomonitoring.

3.5.4 HEC 4: Food, Nutrition, and Subsistence Activity

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” (https://www.nativefederation.org/subsistence). Detailed analysis of “subsistence” is in Section 3.4.7 and Appendix L of the EIS. The EIS analysis includes detailed mapping of subsistence use areas, timing of subsistence activities, harvest data, and uses of the Western Arctic Herd as a function of individual communities.

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. As noted by Guettabi et al. in a 2016 study for the NPS that evaluated differences in household subsistence harvest patterns between the Ambler project and non-project zones, “Most of the local community economies are

[1] https://www.fws.gov/alaska/pages/cooperative-conservation/environmental-contaminants/environmental-contaminants-program

dominated by subsistence and public sectors (including transfer payments) for employment and income and have attenuated private market sectors" (2016). Hence, fishing and hunting for subsistence resources provide a reliable economic base for PACs. Subsistence is focused toward meeting the self-limiting needs of families and small communities (Wolfe and Walker 1987). 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).

Subsistence is a source of nutrition for residents in an area of Alaska where food prices are high.

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. Alaskan wild berries have a very high oxygen radical absorption capacity (ORAC) (Dinstel et al. 2013). In a 2013 paper, Dinstel et al. documented that Alaska wild berries had 3-5 times higher ORAC value than cultivated berries from the lower 48 states. In addition, hunting, gathering, harvesting, and preserving native foods are energy intensive, providing physical activity.

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

- 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 high-density lipoproteins/low-density lipoproteins (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.

As noted by Guettabi, (2016), "Subsistence food production has been identified as a major source of nutritional requirements in rural Alaska and is reported to meet 189% of the protein requirements and 26% of the caloric requirements of rural population (Fall 2014). Fostering subsistence food production was identified as a key strategy to achieving food security in Alaska."

Table 9 in Appendix L of the EIS, provides average harvest and participation data for all resources for the 28 subsistence study communities. Use of subsistence resources among the study communities is extremely high—on average between 96 and 100 percent of households in the study communities report using subsistence resources on an annual basis, and between 75 and 100 percent of households report participating in subsistence activities. On average, subsistence study communities harvest 576 pounds of subsistence resources (in terms of edible pounds) per capita annually. The highest average harvest is in Tanana, at 2,157 pounds, followed by Huslia (1,082 pounds), Fort Yukon (999 pounds), and Hughes (926 pounds). By percentage, large land mammals and salmon are the top resource harvested in 12 study

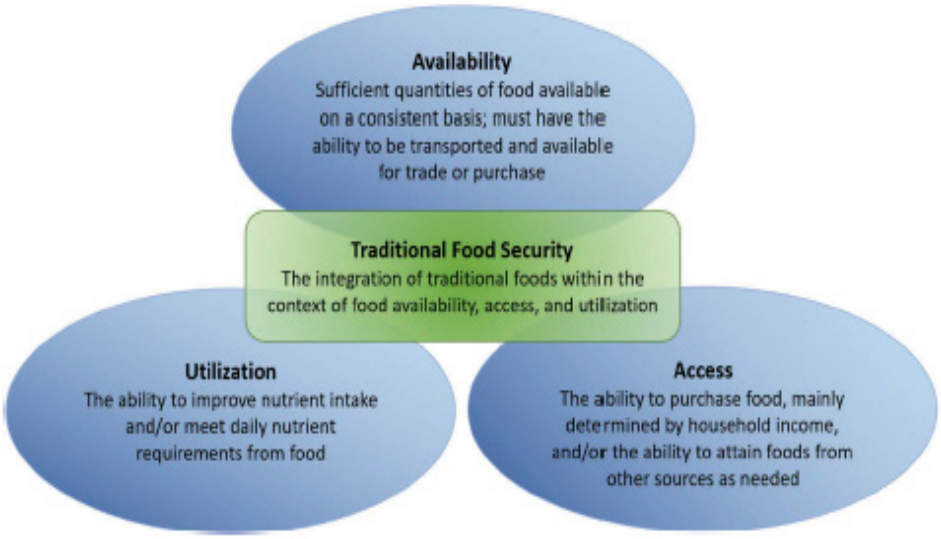
communities. Non-salmon fish is the top harvested resource in two study communities (Selawik and Noorvik). Large land mammals, salmon, and non-salmon fish typically comprise the top three resource categories harvested by most of the study communities, although marine mammals, migratory birds, vegetation, and upland game birds also appear among the top resources for some study communities.

Subsistence use of the Western Arctic Herd is significant. As noted in the EIS (Section 3.4.7), with few exceptions, use of caribou among the 42 study communities is high, with over 50 percent of households in 30 of the 42 study communities using caribou. The contribution of caribou toward the total subsistence harvest is highest in the communities of Anaktuvuk Pass, White Mountain, Ambler, Shungnak, Deering, Koyuk, Noatak, and Buckland. Caribou contributes an average of at least one-third of the total harvest in those communities. On average, caribou contribute approximately 25 percent toward the total harvest for the study communities. Nearly half of households (48 percent) participate in caribou hunting, and residents harvest an average of 101 pounds of caribou annually (see Appendix F, Table 10 of the EIS).

Food Security

Food security means having enough food to fully always meet basic needs. The "pillars" of food security are illustrated in Figure 20.

Figure 20. Pillars of Food Security



Source: Walch et al. 2018

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 model 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 2015, 14 percent of Alaskans statewide were determined as food insecure. The highest percentage of food insecure persons statewide were residents of the YKCA and NAB (22 percent), as shown in Table 27, while the lowest were residents of Anchorage Municipality (12 percent). In Fairbanks North Star

Borough, the percentage was similar to that of Anchorage at 13 percent. This trend is most likely a result of the fact that there are a larger percentage of rural communities in the YKCA and NAB.

"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 (Health factors… 2018). Low income is defined as having an annual family income of less than or equal to 200 percent 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; Taggart 2005; Schafft et al. 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 2015 (the most currently available data) indicated that YKCA had the highest percentage of residents with limited access to healthy foods at 50 percent, more than 5 times the percentage of all Alaskans statewide (see Table 28). The NAB also had a higher percentage than much of the state (34 percent).

"Food environment" is a composite of the percentage of food insecure persons and percentage of persons with limited access to healthy foods (Health factors… 2018). The "food environment index" ranges from 0 (worst) to 10 (best) and equally weights two indicators of the food environment. The YKCA scored lowest on the food environment index (2.1), more than 3 times lower than the overall value for the state as a whole (6.4). The NAB also had a lower food environment index than much of the state (3.5), while the index for Fairbanks North Star Borough was among the highest in the state (7.8). The highest index reported by several urban and semi-urban census areas was 8.2.

Table 28. Percentage of the Population Who Lack Adequate Access to Food by Potentially Affected Area and Alaska Statewide (2015)

Location	No. Persons Food Insecure	Percent of Persons Food Insecure	No. Persons with Limited Access to Healthy Foods	Percentage of Persons with Limited Access to Healthy Foods	Food Environment Index
YKCA	1,260	22%	2,780	50%	2.1
NAB	1,730	22%	2,562	34%	3.5
Fairbanks North Star Borough	12,870	13%	7,101	7%	7.8
Alaska Statewide	ND	14%	ND	9%	6.4

Source: health factors… 2018
ND – Not determined

The "food insecurity" data are consistent with the 2016 Guettabi et al report, which documented that "Over 30% of the surveyed households were considered food insecure in the larger eastern and western project zone communities, with the exception of Shungnak, whose percentage of food insecure households, 14% approached that of Alaska as a whole and the United States."

Food costs

Overall, the cost of living in Rural Alaska is 8 percent 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 (often only one grocery or convenience store present per community). Cost of living issues for PACs are discussed in the EIS (Socioeconomics and Communities Section 3.4.5). Guettabi et al (2016) also present an analysis of food costs including a monetization calculation for subsistence communities.

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 (BRFSS 2019; AN EpiCenter 2018). Fruits include 100 percent 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 2010). In 2017, the percentage of Alaskans meeting the recommended standard of consuming at least 2 cups of fruit and 3 cups of vegetable per day was low at 11.6 percent. The percentage of all Alaskans living in the YKCA (7.6 percent) reporting consuming the standard of fruits and vegetables was nearly half that of those in Fairbanks North Star Borough (13.9 percent), as shown in Table 29, which was greater than for the state overall. The percentage of Alaska Natives in the Interior Tribal Health Region between 2012 and 2016 was lower than for Alaska Natives statewide. There was no data available for any Alaskans living in the NAB regarding fruit and vegetable consumption.

Table 29. Fruit and Vegetable Consumption (2+ Fruits and 3+ Vegetables per Day) by Potentially Affected Area

Borough/Census Area	Percentage All Alaskan Adults (2017)	Tribal Health Region	Percentage of Alaska Native Adults (N) (2012–2016)
YKCA	7.6%	Interior	12.4% (30)
NAB	-	Northwest Arctic	-
Fairbanks North Star Borough	13.9%	NA	NA
State of Alaska	11.6%	NA	16.3% (183)

Source: AN EpiCenter 2018; AK-IBIS 2019
NA = Not applicable
- = Data not available

Micronutrient Deficiencies

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 2001-2010 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 SOE 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.

Key Points- Food, Nutrition, and Subsistence

1. Subsistence is a fundamental characteristic of PACs.
2. Subsistence harvesting activities across all PACs are extremely high and are nutritionally essential for individuals and communities.
3. Food insecurity is a significant problem across PACs.

3.5.5 HEC 5: Infectious Diseases including STIs

Reportable communicable diseases include communicable infectious, vector-borne/parasitic diseases, such as tuberculosis (TB), influenza, pneumonia, septicemia, viral encephalitis, viral hepatitis, and HIV and other STIs (Chlamydia, gonorrhea, and syphilis). 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.

Non-reportable infectious diseases include human papilloma virus (HPV) (an STI) and *Helicobacter pylori. H pylori* is a bacterium associated with inflammation and ulcers of the stomach and intestinal lining. *H. pylori* infection is common in developing countries with poor sanitation and has been found to be highly prevalent in rural Alaska with the presence of antibodies against *H. pylori* at almost 70 percent (Miernyk et al. 2018). Socioeconomic and environmental factors, crowding, and drinking water that was not piped or delivered were found to be associated with *H. pylori* positivity (Miernyk et al. 2018).

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).

During 2011-2013, reportable communicable diseases were not among the leading causes of death for any PAC. Of infectious and parasitic diseases, “septicemia” was the most common cause of death due to infectious and parasitic disease in all areas as well as statewide (see Table 30). TB, HIV, and hepatitis are significant communicable diseases at the state level; however, caseloads at the borough/area are small. Alaska Native TB rates in 2017 (statewide data) were approximately 36 times higher than Alaskan whites and four times higher than the all races, statewide TB incidence rate per 100,000 (ADHSS SOE 2018c).

Viral hepatitis was the second most common cause in the Fairbanks North Star Borough and statewide. Hepatitis C (a reportable disease in Alaska) is a significant issue as state-wide rates over the 2000-2017

time period have significantly increased—from 722 reported cases in 2000 to 1,214 cases in 2017[1]. Most people become infected with the Hepatitis C virus by sharing needles or other equipment to inject drugs. For most boroughs/areas, mortality rate due to influenza and pneumonia was higher than the rate for infectious and parasitic diseases.

Table 30. Deaths due to Reportable Communicable Diseases by Potentially Affected Area and Alaska Statewide (2011-2013)

Disease	YKCA Deaths (Age Adjusted Rate)	NAB Deaths (Age Adjusted Rate)	Fairbanks North Star Borough Deaths (Age Adjusted Rate)	Alaska Statewide Deaths (Age Adjusted Rate)
Infectious and Parasitic Disease	5 (**)	8 (61.4)	23 (9.8)	268 (14.8)
TB	0 (0)	2 (**)	0 (0)	8 (4*)
Septicemia	5 (**)	3 (0)	12 (5.3)	115 (7.2)
Viral Hepatitis	0 (0)	0 (0)	6 (1.8*)	68 (2.5)
HIV Disease	0 (0)	0 (**)	1 (**)	19 (8*)
All Other Infectious Diseases	0 (0)	3 (**)	1 (**)	58 (3.7)
Influenza and Pneumonia	6 (46.4*)	1 (0)	21 (12.1*)	176 (12.1)
Influenza	0 (0)	0 (0)	3 (**)	11 (5*)
Pneumonia	6 (46.4*)	1 (**)	18 (11.1*)	165

Source: Alaska Bureau of Health Analytics and Vital Statistics 2019
[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.

Sexually Transmitted Infections (STIs)

STIs reported include HIV, chlamydia, gonorrhea, and syphilis.

HIV

HIV and AIDS are reportable conditions in Alaska. From January 1, 1982 through December 31, 2018, 1,890 cases of HIV were reported to SOE. Of these reported cases:

- 1,239 (66 percent) were initially diagnosed in Alaska;
- 1,232 (65 percent) are not known to have died, 699 (57 percent) of whom are currently living in Alaska; and
- 1,228 (65 percent) ever had a diagnosis of AIDS.

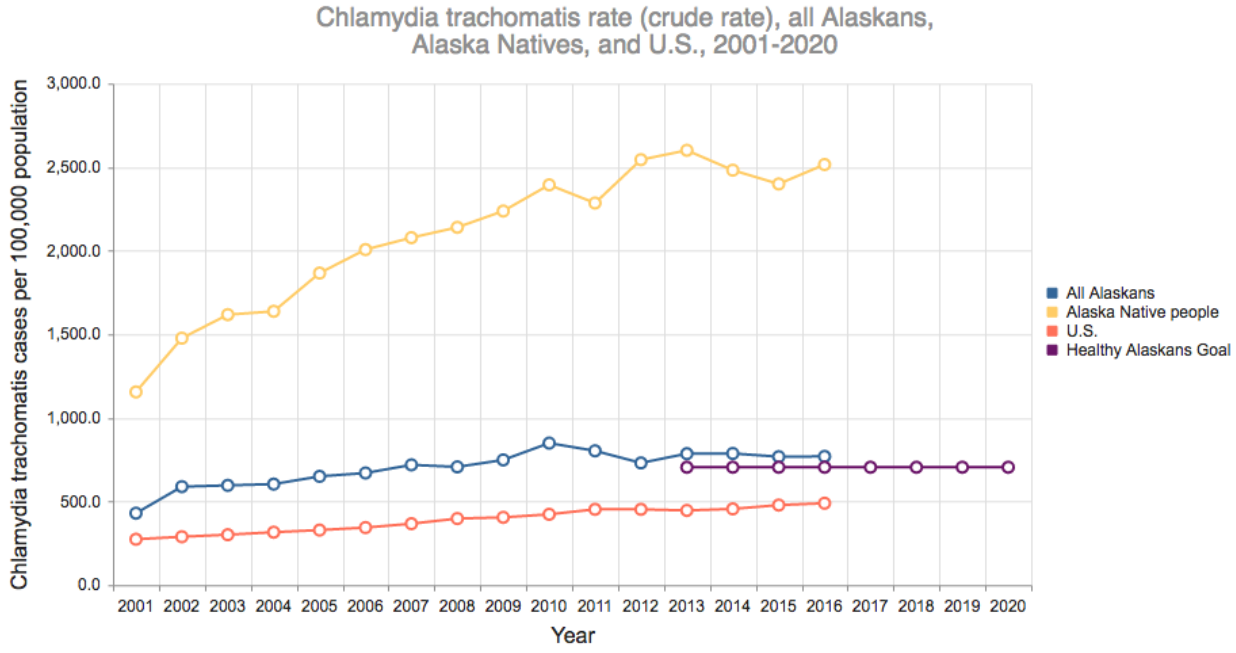
During 2018, 58 cases of HIV infection were reported to ADHSS SOE; of which, 22 (38 percent) were newly diagnosed in Alaska, yielding a statewide incidence of 3 cases per 100,000 persons. In 2018, there were two cases of HIV first diagnosed in the Interior Public Health Region and one in the Northern Public Health Regions (ADHSS SOE 2019b).

[1] http://dhss.alaska.gov/dph/Epi/id/Pages/hepatitis/cases.aspx

Chlamydia

Chlamydia trachomatis (CT) infection is the most commonly reported bacterial STI in the U.S. and in Alaska. Chlamydia is known as a "silent" infection because most infected people have no symptoms. An untreated CT infection can cause pre-term labor, pelvic inflammatory disease, 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 (Alaska Department of Health and Social Services 2011a). 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 2019), as shown in Figure 21. In 2017, 5,938 cases of CT were reported to ADHSS SOE yielding an annual incidence rate of 806 cases per 100,000 persons, which represents a 5-percent increase from 2016. Of 2,496 specimens that tested positive for CT at the State Public Health Laboratory and the Alaska Native Medical Center Laboratory in 2017, 362 (15 percent) also tested positive for *Neisseria gonorrhea.* Of all CT cases 4,589 (78 percent) were in persons aged <29 years, with the highest rate occurring in persons aged 20–24 years at 4,166 cases per 100,000 persons. The majority of cases occurred among women (66 percent).

Figure 21. Chlamydia Trachomatis Crude Rate, All Alaskans, Alaska Natives, and US (2001-2020)



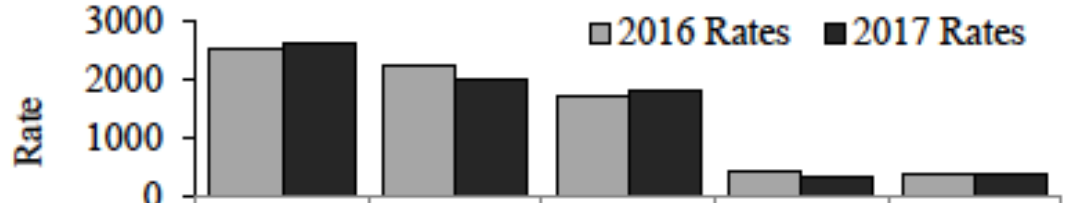
Source: AK-IBIS 2019

Rates by race were highest among non-Hispanic American Indian Alaska Native people (AI/AN), Native Hawaiian Pacific Islanders (NH/PI), and Black persons, respectively, as shown in Figure 22 (ADHSS 2018a). Chlamydia rates vary by tribal health region. In 2015, the rate of CT in the NAB (2,856 per 100,000) was almost twice the statewide rate (1,654 per 100,000), while the rate in the Interior was similar to the statewide rate of CT at 1,838 per 100,000 (AN EpiCenter 2017a), as shown in Table 31.

To address the elevated rates of Chlamydia in Alaska, several partners in state have sponsored expedited partner therapy to promote safe sexual behavior (ADHSS SOE 2011). The SOE regularly warns health

care providers to be alert for risks for and symptoms of STIs and to provide testing and prompt reporting of any outbreaks.

Figure 22. Chlamydia Infection Rate per 100,000 Persons, by Race and Ethnicity — Alaska, 2016 and 2017*



	AI/AN	NH/PI	Black	Asian	White
2016 Rates	2516	2240	1695	402	358
2017 Rates	2629	2014	1804	332	346

Source: ADHSS SOE 2018b
*Note: 430 cases in 2017 and 8 cases in 2016 were of unknown race and are not included in this figure.

Table 31. Age-Adjusted Alaska Native Chlamydia Incidence Rates per 100,000 by Potentially Affected Native Health Corporation Region and Statewide (2015)

Tribal Health Region	Number	Rate
Northwest Arctic	218	2,856
Interior	245	1,838
Statewide	2,633	1,654

Source: AN Epi Center 2017a

Gonorrhea

Gonorrhea (GC) is an STI caused by the bacterium *Neisseria Gonorrhea*. In 2017, Alaska experienced an outbreak with preliminary data indicating the State's rate was the second highest in the nation (ADHSS SOE 2018a). Untreated GC can result in pelvic inflammatory disease, 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. In 2017, there were 2,190 GC cases statewide at an incidence rate of 297 cases per 100,000 persons, representing a 51 percent increase from 2016. The majority of cases occurred among persons aged ≤29 years (58 percent) and half were females (50 percent). The highest GC rate occurred among non-Hispanic American Indian/Alaska Native persons, blacks, and Native Hawaiian/Pacific Islanders (1,126, 1,024, 519 per 100,000, respectively). In 2015, the Interior Tribal Health Corporation Region had a GC rate exceeding that of the State and the NAB, as shown in Table 32.

Table 32. Age-Adjusted Alaska Native Gonorrhea Incidence Rates per 100,000 by Potentially Affected Native Health Corporation Region (2015)

Tribal Health Region	Number	Rate
Northwest Arctic	32	488
Interior	94	745
Statewide	644	510

Source: AN Epi Center 2017c

Syphilis

During 2018, 114 cases of syphilis were reported to SOE, representing a 293-percent increase over 2017 (ADHSS SOE 2019d). Syphilis is an important issue as it may promote HIV acquisition and transmission. In addition, HIV infections may alter the response to syphilis treatment (ADHSS SOE 2019d). Eighty-five percent of the reported cases were living in urban communities (Anchorage/Mat-Su, Juneau, or Fairbanks).

Vector-Borne and Zoonotic Diseases

This section discusses the reported vector-borne and zoonotic diseases.

Vector-Borne Diseases

Alaska is potentially vulnerable to vector-borne diseases including, dengue (mosquito-borne) and Lyme disease (tickborne)[1]. Alaska has reported confirmed cases of dengue; however, these cases are almost always due to individuals who became infected while traveling to endemic countries, and developed symptoms after returning home. At present Alaska is not known to harbor the dengue vector, *Aedes aegypti.*

Alaska is home to six native tick species, or ticks that have historically been found in the state. Several non-native (or invasive) and medically important tick species have been found in Alaska on animals or on people who have traveled from out of state. A total of 117 cases of confirmed Lyme disease have been reported in Alaska over 2000-2016; however, persons who are diagnosed with these diseases have contracted them from exposures while traveling out of state. Tularemia occurs sporadically in Alaska, and humans can become infected from a tick bite and through direct contact with an infected animal[2].

Zoonotic Diseases

For more than 40 years, CDC's Arctic Investigations Program (AIP) has collaborated with ANTHC, ADHSS, and other partners to evaluate infectious disease threats including zoonotic diseases. Zoonotic diseases are infections that can be transmitted from animals to human. Hence, AIP and ANTHC have formed a "One Health" working group to better understand and respond to issues at the interface of human, animal, and environmental health. The "One Health" approach is a global strategy that recognizes that 6 out of every 10 infectious diseases in humans are spread from animals. Known zoonotic diseases that occur in Alaska include brucellosis, toxoplasmosis, trichinellosis, giardiasis/cryptosporidiosis, echinococcosis, rabies, and tularemia (Hueffer et al. 2013).

Climate and weather can impact the distribution and risk of many helminthic, bacterial, viral, and protozoan parasitic diseases as well as insect and ectoparasitic vectors (Hueffer et al. 2013); for example, intestinal giardiasis, which can be transmitted from beavers and may be moving northward in Alaska (CDC AIP 2016).

Foodborne Illness

Foodborne illnesses reported are botulism and trichinellosis.

Botulism

Between 2004 and 2008, the Alaska SOE investigated 36 outbreaks of foodborne illness from all regions of the state (ADHSS SOE 2010a). At least 366 persons were affected by these outbreaks, which were

[1] https://www.cdc.gov/ncezid/dvbd/vital-signs/pdfs/State-Profile-AK-P.pdf
[2] http://dhss.alaska.gov/dph/Epi/id/Pages/Tickborne.aspx

caused by a wide variety of pathogens or toxins; the causative agents were identified in 92 percent of outbreaks, and ingestion of pre-formed toxin from *Clostridium botulinum* (or botulism) caused over half (20/36) of the outbreaks. The bacteria that make botulinum toxin, *Clostridium botulinum*, are naturally occurring and found ubiquitously in the environment. During 1950–2017, all Alaska foodborne botulism cases, for which a food source was identified, occurred following consumption of traditionally prepared Alaska Native foods (ADHSS SOE 2019a).

Trichinellosis

Trichinellosis is a parasitic disease that occurs following consumption of raw or undercooked meat infected with *Trichinella* larvae. In the Arctic, *Trichinella* is found in carnivores such as bears, wolves, foxes, lynx, coyotes, walruses, and seals. Herbivores also occasionally become infected after accidentally ingesting meat (ADHSS SOE 2015a). During 2005–2014, SOE received reports of 17 trichinellosis cases from nine outbreaks. The incidence of trichinellosis was >40 times higher in Alaska than in the U.S. overall (4.1 versus 0.1 cases per 1 million population, respectively) (ADHSS SOE 2015a). During July 2016–May 2017, the Alaska SOE investigated two outbreaks of trichinellosis in the Norton Sound region associated with consumption of raw or undercooked walrus (*Odobenus rosmarus*) meat; five cases were identified in each of the two outbreaks (Springer et al. 2017).

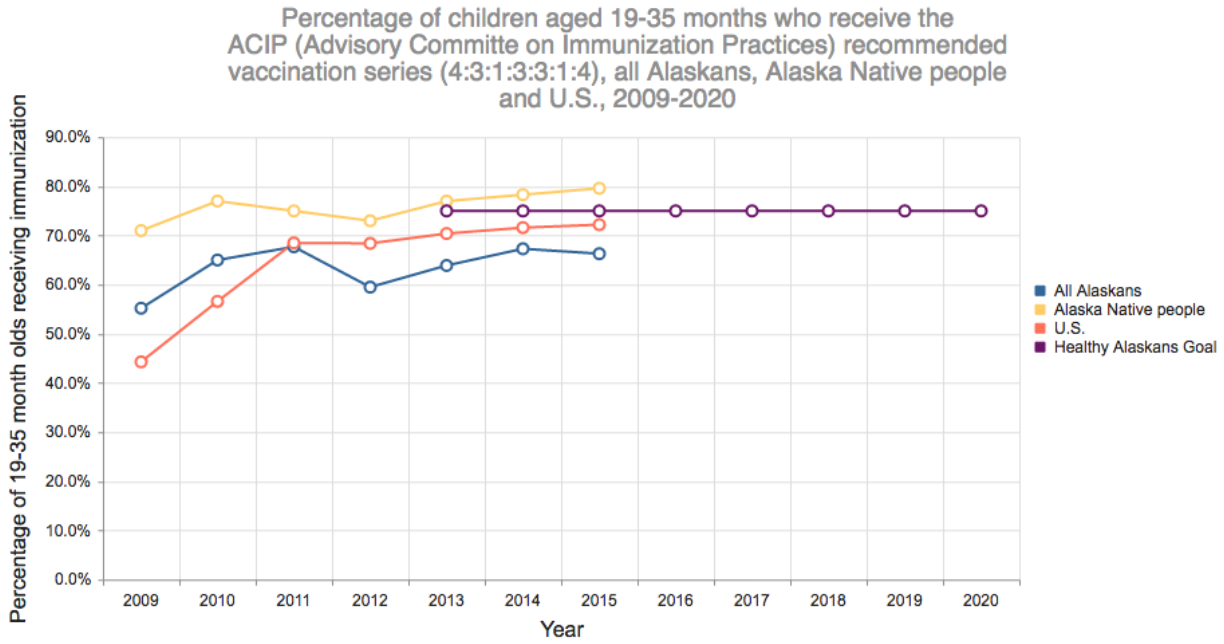
Immunizations

Immunization rates (greater than 80 percent coverage) for both children and adults are a critical community health population level performance indicator. Herd immunity or community immunity is defined as resistance to the spread of a contagious disease within a population that results if a sufficiently high proportion of individuals are immune to the disease, especially through vaccination. The level of vaccination needed to achieve herd immunity varies by disease but ranges from 83 to 94 percent.

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. As described previously, sufficient immunization rates are critical for reaching herd immunity, thus preventing outbreaks of vaccine preventable diseases.

In 2015, 66.3 percent of all 19-35-month-olds statewide had received the recommended vaccination series, falling short of the HA2020 goal of 75 percent (see Figure 23). The rate among Alaska Natives, however, exceeded the HA2020 goal in 2015 at 79.6 percent, as well as the national rate (72.2 percent).

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



Source: AK-IBIS 2019

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 (National Institute of Allergy and Infectious Diseases 2011). In 2013, pneumonia was the most common cause of death due to a reportable infectious disease in YKCA, Fairbanks North Star Borough, and statewide (see Table 30). In 2017, 70.9 percent of Alaskans over 65 years of age statewide had received the pneumococcal vaccine (see Table 32). The highest vaccine coverage occurred in Fairbanks North Star Borough (77.1 percent). Data for the NAB and YKCA were not available (see table footnote for Table 33). In 2017, 33.4 percent of Alaskan adults statewide had received the influenza vaccine. The highest influenza coverage occurred among Alaska Natives living in YKCA (43 percent).

Table 33. Vaccination Rates by Potentially Affected Area (2017)

Age Groups	YKCA	NAB	Fairbanks North Star Borough	Alaska Statewide
Percent of all Alaskans over 18 who had received influenza vaccine	38.2%	*	30.8%	33.4%
Percent of Alaska Natives over 18 who had received influenza vaccine	43%	*	*	35.7%
Percent of all Alaskans over 65 who had received pneumococcal vaccine	*	*	77.1%	70.9%
Percent Alaskan Natives over 65 who had received pneumococcal vaccine	*	*	*	76.8%

Source: AK-IBIS 2019

* The estimate, confidence interval, and number of responses have been suppressed in accordance with the surveillance system's data dissemination policy. Data are suppressed for the following reasons: (1) the number of responses (numerator) is very small and not appropriate for publication and/or (2) the sample size (denominator) is very small and not appropriate for publication.

Key Points- Infectious Diseases

1. Infectious diseases are still an important morbidity and mortality concern for Alaska, particularly STIs.
2. Rates of the GC and CT are extremely high for Alaska Natives. Increases in syphilis are also documented.
3. The caseload for HIV in the project related boroughs/areas is small.
4. Vector borne and zoonotic disease risks are potentially increasing due to climate and weather pattern changes.
5. Foodborne illness outbreaks are well documented involving subsistence foods.

3.5.6 HEC 6: Water and Sanitation

The lack of clean running water and proper sewage disposal is a leading cause of preventable disease in rural Alaska villages. Water resources and quality are discussed in the EIS (Section 3.2.6) and HEC#3 Exposure to Potentially Hazardous Materials. Formal, systematic sanitation survey data are not available for the PACs.

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 percent 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 percent 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 percent of homes are served by a piped, septic tank and well, or covered haul system. An “unserved” community is one in which 55 percent or less of homes are served by a piped, septic and well, or covered haul system (Alaska water… 2019). 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 over 3,300 year-round occupied rural Alaska homes that lack running water and a flush toilet (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 (Alaska water… 2019):

- **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 (such as 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.

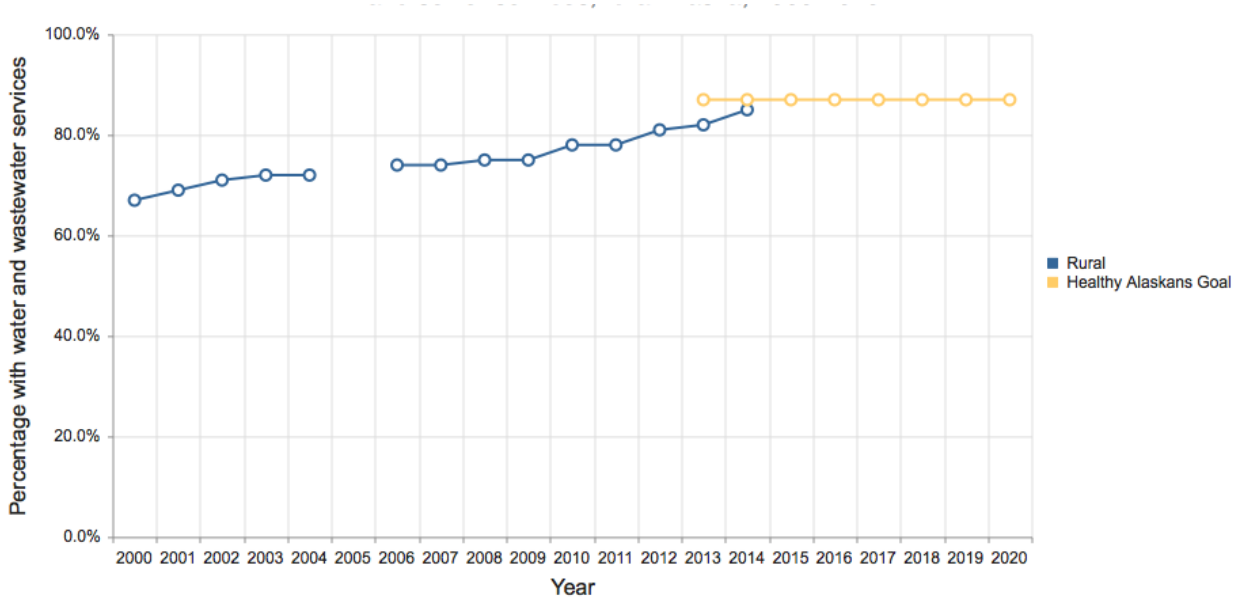
More than 700 homes are served by operation-intensive haul systems. There are approximately 4,500 rural homes connected to community-wide piped systems that have surpassed or are nearing the end of their design life. The ADEC Division of Water recognizes that conventional, community-wide piped systems and truck haul systems are increasingly expensive to construct, maintain, and replace (Alaska water… 2019). 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 percent of total monthly household income in many villages (as compared to 1–2 percent 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 (Alaska water… 2019).

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.

Water and Sanitation Facilities and Services within PACs

Despite major improvements in recent decades, Alaska still lags behind other states in having basic sanitation services. In 2014, 85.0 percent of rural community housing units statewide had water and sewer services, falling short of the HA2020 goal of 87.0 percent (see Figure 24). Water and sanitation services information by PAC is available at https://dec.alaska.gov/Applications/Water/OpCert/Home.aspx?p=Home.

Figure 24. Percentage of Rural Community Housing Units with Water and Sewer Services, Rural Alaska (2000-2020)



Source: AK-IBIS 2019

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 U.S. Department of Health and Human Services recommends an optimal water fluoridation concentration of water fluoridation concentration of 0.7 mg/L.

The CDC recognizes community water fluoridation as one of 10 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 (ibis.dhss.alaska.gov). Research suggests that water fluoridation reduces tooth decay by approximately 25 percent 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 2017, 42 percent of all Alaskans were served by community water systems with optimally fluoridated water, falling short of the HA2020 goal of 58.0 percent (AK-IBIS 2019). In 2014, 74.4 percent of the U.S. population was served by community water systems with optimally fluoridated water.

Key Points- Water and Sanitation

1. The status of PAC water and sanitation services is likely suboptimal; however, detailed data by village are not available.
2. General environmental water quality appears adequate.

3.5.7 HEC 7: Non-Communicable and Chronic Diseases

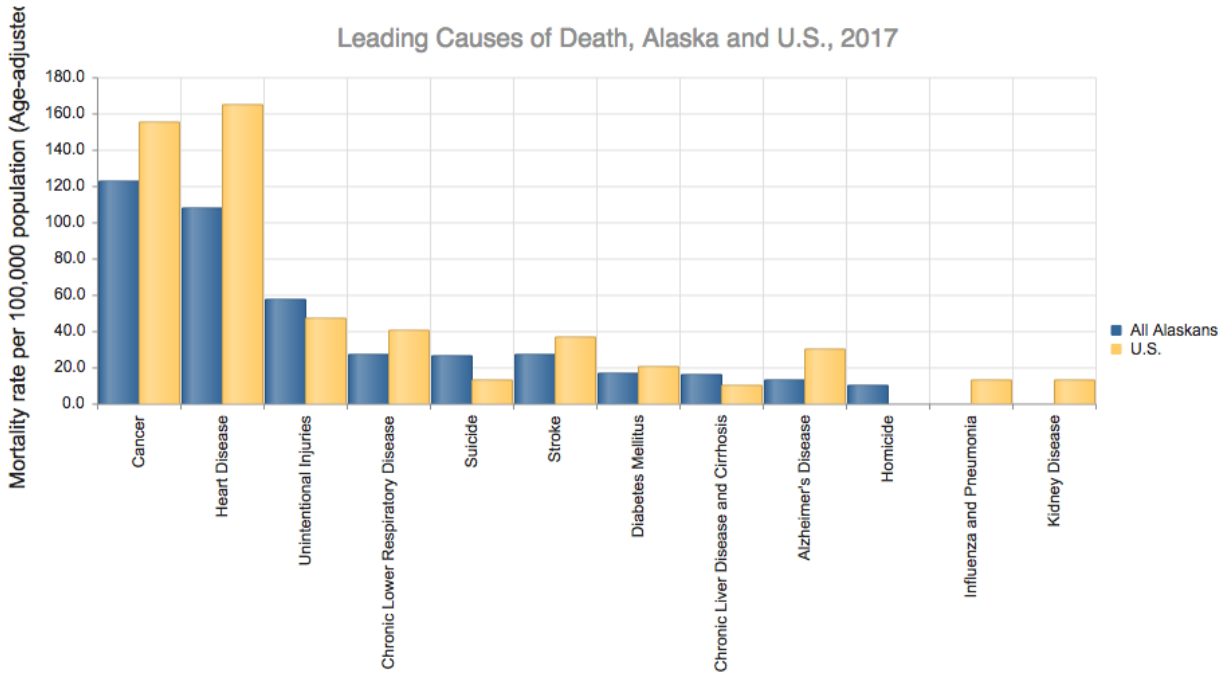
The non-communicable disease (NCD) HEC considers outcomes and determinants related to chronic disease.

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. HEC#1 presented a detailed discussion related to tobacco, alcohol, and drug usage across the project-relevant public health regions.

Outcomes

As show in Figure 25, two NCDs, cancer and heart disease, are the leading causes of death for both Alaskans and the U.S. as a whole.

Figure 25. Leading Causes of Death, Alaska and the U.S. (2017)

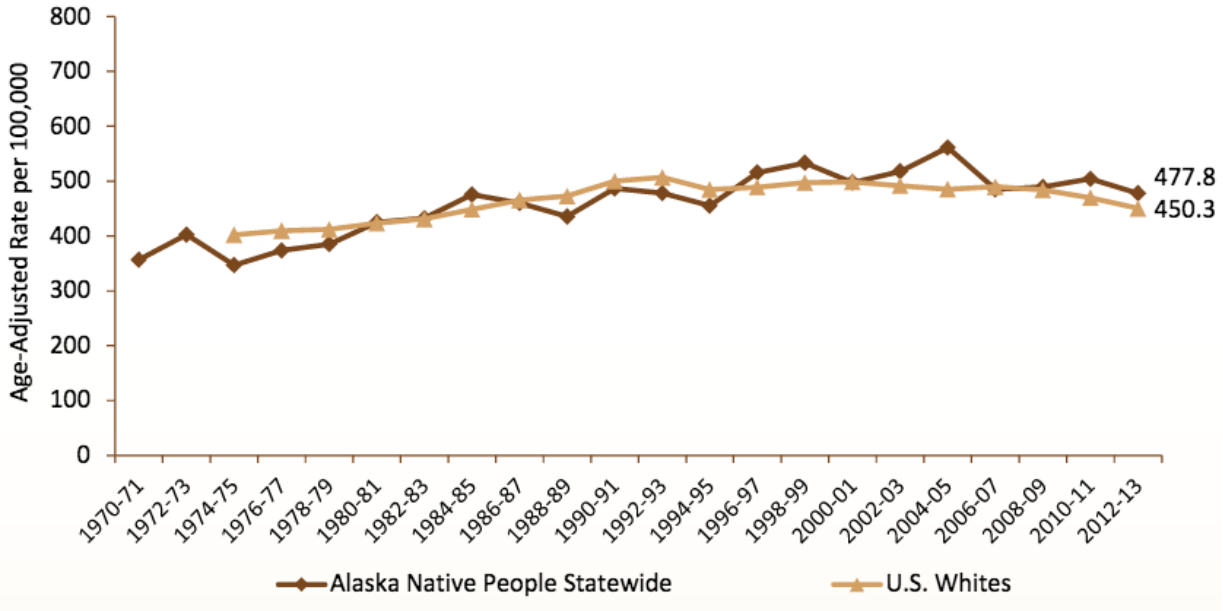


Source: AK-IBIS 2019

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 U.S. whites nationally during 2012-2013 (see Figure 26). 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 Native people. In 2017, the cancer mortality rate among all Alaskans was 136.2, while for Alaska Natives the rate was 209.0 per 100,000 population (AK-IBIS 2019).

Figure 26. Trends in Cancer Incidence Rates per 100,000 Population (1970-1971 to 2012-2013)



Source: AN EpiCenter 2015

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. (Non-small cell… 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 (Non-small cell… 2016).

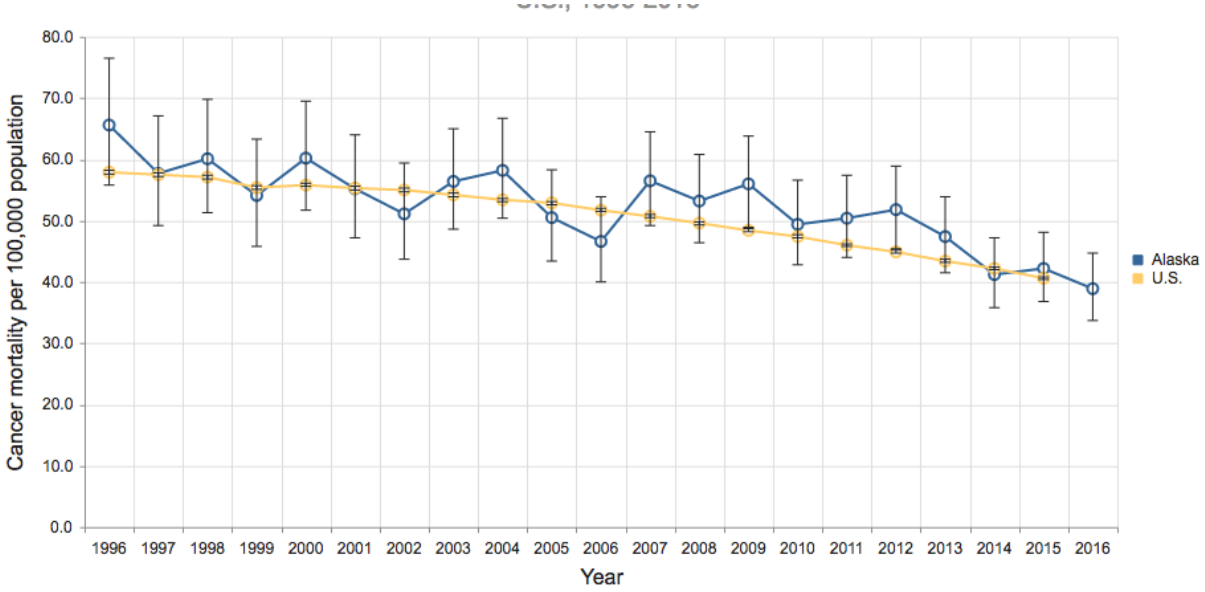
Cigarette smoking is the largest risk factor for lung cancer, followed by cigar and pipe smoking and accounts for approximately 80 percent of lung cancer deaths. Chronic exposure to secondhand smoke will increase a non-smoker's chance of developing lung cancer by 20-30 percent. Other risk factors for 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 (Non-small cell… 2016).

Between 2011-2013 the YKCA (229.4 per 100,000 population) had the highest rate of deaths due to malignant neoplasms among PACs, exceeding the Alaska statewide rate by more than 25 percent (168.1 per 100,000) (see Table 34). Among all regions, the highest death rate due to a specific cancer type was trachea, bronchus, and lung cancer.

Alaska had consistently higher mortality rates of lung cancer than the U.S. overall until recently. In 2016, Alaska's lung cancer incidence rate was 38.9 per 100,000 population compared with the national rate of 40.4 in 2015 (see Figure 27). 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 2019). 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 2015, the incidence rates of lung cancer across the key boroughs/areas were slightly lower than the overall state incidence (68.9 per 100,000). The Fairbanks North Star Borough had the highest (66.2 per 100,000), followed by the YKCA (65.2 per 100,000), and the NAB (62.2 per 100,000) (AK-IBIS 2019). During this time period, Alaska Natives had a higher incidence rate of lung cancer than any other race statewide at 92.8 per 100,000 population, compared to 66.4 for whites, 62.4 for blacks, and 44.9 for Asians/Pacific Islanders.

Figure 27. Lung Cancer Mortality Rate (Age-Adjusted), Alaska and U.S. (1996-2016)



Source: AK-IBIS 2019

Breast Cancer

Excluding basal and squamous cell skin cancers, breast cancer is the most common cancer among U.S. women (AK-IBIS 2019). 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 (What are… 2014). Until recently, Alaska had consistently had higher rates of breast cancer than the U.S. In 2015, Alaska's breast cancer rate was 122.0 per 100,000 females compared with the U.S. rate of 123.9.

Female breast cancer ranked first for the number of cancer incidence cases in Alaska between 2010 and 2014 (15.6 percent of cancers with 2,109 cases) (Alaska Cancer Registry 2017). Similar to the U.S. overall, breast cancer incidence in Alaska has remained relatively stable over the past decade. Among key project-related boroughs/areas, the lowest incidence of breast cancer occurred in the NAB (84.5 per 100,00 females) between 1996-2015. Fairbanks North Star Borough (132.9 per 100,000 females) and YKCA (117.0) had incidence rates that were closer to the statewide rate (AK-IBIS 2019). The statewide incidence was 131.9. Asians/Pacific Islanders had a lower incidence rate of breast cancer than any other race at 83.7 per 100,000 females, compared to 139.1 for Alaska Natives, 132.9 for whites, and 123.4 for blacks statewide. During 2011-2013, the breast cancer mortality rate was 18.6 per 100,000 women in Alaska (see Table 34). Among potentially affected areas, the Fairbanks North Star Borough had the

highest breast cancer mortality rate at 16.2 per 100,000 women. Census area data, however, should be interpreted with caution because the rates are statistically unstable because they are based on fewer than 20 occurrences.

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 9 men (11 percent) 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 2019). Prostate cancer ranked first among incident cancers for men between 2010 and 2014, statewide (Alaska Cancer Registry 2017).

For key project-related boroughs/areas, the NAB had the lowest incidence of prostate cancer during 1996-2015 with a rate of 45.5. per 100,000 males (AK-IBIS 2019). In comparison, the statewide rate was more than twice this value at 128.5 per 100,000 males, which was similar to the incidence rate in Fairbanks North Star Borough (134.6). The incidence of prostate cancer in YKCA was 108.9 per 100,000 men.

Prostate cancer incidence is strongly correlated with race. Between 1996 and 2015, blacks had a much higher rate than any other race in Alaska at 216.6 per 100,000 males, compared to 136.6 for whites, 96.6 for Asian/Pacific Islanders, and Alaska Natives had the lowest rate at 68.9 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 (see Table 34). The cancer mortality rate for the Fairbanks North Star Borough was similar to that for Alaska overall. It should be noted, however, that this rate was based on fewer than 8 occurrences and is therefore statistically unstable.

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 22 (4.5 percent) for men and 1 in 24 for women (4.2percent) (AK-IBIS 2019). Important risk factors for colorectal cancer include old age (approximately 90 percent 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 (Colorectal cancer… 2015).

Colorectal cancer ranked third in Alaska for the number of cancer incident cases during 2010-2014 (9.8 percent of all cancers with 1,327 cases) (Alaska Cancer Registry 2017). Rates of colorectal cancer in Alaska and the U.S. have declined over the past decade. In 2014, the incidence of colorectal cancer was similar for all Alaskans (42.8 per 100,000 population) and the U.S. (38.5 per 100,000 population) (AK-IBIS 2019). 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 2015, the colorectal cancer incidence rate for men was 47.0 per 100,000 males, as compared to 37.4 per 100,000 females.

Between 1996 and 2015, the YKCA (102.2 per 100,000) had the highest rate of colorectal cancer among key project-related boroughs/areas with an incidence more than twice that of Alaska statewide (49.9). The incidence rate was also higher in the NAB (96.3 per 100,000) compared to the state, as well as the Fairbanks North Star Borough (46.0) (AK-IBIS 2019). During this same time period, Alaska Natives had a much higher incidence rate of colorectal cancer than any other race at 96.3 per 100,000 population, compared to 45.9 for blacks, 42.8 for whites, and 32.7 for Asians/Pacific Islanders (AK-IBIS 2019). 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 (Cancer stat… 2016).

Between 2011 and 2013, colorectal cancer mortality rates were among the highest for all key project-related boroughs/areas and in many cases, were the second leading rate of cancer death after lung cancer (see Table 34).

Table 34. Cancer Deaths by Type and PAC (2011-2013)

Cancer Type	YKCA Deaths (Age Adjusted Rate)	NAB Deaths (Age Adjusted Rate)	Fairbanks North Star Borough Deaths (Age Adjusted Rate)	Alaska Statewide Deaths (Age Adjusted Rate)
Malignant Neoplasms	37 (229.4)	30 (213.3)	322 (169.1)	2,873 (168.2)
Colon, rectum and anus	4 (**)	5 (**)	26 (12.6)	261 (15.0)
Liver and intrahepatic bile ducts	0 (0)	2 (**)	11 (5.6*)	129 (6.2)
Trachea, bronchus, lung	8 (52.2*)	8 (69.1*)	94 (51.2)	797 (47.8)
Breast[b]	2 (**)	1 (**)	16 (15.3*)	176 (18.6)
Prostate[b]	1 (**)	1 (**)	8 (13.9*)	114 (18.2)
Lymphoid & hematopoietic	4 (**)	1 (**)	34 (20.6)	236 (15.3)
Non-Hodgkin's lymphoma	3 (**)	1 (**)	13 (7.9*)	85 (5.5)
Leukemia	1 (**)	1 (**)	12 (6.7*)	90 (5.3)
All other lymphoid & hematopoietic	0 (0)	0 (0)	9 (6.0*)	61 (3.8)
All other malignant neoplasms	18 (107.6)	6 (30.7*)	133 (65.4)	1,160 (66.3)

Source: Alaska Bureau of Health Analytics and Vital Statistics 2019
[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

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 (such as tobacco use, physical inactivity, and improper nutrition), health status (such as hypertension, hyperlipidemia, overweight, or diabetes), and policies (such as smoking policies in restaurants and worksites) (Fryar et al. 2012). Substantial differences in

CHD death rates and preventive measures exist by race, age, sex, place of residence, and other demographic factors (Mozaffarian et al. 2015).

Heart disease mortality in Alaska declined between 2000 (213.1 deaths per 100,000 people) and 2017 (133.4 deaths per 100,000) (AK-IBIS 2019). In 2017, statewide rates of heart disease mortality were higher in males (172.0 per 100,000) than females (97.6 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 (218.6 per 100,000) than all Alaskans (133.4) in 2017 (AK-IBIS 2019). Between 2012 and 2015, Alaska Native residents of the Interior (166.0 per 100,000) and NAB (186.6) had heart disease mortality rates below the statewide rate (208.2) for all Alaska Natives (see Table 35).

Among key project-related boroughs/areas, YKCA had the highest rate of major cardiovascular disease death at 261.9 per 100,000 population (see Table 36). Between 2011-2013, the lowest rate occurred among residents of the Fairbanks North Star Borough (191.5 per 100,000 population), which was close to the statewide rate of 208.2 deaths per 1000,0000 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 35. Major Cardiovascular Disease Deaths by Potentially Affected Area (2011-2013)

Disease	YKCA Deaths (Age Adjusted Rate)	NAB Deaths (Age Adjusted Rate)	Fairbanks North Star Borough Deaths (Age Adjusted Rate)	Alaska Statewide Deaths (Age Adjusted Rate)
Major Cardiovascular Diseases	41 (261.9)	27 (215.7)	338 (191.5)	2,866 (189.9)
Heart Disease	35 (220.2)	11 (86.6*)	242 (130.1)	2,146 (137.7)
Ischemic heart disease	23 (126.0)	1 (**)	139 (68.0)	1,225 (74.3)
Acute myocardial infarction	4 (**)	1 (**)	27 (14.1)	246 (15.7)
Atherosclerotic cardiovascular disease	11 (52.8*)	5 (**)	55 (20.5)	450 (22.6)
All other ischemic heart disease	8 (50.4*)	5 (**)	57 (33.5)	529 (24.1)
All other heart disease	12 (94.2*)	9 (76.9*)	103 (62.1)	921 (63.4)
Cerebrovascular disease	6 (41.7*)	6 (48.0*)	74 (48.9)	544 (40.4)
All other cardiovascular diseases	0 (0)	1 (88)	22 (12.5)	176 (11.8)

Source: Alaska Bureau of Health Analytics and Vital Statistics 2019
[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.

Table 36. Age-Adjusted Alaska Native Heart Disease Death Rates by Potentially Affected Tribal Health Region per 100,000 by Potentially Affected Native Health Corporation Region (2012-2015)

Tribal Health Region	Number	Age-Adjusted Rate
Northwest Arctic	29	186.6
Interior	69	166.0
Alaska Statewide	618	208.2

Source: AN EpiCenter 2017b

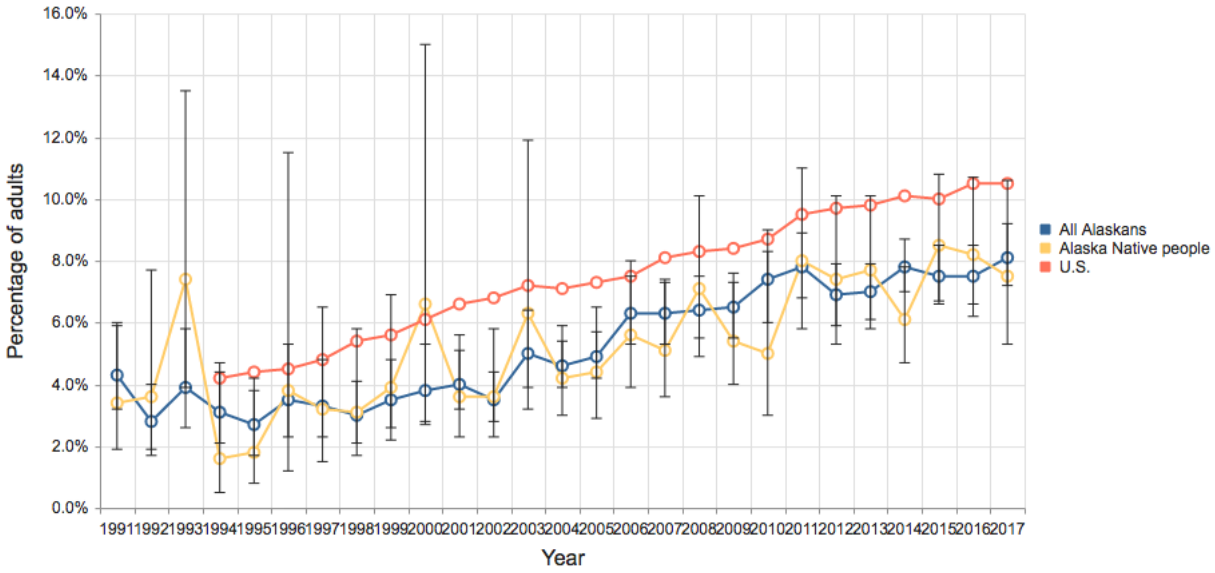
Diabetes

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 stay 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 2014). Currently, the CDC estimates that one in three persons will develop diabetes during their lifetime (CDC 2014a).

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 (8.1 percent) is lower than that for the U.S. (10.5 percent), as shown in Figure 28. Between 1998 and 2014, 87.1 percent of individuals with a diagnosis of diabetes in Alaska saw a health care professional for their diabetes (AK-IBIS 2019).

Figure 28. Percentage of Adults (18+) with Diabetes, Crude Rate, all Alaskans, Alaska Natives, and U.S. (1991-2017)



Source: AK-IBS 2019

Chronic Lower Respiratory Diseases

Chronic lower respiratory diseases include asthma, chronic obstructive pulmonary disease (COPD), bronchitis and emphysema. In 2014, this suite of diseases was the fourth leading cause of death in Alaska and in the U.S. A statistically reliable rate for chronic lower respiratory disease death rate was only available for the Fairbanks North Star Borough (40.0 per 100,000), which was approximately equal to the Alaska statewide rate (39.4) during 2011-2013 (see Table 37).

Table 37. Age-Adjusted Chronic Lower Respiratory Disease Death Rate by Potentially Affected Area and Statewide (2011-2013)

Census Area/Borough	Deaths	Age-Adjusted Mortality Rate
YKCA	5	**
NAB	5	**
Fairbanks North Star Borough	66	40.0
Alaska Statewide (2017)	579	39.4

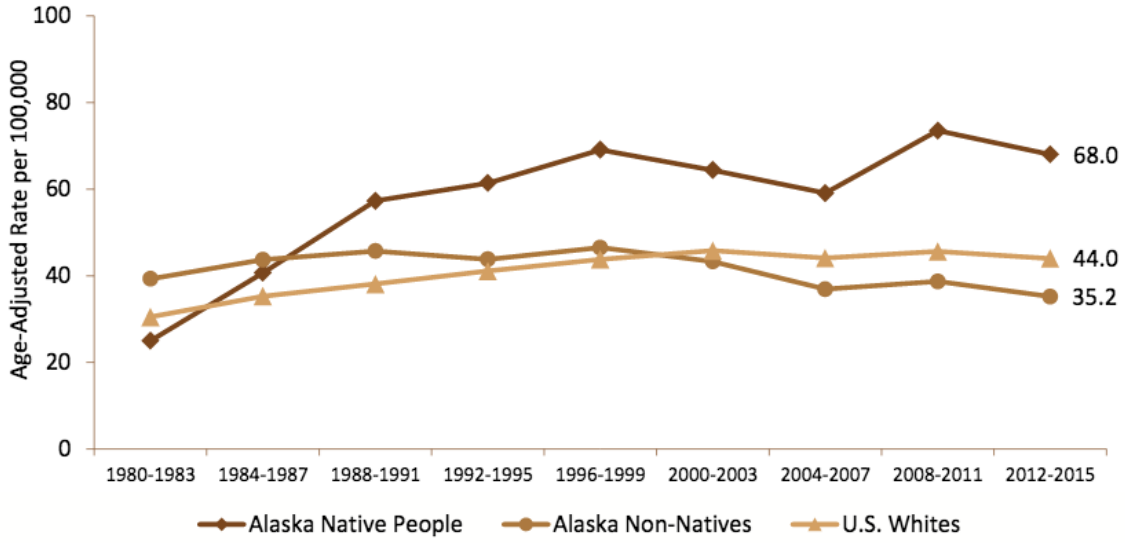
Source: Alaska Bureau of Health Analytics and Vital Records 2019
[a]Age-adjusted rates are per 100,000 U.S. year 2000 standard population
* Rates based on fewer than 20 occurrences are statistically unreliable and should be used with caution.
**Rates based on fewer than 6 occurrences are not reported.

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 chronic lower respiratory diseases excluding asthma.

There is significant disparity in rates of rates of COPD mortality between Alaska Natives and Non-Natives. During 1980-2015, Alaska Native people experienced a COPD mortality rate 1.9 times higher than non-Natives and 1.5 times higher than U.S. whites ($p<0.01$) (see Figure 29). During 2012-2015, COPD, at a rate of 68.0 per 100,000 population, was the fifth leading cause of death among Alaska Native people (see Table 38). COPD mortality rates among Alaska Native people increased significantly between 1980 and 2015 ($p<0.01$). A statistically reliable rate for chronic lower respiratory disease death rate was only available for the Interior Tribal Health Region (74.9 per 100,000), which was higher than the Alaska statewide rate (68.0) during 2012-2015.

Figure 29. Average Annual Age-Adjusted COPD Mortality Rates per 100,000 Population (1980-2015)



Source: AN EpiCenter 2017c

Table 38. Average Annual Age-Adjusted COPD Mortality Rates Per 100,000 Population by Tribal Health Region for Alaska Natives (2012-2015)

Tribal Health Region	Number of Deaths	Age-Adjusted Rate
Interior	27	74.9
Northwest Arctic	5	30.9*
Alaska Statewide	183	68.0

Source: AN EpiCenter 2017a
*Rates based on fewer than 20 deaths may be statistically unreliable and should be used with caution. Data are not shown if the number of deaths is <3.
Note: Totals include 7 Alaska Native persons with unknown tribal health region.

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. Department of Health and Human Services [USDHHS] 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 2019). 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.

Research indicates that Alaska Natives die by suicide at a rate nearly four times the U.S. average and the average for all American Indians and Alaska Natives (Berman 2014). 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 2017, the mean number of mentally unhealthy days was 3.9 for all Alaskans and 4.3 for Alaska Native people (AK-IBIS 2019). Females reported a higher number of mentally unhealthy days (4.4) as compared to males (3.4) in 2017. Overall, people over 65 years of age reported fewer mentally unhealthy days (2.2) than younger age groups. During 2015-2017, Alaska Native people reported more mentally unhealthy days during the past 30 days (4.2) than white individuals (3.4) (AK-IBIS 2019). Conversely, there is a marked reduction in the number of reported mentally unhealthy days by individuals, particularly over age 65, who practice a subsistence lifestyle (Poppel, et al. 2007).

Results from the 2015 YRBS found both short-term and long-term trends show an increase in the percentage of students feeling sad or hopeless (33.6 percent in 2015). There has also been an increase in the percentage of students who say they feel alone (24.8 percent in 2015) (YRBS 2015). Between 2013 and 2015 there was also an increase in the percentage of students who had seriously considered suicide (20.1 percent in 2015). There were no significant long-term or recent changes in the percentages of students planning (16.7 percent in 2015) or making a suicide attempt (10.7 percent in 2015) (AK-IBIS 2019).

Determinants

Determinants for this HEC are physical activity levels and obesity and overweight rates.

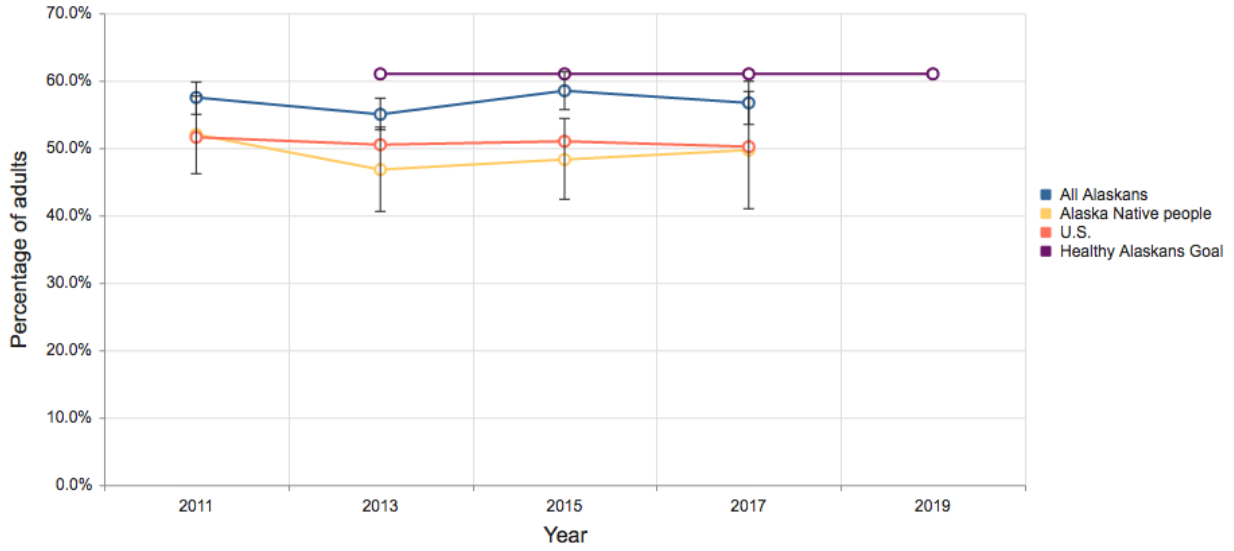
Physical Activity Levels

Consistent physical activity is an important indicator of future NCD 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 USDHHS Physical Activity Guidelines (150 minutes or more total minutes per week of moderate or vigorous exercise) to 61 percent by 2020. Figure 29 shows the percentage of adults getting the recommended amount of aerobic physical activity. In 2017, 56.7 percent of all Alaskans reported getting the recommended amount of physical activity, while 49.7 percent of Native Alaskans reported the same. The percentage of all adults nationally who reported getting the recommended amount of physical activity in 2017 was 50.2 percent.

Table 39 displays 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 key project-related boroughs/areas during 2012-2017. The highest percentage of people residing in the Fairbanks North Star Borough answered yes to this question (80.4 percent), followed by the NAB (78.0 percent). The lowest percent of people living in the YKCA reported leisure time physical activity (73.6 percent); however, none of the rates were very different from the percentage reported Alaskans statewide (79.3 percent).

Figure 30. 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: AK-IBIS 2019

Table 39. Leisure Time Physical Activity Rates by Potentially Affected Region (2012-2017)

Census Area/Borough	Number	Age-Adjusted Prevalence
YKCA	516	73.6%
NAB	285	78.0%
Fairbanks North Star Borough	3,196	80.4%
Alaska Statewide	20,772	79.3%

Source: AK-IBIS 2019

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 people overweight and obesity 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 percent for children between the ages of 2 and 5 years, 4 percent for children ages 6 to 11 years, 6 percent for adolescents ages 12 to 19 years, and 15 percent for adults. By 2008, the prevalence of obesity had reached 10 percent for children 2 to 5 years, 20 percent for children 6 to 11 years, 18 percent for adolescents 12 to 19 years, and 34 percent for adults. In the early 1990s, no state had an adult obesity prevalence rate of more than 25 percent. Since 2008, 32 States have an adult obesity rate more than 25 percent (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 affects 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 2017, the prevalence of obesity and overweight among all Alaskan adults (ages 18 and over) was 33.1 percent and 32.4 percent (similar to the national prevalence) for obesity and 31.6 percent and 35.3 percent for overweight (AK-IBIS 2019). Obesity and overweight prevalence among Alaskans adolescents (students in grades 9-12 in traditional schools) was 13.7 percent and 17.5 percent, and among children (grades K-8; 2015-2016), 17.7 percent and 16.9 percent, respectively. In 2017, NAB had the highest prevalence of obesity at 35.9 percent, while Fairbanks North Star had the lowest age-adjusted prevalence of obese adults (30.1 percent) (see Table 40). The YKCA had the highest prevalence of overweight adults at 37.5 percent. The prevalence of overweight adults was similar across all key project-related boroughs/areas, and all exceeded the statewide rate (32.4 percent).

Table 40. Age-Adjusted Prevalence of Obesity and Overweight Residents by Age Group and Potentially Affected Area (2015-2017)

Census Area/Borough	Age-Adjusted Prevalence/ all Alaskan adults Obesity	Age-Adjusted Prevalence/ all Alaskan adults Overweight
YKCA	31.4%	37.5%
NAB	35.9%	36.4%
Fairbanks North Star Borough	30.1%	37.1%
Alaska Statewide (2017)	33.1%	32.4%

Source: AK-IBIS 2019

Table 41 shows the prevalence and death rate due to diabetes among key project-related boroughs/areas. The YKCA had the highest prevalence of diabetes (10.1 percent), while Fairbanks North Star Borough had the lowest (6.4 percent). Only Fairbanks North Star Borough had more than 20 occurrences of diabetes deaths; thus, comparison to other boroughs was not possible. The rate of diabetes deaths in Fairbanks North Star Borough (13.0 per 100,000) was less than the Alaska statewide rate (19.4).

Table 41. Age-Adjusted Diabetes Prevalence and Deaths due to Diabetes by Potentially Affected Area

Census Area/Borough	Age-Adjusted Diabetes Prevalence/all Alaskan adults (2015-2017)	Number of Diabetes Deaths (2011-2013)	Age-Adjusted Diabetes Death Rate/all Alaskan adults (2011-2013)
YKCA	10.1%	3	**
NAB	8.6%	2	**
Fairbanks North Star Borough	6.4%	26	13.0
Alaska Statewide (2017)	8.1%	324	19.4

Source: AK-IBIS, 2019 & Alaska Bureau of Health Analytics and Vital Records 2019
[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.

Key Points- Non-Communicable Diseases

1. NCDs are the dominant the burden of disease in the key project related boroughs/areas.
2. Key NCD determinants such as tobacco, alcohol usage and obesity are significant drivers of the NCD burden of disease.

3.5.8 HEC 8: Health Services Infrastructure and Capacity

This category considers health outcomes and determinants related to health care access and health care infrastructure. Important outcomes include the number of medical evacuations, clinics or hospital visit trends, health expenditures, and medication usage. Health determinants may include distance to health facilities, the presence of community health aides, and the frequency of physician visits to the area.

The Alaska Native Medical Center (ANMC) in Anchorage is owned and managed by the Cook Inlet Region, Inc. (CIRI), an Alaska Native Corporation that organizes and manages services to Alaska Natives and the ANTHC. The medical center is the statewide referral center and gatekeeper for specialty care for Alaska Natives. The AN EpiCenter maintains health statistics on the NAB and the Interior Public Health Regions.

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/.

Health services in the Ambler Road proposed project area are provided by the following organizations:

- Maniilaq Association
- Tanana Chiefs Conference

Maniilaq Health Services (MHS) provides comprehensive primary health care including medical, nursing and community health services based out of the Maniilaq Health Center in Kotzebue, and village health

clinics located in each of their communities. Long-term skilled nursing services are also provided at Utuqqanaat Inaat in Kotzebue. MHS is accredited by the Joint Commission.

Emergency Services

The website for Maniilaq Health Center (MHC) reports that the center provides all levels of emergency care in the five-bed unit, 24 hours a day 7 days a week. The emergency department is designed to provide rapid and varied emergency care, especially for those with sudden and acute illness or who are victims of trauma. A triage system is available to screen patients and to determine priority of needs. Illness and injuries that are severe are stabilized for transportation in conjunction with Guardian Flight to a higher level of care. Nurses are trained to care for patients from birth throughout the lifespan.

The outpatient services department is designed to meet all the primary care, pediatric and women's health needs of the Northwest Borough and Point Hope and is staffed by physicians, nurse practitioners, midwives, and nurses. The outpatient department serves as a potential entry portal for the communities. Clients are grouped into teams, which consist of a Provider, Nurse and Case Manager to maintain continuity of care. MHC provides all services from prenatal care to geriatrics. The outpatient department has access to auxiliary services such as lab, X-ray, physical therapy and specialty consultants both locally and in Anchorage. The outpatient department must meet community goals through the Government Performance and Reporting Act to ensure quality health care is being provided.

MHC provides inpatient services in a 17-bed comprehensive medical/telemetry care unit; which includes a low stimulation room to address behavioral health needs as well as a standalone obstetrics department. MHC's obstetrics department consists of four of these beds in a separate obstetric/labor and delivery unit that includes a newborn nursery and two birthing rooms. The inpatient unit also provides palliative care services to the community. MHC has the following additional services:

- Adult and pediatric dental services
- Physical therapy
- Ophthalmology
- Radiology
- Laboratory

Community Health Aide/Practitioners (CHAPs) are the primary care providers at the MHS village clinics. The CHAP program is unique only to the State of Alaska. This program was built to help serve the people in rural Alaskan villages to meet their medical care needs. The services that a CHAP provides include acute, chronic, preventive, and emergency care. Each CHAP, depending on their level of training, either communicates with a mid-level provider or medical doctor, or uses the Community Health Aide Manual Medical Standing Orders to decide the best care or treatment for patients. Maniilaq Association has the following community level clinics:

- Ambler Clinic
- Kobuk Clinic
- Shungnak Clinic

Tanana Chiefs Conference is accredited by the Accreditation Association for Ambulatory Health Care and provides outpatient services to Indian Health Service beneficiaries in Interior Alaska. The Chief Andrew Isaac Health Center is located in Fairbanks and provides the following health services:

- Immunizations
- Obstetric care
- Orthopedics
- Pediatrics
- Diabetes care
- Radiology
- Women's health
- Dental, and
- Vision
- Urgent care

Tanana Chiefs Conference has the following community level clinics:

- Alatna Clinic
- Allakaket Clinic
- Evansvillle Clinic
- Huslia Clinic
- Hughes Clinic
- Rampart Clinic
- Tanana Health Center
- Manley Health Clinic

Healthcare Delivery—Services

Healthcare delivery services include response to accidents and injuries, routine medical care, and behavioral healthcare.

Accidents and Injuries

Accidents and injuries are an important cause of mortality and morbidity in Alaska. The term UI refers to causes of injury or death other than suicide and homicide. In Alaska, the medical emergency response system to accidents and injuries is complex due to a combination of community remoteness/access and weather.

The initial response related to accidents and injuries is managed locally by the Alaska CHAP. CHAP is a multidisciplinary system of mid-level behavioral, community, and dental health professionals working alongside licensed providers to offer patients increased access to quality care in rural Alaskan areas. Clinic personnel call for assistance within the local community as initial search and rescue is conducted locally by those who have appropriate vehicles (snowmachines) and fuel resources. The CHAP contacts the regional responsible on-call medical doctor through the existing telemedicine system and/or by cell. The on-call physician determines necessity for medical evacuation.

Emergency calls for medical transport is transmitted to Guardian Flights in Fairbanks. Guardian Flight is the Alaska AirMedCare Network provider. Guardian Flight is the state's largest air medical provider with more aircraft in more places than all of the other organizations in the state combined. It takes Guardian Flight approximately 35 minutes to mobilize and become airborne. Flight time is a function of location and weather; for example, approximately 1 hour and 15 minutes to Ambler. The aircraft requires at least 2,500 feet of cleared runway to land. Emergency flights cannot land in Alatna due to runway length and instead land at the most proximate suitable landing area. Seasonal issues are significant and related to adequate runway snow removal. If an adequate local runway is not available local villagers must transport the evacuee to another village that has an appropriate landing strip. In some circumstances, the emergency flight crews can obtain emergency evacuation services from the U.S. military (Fairbanks) who have helicopter availability, but this is not consistently available. The military is the only option for helicopter evacuation for the PACs.

Routine Medical Care

Local clinics are very basic. However, telemedicine is available and provides access to a higher level of care. Facilities have an exam, trauma and dental rooms but have no lab or x-ray. Simple point of care blood analysis such as glucose and hemoglobin can be performed in the clinics. There is no local housing for health staff, and no provisions for housing. Health aides are living in older houses, some among three generations and are on-call 24 hours per day. For example, Kobuk has seen an increase in after-hours visits. Increasingly more women are getting jobs with no provisions for childcare. There is a concern that health aides will get jobs at local mines for better pay. Telemedicine access in Kobuk and Hungnam is of a lesser quality, much slower than Ambler, so any improvements in fiber optics due to the project would enhance health care delivery.

Behavioral Healthcare

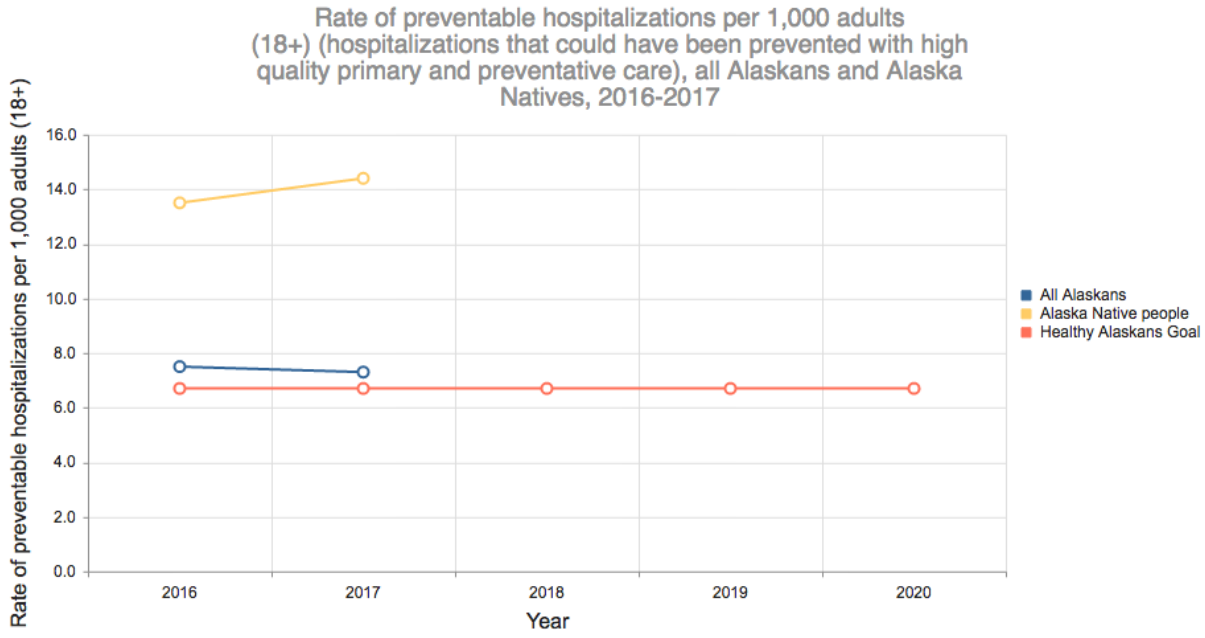
There are significant concerns surrounding mental health and wellness: particularly alcohol use, marijuana, occasional meth, opioids, a lot of domestic violence, substance abuse resulting in physical injuries in the area. There is a lack of law enforcement and there are periods when the VPSO is off, so there is no law enforcement at all. Collisions happen with no investigations. There are no village public safety officers in Alatna/Allakaket. Sexual assaults occur with no response. There are no behavioral health services available.

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 (ibis.dhss.alaska.gov). "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 31 shows the disparity between the rates of preventable hospitalizations among all adult Alaskans as compared to Alaska Native adults between 2016 and 2017. During this period the rate among Alaska Natives increased from 13.5 per 1,000 adults to 14.4. In contrast, the rate of preventable hospitalizations among all Alaskan adults remained relatively stable dropping slightly from 7.5 to 7.3 per 1,000 adults. It is notable that rate in 2017 for Alaska Natives is nearly twice the statewide rate.

Figure 31. Rate of Preventable Hospitalizations per 1,000 adults (18+), All Alaskans and Alaska Natives (2015-2017)



Source: AK-IBIS 2019

Health insurance plans provide partial or complete payment of specified health care costs for enrollee(s), with varied levels of coverage among individual plans. Employers, government programs such as Medicare, provide plans while 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 2019).

In 2017, 13.6 percent of all Alaskans statewide reported cost as a barrier to accessing healthcare within the past year and 11.0 percent of all Alaska Natives reported cost as a barrier to care (AK-IBIS 2019).

Key Points- Health Services, Infrastructure and Capacity

1. There is an established and functioning health care service and delivery system across the key project related boroughs/areas.

3.6. Boom and Bust: Lessons Learned from the Development of Large Energy and Mining Projects

As part of the baseline literature report, published papers and academic studies were reviewed that looked at the suite of impacts associated with the development of large energy and mining projects. Most of the recent literature is focused on shale oil and gas projects that have been developed within the last 10 years. There are very limited socio-economic data for Alaska mining projects, such as Red Dog Mine (Loeffler 2015). Studies regarding potential hazardous materials impacts at the Red Dog Mine are presented in Section 3.4.3 (HEC#3 Exposure to Potentially Hazardous Materials). Internationally, the Canadian Alberta Oil Sands projects have been studied in indigenous communities (Parlee 2015).

There are published reports and studies of the offshore oil/gas industry in coastal Louisiana. The older (pre-1990) "boom town" literature is primarily related to mining projects. Therefore, there are a wide range of regions in the U.S. and Canada that have been studied, including Alabama, British Columbia, Colorado, Idaho, Louisiana, Minnesota, Montana, Nevada, North Dakota, Northwest Territories, Oklahoma, Pennsylvania Utah, and Wyoming. There is extensive published literature surrounding the "boom-bust-recovery-cycle." A set of key references for this literature is shown in the overall references (Chapter 6).

After more than 40 years of study in various locations, the potential social and health impacts arising from rapid natural resource development are widely recognized. Clearly the effects can vary based on both the nature of the resource activity, the stage or phase of activity, and the characteristics of the affected communities. The existing literature provides a useful background in terms of the types of effects to consider.

In general, most of the energy and mining projects have been in relatively rural locations with:

- Greenfield developments;
- Low population densities;
- Relatively weak social services infrastructure;
- Little or no history of large-scale industrial development and
- Workforces with minimal large project industrial construction experience.

While there are clear and distinct demographic differences between the geographic home of the proposed Ambler Project and the Bakken (North Dakota and Montana) and Marcellus (rural Pennsylvania and New York State) shale oil/gas projects there are nonetheless some commonalities.

As will be shown in the next section, when a comparison is made between the set of key informant and focus group concerns in the Bakken and Marcellus shale development areas and a similar stakeholder concerns documented for the proposed Ambler Project l, there is substantial overlap in the responses. This commonality, despite significant community differences is quite revealing and indicates that the same set of fears and concerns are present regardless of whether the underlying community geography and ethnic makeup is significantly different. Summaries of the environmental, social and health "concerns" associated with recent large extractive industry projects are presented in the next sections. These stakeholder concerns can readily be compared with similar stakeholder comments registered for the Ambler Project (HIA Chapter 2; EIS Stakeholder Chapter/Section/Appendix I).

3.6.1 Bakken Concerns

A series of community and key informant interviews was systematically performed across numerous areas in the Bakken shale oil/gas development area in North Dakota (North Dakota State University 2011). Focus group findings included population change, labor and jobs, housing and cost of living, infrastructure, education, services (both public and private), crime, and other, more general concerns. More detailed responses by area from this survey are summarized.

Population Growth/Quality of Living

The following responses from the focus group relate to population growth and quality of living:

- Increased pressures on infrastructure, clashes of values, and displaced individuals and families.

- Challenges of culture gaps that are created by in-migrants of various backgrounds.
- Neighborhood trust issues (Montana Board Crime Control, 2013):
    - Changes in the density of acquaintanceship. This may sometimes be expressed in statements like "we used to know everyone, now there are a lot of strangers in our community."
    - Declines in local identity, solidarity and trust in other community members.
    - Fear of crime.
    - Less control of deviant behavior, reduced respect for law and order, less effective socialization of youth.
    - Diminished community satisfaction and reduced attachment to the community.

Housing and Cost of Living

The following responses from the focus group relate to housing and cost of living:

- Population growth has exacerbated the housing situation.
- Any housing that is built, unfortunately, is too expensive for those with non-oil wages to handle, especially since some residents are "on a fixed income and can't afford increased prices."
- Residents "don't want to be saddled with the burden of expensive development projects when the boom goes bust."
- Oil paycheck "Haves" and the others as "Have-nots", the real barrier to economic security is the prices. Those making an oil paycheck have been able to brook food and housing costs; those in non-oil related fields (such as small business ownership or retail) have problems absorbing price increases.
- Housing affordability has become such an issue for some families that it is plunging them into poverty or leading to eviction.
- The rising cost of food prices has put even more strain on families.
- A divide has been created between the oil field earners and non-oil related workers.

Labor and Jobs

The following responses from the focus group relate to labor and jobs:

- Infrastructural improvements, child protection cases, and small business opportunity are some of the things that are weighing down non-oil related organizations.
- Development groups, specialists are needed to guide them through strategic plans and increased caseloads.
- There are still labor shortages for non-oil related business:
    - Both public and private can't compete with (oil) wages.
    - Other than minimum wage labor, professionals are needed to address topics such as infrastructural work, social service cases, and policy.
    - Service agencies and small businesses struggle to get employees, not only because employees can earn more money in the oil fields, but because potential employees cannot find housing or childcare.

- Employees currently working in area businesses can be difficult to manage because they can get jobs anywhere if they become dissatisfied.
- The lack of childcare is a major factor causing problems for families.

Infrastructure

The following responses from the focus group relate to infrastructure:

- Roads, traffic, noise and road dust
- Sanitation
- Sewage
- Water treatment and water lines

Education

The following responses from the focus group relate to education:

- Some schools are experiencing stress in trying to find staffing to handle the increased enrollment:
  - Wide swings in enrollment
  - Schools have issues hiring teachers because of this uncertainty in enrollment numbers
- Language/translation, English as a Second Language issues.
- Classroom space, buildings.
- Some of the new students are behind academically because of the many moves a family may have made or lower educational standards in their home state.
  - Students cannot be put in "special programs" simply for being homeless because being "homeless is not a learning disability"
- Home environment conducive to studying.

Crime

The following responses from the focus group relate to crime:

- The number of domestic violence reports and child protection cases increased
- General increase in all crime, robbery, fights, alcohol, drugs
- Weapons
- Sex offenders
- Sexually oriented commerce
- Careless driving

Service Organizations (Including Health and Social Services)

The following responses from the focus group relate to service organizations, including health and social services:

- Strain on existing staff and programs.
- Budget cuts from recession.
- Difficult to initiate new programs to address the concerns that are emerging from the oil boom while still maintaining the quality of the current programs**.**
- Difficult time attracting new employees to the region because of the lack of available housing.
- With a lack of ability to finance additional salaried employees, getting a qualified individual becomes even more challenging.
- Social Services and Child Protective Services have seen dramatic increases in their caseloads.
- Some of those who leave their home states come to find a lack of housing and they are unqualified for a job in the oil fields. This creates a strain for agencies such as Social Services and Salvation Army when these individuals and families seek shelter, sustenance, and employment.
- Demand for health services including emergency response:
    - More accident and injuries

3.6.2 Pennsylvania Marcellus Shale Surveys 2010

In 2010, broad social surveys in key Marcellus shale communities were conducted by Penn State University (Braiser and Kelsey 2012). In addition, interviews and surveys were conducted in communities in Texas and Arkansas that had long histories of energy resource development. Key findings from these surveys are presented in the following subsections.

Pennsylvania

The following subsections discuss the social impacts, infrastructure, and aesthetic quality and environmental health findings from the Pennsylvania survey.

Social Impacts

The most significant social concern expressed among study participants was the fear that development of the Marcellus Shale would create or exacerbate inequalities among local residents. This can occur directly (i.e., those with leases and royalty income versus those without) and indirectly by making life harder for those already disadvantaged. This was most often conveyed in terms of housing problems but was also described in terms of increased cost of living and limited access to services.

Infrastructure

Roads and traffic issues top the list of concerns about physical infrastructure in all four counties. Managing growth was a concern because of the potential costs to municipalities to extend water and sewer lines. The cost and availability of housing is a significant concern in the rural counties. Participants in Greene and Susquehanna counties described how sky-rocketing rents were making it extremely difficult for residents to find adequate, affordable housing.

Aesthetic Quality and Environmental Health

Study participants expressed concern about the impacts on the landscape, and relatedly, their desire to live in the area. For many, the rural nature of these areas is the reason they live where they do; they feared that development of the Marcellus would permanently degrade the amenities and quality of life they've come to appreciate. Study participants in Westmoreland and Susquehanna counties raised concerns over

environmental health. These concerns include water quality and quantity, forest fragmentation, and wildlife habitat. Dimock, a small town in Susquehanna County, has been very active in drilling and during 2009 and early 2010; there were several accidents ranging from potential well contamination to spills and other accidents.

Arkansas and Texas Interviews

The following subsections discuss the economic impacts, infrastructure, environment, and government findings from the Arkansas and Texas interviews.

Economic Impacts

Respondents in both Texas and Arkansas discussed the positive economic impact natural gas development had on their regions. These impacts included the addition of direct and indirect jobs to the local area. Also discussed was the ripple effect the presence of the industry has had on hotels, restaurants, and retail. Interviewees also discussed the increase in income many landowners who have leased their property have seen. One interviewee called it an injection of revenue into the local economy.

Infrastructure

Road damage and traffic was one of the biggest concerns among interviewees. Arkansas participants described in detail how these issues were affecting each county studied. Roads were not made to sustain the current amount of impact caused by the increased truck traffic. In Texas, one government official indicated companies must define the route they will take to each drill site so that the damage can be accurately assessed. In Arkansas, a government official stated he wished he insisted on obtaining route information from firms prior to the drilling, as they never anticipated the large number of tri-axle trucks that would be traveling these roads daily, weekly, and monthly.

Environment

In Texas, participants discussed how the current discussion among residents in the region is focused on air quality and the amount of benzene in the air. Several interviewees mentioned that residents in the local area are concerned about high levels of benzene potentially caused by drilling. However, the Texas Commission on Environmental Quality has not yet come up with conclusive evidence proving that to be the case. In Arkansas, the concern was about water quality and damage to surface water. Arkansas government officials reported no well contamination yet. They have developed stringent testing and regulation.

Government

Key informants in Texas and Arkansas indicated that local government resources will be strained. Additional people are needed on the local level to carry out government functions as shale development proceeds. Local governments should have one point person who knows a single point of contact in each drilling company, has access to all truck routes, and encourages these companies to use local businesses, even providing them with necessary information about the local business community. Local government ordinances should be comprehensive and strong. They should be re-evaluated regularly.

Conclusion Penn State Study

They expressed a desire for development strategies and tools for managing growth that provide the most benefits to their counties. Taxes were described frequently as one potential tool to provide direct income to local jurisdictions. Training programs for educating the local population for entry into gas exploration and development fields was another tool discussed for distributing the benefits from Marcellus development. Participants also wanted information that could guide their decision-making and allow them

to anticipate emerging problems. Although many participants were uncertain about the likely trajectory of the development, they expressed hope that developing the Marcellus play would benefit their communities.

Key informants in Arkansas and Texas were asked if they had any advice or "lessons learned" that they could share with us as our region further develops the Marcellus Shale. Two suggested that communication with the industry and the community was of the utmost importance. They suggested local government educate residents about the process and the business. There were issues with their state's regulatory and tax systems. Specifically, money does not trickle down into the communities to mitigate drilling issues (Braiser and Kelsey 2012).

3.6.3 Lessons Learned from Recent U.S. Extractive Industry Projects

The resource development "boom-bust-recovery cycle" has generally produced a wide variety of community-level effects, some but by no means all, could potentially be seen with the Ambler Project particularly for the long-term future mining development scenario:

- A lack of available, affordable, and adequate housing. Food inflation is also a strong potential. Demands for and costs of housing increased during the "boom" phase of the cycle. Some communities reported excess housing during the "bust" phase:
    - Functionality of large "man camps" and impacts of crime, substance abuse, communicable diseases, etc.
    - Housing inflation both for short and long-term rentals.

- Significant changes in index crime rate and demands for law enforcement:
    - Rise in service call rates (calls for service per sworn officer) with slow response times from law enforcement
    - Inability to recruit and pay competitive wages versus project construction
    - Increased demand for non-sworn positions
    - Impacts of "man camps" on crime rates
    - Increase in sexual offenders
    - Increase need for equipment and facilities

- Primary economic impacts for communities during the "boom" phase included increases in new, natural resource-related jobs, retail purchases, and taxes with decreases in each during the "bust" phase.

- High rates of employee turnover were experienced among non-natural resource-related businesses; government agencies, schools, and other institutions faced challenges filling positions:
    - Wage inflation is likely with cascade effects on traditional service jobs including schools, medical and government services.
    - Shortages in key government service areas, e.g., social services, health, schools, law enforcement.

- Many communities already faced infrastructural challenges, including a lack of road, sewage and solid waste infrastructure:
    - The magnitude and size of the proposed future projects presents significant transportation (road, air, water) accident and injury risks
    - Increased traffic on all roads, reduced visibility
    - Road maintenance due to increased traffic volume
    - Significant influx can stress local sewage, water and sanitation services capacity
- Many communities also faced budgetary problems as they attempted to remedy their infrastructural problems.
    - Major revenue flows may not meet the timeline required for infrastructure improvements.
- The number and rates of crime increased for index crimes, including domestic violence, both during the "boom" and "bust" phases of the economic cycle.
    - The current lack of law enforcement support in the PACs was noted in the HEC#1 SDH baseline
- Increased school enrollments and demands for social and services were noted during the "boom" phase of the economic cycle:
    - School performance is already a major community concern
    - Inability to recruit and pay competitive wages for teachers and aides versus oil/gas construction
    - Inability to predict enrollment and classroom needs
    - Demand for special education services
    - English as a second language issues
    - Cultural melding
    - Background disparity differences among influx students
- Demand on health infrastructure including emergency response, emergency rooms and public health clinics:
    - Increased waiting times for emergency rooms and emergency services
    - No certified trauma center is present in SWLA including Calcasieu Parish
    - Increases in trauma related events (such as road traffic)
    - Increases in substance abuse and demand for social services
    - Rise in STIs
    - Increases in highly communicable respiratory infections
    - Rise in rapes, domestic violence, and assaults with cascading demand on health services
    - Increased demand for maternal and childcare services

4. Environmental Consequences

The EC analysis is based on the rating and ranking methodology presented in the 2015 ADHSS HIA guidance. Information developed in the EIS EC chapter (and appendices) is cross-referenced and, as appropriate, also used as a technical basis for the ratings and rankings for the proposed action and alternatives.

4.1. Rating and Ranking

The goal of an HIA is to identify potential health impacts and communicate these impacts to decision-makers during the planning and permitting process. The most important key health impacts related to the proposed Ambler Project are discussed in this section.

A health impact is a change in a specific health outcome or health determinant. The ADHSS (2015) defines health as "the reduction in mortality, morbidity and disability due to detectable disease or disorder and an increase in the perceived level of health." Given the multi-dimensionality of health, a project may affect aspects of health at an individual, community, regional level, or a statewide level. Health impacts are changes in specific health outcomes or determinants, not general changes in environmental conditions.

Suites of potential impact statements were developed based on three sources of information: (1) stakeholder comments (see Chapter 2 of the HIA for detailed presentation of these comments); (2) ADHSS HIA experience with extractive industry projects from 2008 to the present; and (3) a workshop held in April 2019 with cooperating agencies.

The potential consequences to human health were evaluated using criteria outlined in Alaska's HIA guidance (ADHSS 2015). The analysis and impact ratings for human health are consistent with the principles of analysis required by NEPA despite occasional differences in terminology. The health analysis considered the No Action Alternative and Alternatives A, B, and C. A full description of the alternatives is provided in Chapter 2 of the EIS. The impacts analysis considered:

- No Action Alternative;
- Impacts common to all action alternatives; and
- Alternatives A, B, and C.

From a health perspective, Alternatives A, B, and C have a significant number of impacts in common across all HECs with one significant exception involving Alternative C: a much smaller profile in terms of the documented presence of NOA (see Section 3.5.3) along the proposed road (see EIS Section 3.2.2 Soils and Permafrost). Alternative C also has a difference in how close the road is to the Hughes community (see EIS Chapter 2); however, from an overall health impact perspective, this does not otherwise materially change the Alternative C assessment. Therefore, to avoid duplication of impact rating tables, the overall findings apply equally to Alternatives A, B, and C unless otherwise noted (the HEC#3 Hazardous Materials rating for Alternative C).

As described in the EIS (Chapter 3), impact statements per HEC were developed for two scenarios:

1. "Road" under two phases: (1) construction and (2) operations and maintenance covering the No Action and Alternatives A, B, and C. From a health perspective, the impact statements are identical for both road phases.

2. “Other indirect and cumulative impacts of growth” based on a long-term commercial mining district development scenario described in Sections 2.1 and 2.2 in Appendix H.

The impact statements per HEC are shown in Table 42.

1 **Table 42. Impact Statements per HEC**

HEC	Road - Direct Effects	Future Mining - Indirect and Cumulative Impacts of Growth
#1 Social Determinants of Health	• Increase in household incomes, employment, and education attainment • Increases in psychological stress and stability—individual and family (includes teen pregnancy) • Increases in substance abuse (including drug, tobacco, and alcohol) • Increases in intentional injuries, including gender-based violence • Increase in suicide rates • Changes in family/community cohesion	• Long-term increase in household incomes, employment, and education attainment • Increases in psychological stress and stability—individual and family (includes teen pregnancy) • Increases in substance abuse (including drug, tobacco, and alcohol) • Increases in intentional injuries, including gender-based violence • Increase in suicide rates • Changes in family/community cohesion
#2 Accidents and Injuries	• Improvements in emergency response times and evacuation • Increases in unintentional accidents and injuries (surface/water/air modalities) morbidity and mortality rates due to village interaction with road transportation traffic	• Improvements in emergency response times and evacuation • Increases in unintentional accidents and injuries (surface/water/air modalities) morbidity and mortality rates due to village interaction with road transportation traffic
#3 Hazardous Materials	• Increased risk of exposure to NOA • Increased exposure to non-NOA potentially hazardous chemicals in air, water, and soils • Bioaccumulation in flora (plants) and fauna (animals) • Increased risk of release event due to a road traffic accident • Increased risk of community driven fuel release events at road transfer points	• Increased risk of exposure to NOA • Increased exposure to non-NOA potentially hazardous chemicals in air, water, and soils • Bioaccumulation in flora (plants) and fauna (animals) • Increased risk of release event due to a road traffic accident • Increased risk of community driven fuel release events at road transfer and potential spur points (Kobuk, Ambler, and Shungnak)

HEC	Road - Direct Effects	Future Mining - Indirect and Cumulative Impacts of Growth
#4 Food, Nutrition and Subsistence	• Decrease in food transportation costs to trade stores (assumes road access to commercial transport vehicles) • Decreased access to subsistence flora and fauna • Decreased quantity of subsistence flora and fauna, includes competition for resource and changes in animal migration patterns • Decreased quality (perceived or actual) of subsistence flora and fauna due to dusts including NOA • Decrease in food security due to changes in access, quantity, and quality of subsistence resources • Change in overall diet composition—increase processed/commercial foods versus subsistence	• Decrease in food transportation costs to trade stores (assumes road access to commercial transport vehicles) • Decrease in overall household level/community food insecurity due to increased availability of commercial food products • Decreased access to subsistence flora and fauna • Decreased quantity of subsistence flora and fauna, includes competition for resource and changes in animal migration patterns • Decreased quality (perceived or actual) of subsistence flora and fauna due to dusts including NOA • Decrease in food security due to changes in access, quantity, and quality of subsistence resources • Change in overall diet composition—increase processed/commercial foods versus subsistence
#5 Infectious Diseases	• Increase in STI rates (including gonorrhea, chlamydia, Hepatitis C, and HIV) • Increase in infectious (respiratory) disease morbidity and mortality rates (such as influenza pneumonia and TB) • Increase in rates of foodborne illness • Introduction of new infectious diseases—zoonotic, parasitic and vector borne • Increase in rates of vaccine preventable diseases	• Increase in STI rates (including gonorrhea, chlamydia, Hepatitis C, and HIV) • Increase in infectious (respiratory) disease morbidity and mortality rates (such as influenza pneumonia and TB) • Increase in rates of foodborne illness • Introduction of new infectious diseases—zoonotic, parasitic and vector borne • Increase in rates of vaccine preventable diseases
#6 Water and Sanitation	• Decrease in morbidity and mortality rates due to improvements in access, quantity, and quality of water and sanitation facilities (improved income [employment] and village finances) • Increase in morbidity and mortality rates due to changes in access, quantity, and quality of water and sanitation facilities	• Decrease in morbidity and mortality rates due to improvements in access, quantity, and quality of water and sanitation facilities (improved income [employment] and village finances) • Increase in morbidity and mortality rates due to changes in access, quantity, and quality of water and sanitation facilities

HEC	Road - Direct Effects	Future Mining - Indirect and Cumulative Impacts of Growth
#7 Non-Communicable and Chronic Diseases	• Increase in cancer, respiratory, and cardiovascular morbidity and mortality rates due to changes in diet and activity associated with decline in subsistence versus trade store food products	• Increase in cancer, respiratory, and cardiovascular morbidity and mortality rates due to changes in diet and activity associated with decline in subsistence versus trade store food products
#8 Health Services, Infrastructure and Capacity	• Improved telecommunications including access to Ambler Project fiber cable • Broader public use, particularly for emergency accident response	• Improved telecommunications including access to Ambler Project fiber cable • Improved income streams/royalties with increases in overall investment in health services including staffing • Improvement in ability to perform search and rescue access and funding • Broader public use, particularly for emergency accident response • Decreased availability of Community Health Aide Programs (CHAP) due to employment at local mines

2

The ADHSS impact rating process was used for each potential health impact issue within each HEC. Step one of the ADHSS process is to assign a score that describes the intensity of the impact and the likelihood that the impact could occur. Each dimension is reviewed and given a score of 0, 1, 2, or 3. This is generically illustrated in Table 43. There are objective and subjective components to the rating process. The Chapter 3 baseline data objectively describes the underlying burden of disease in the project area as a function of HEC and frame the analysis of health effect. The project description is utilized to help define road construction and operational duration. The magnitude and extent are based on professional experience and judgment; hence, the health workshop included a broad cross section of health experts from the project area who provided input regarding potential ratings.

Table 43. Step 1 – Impact Assessment

Impact Rating Score	A – Health Effect	B - Duration	C - Magnitude	D - Extent
0 – Low	Effect is not perceptible	Less than 1 month	Minor	Individual cases
1 – Medium	Minor benefits or risks to injury or illness patterns (no intervention needed)	Short-term: 1-12 months	Those impacted will: 1. Be able to adapt to the impact with ease and maintain pre-impact level of health, 2. See noticeable but limited and localized improvements to health conditions	Local: small limited impact to households
2 – High	Moderate benefits or risks to illness or injury patterns (intervention needed, if negative)	Medium-term: 1 to 6 years	Those impacted will: 1. Be able to adapt to the health impact with some difficulty and will maintain pre- impact level of health with support, or 2. Experience beneficial impacts to health for specific population some maintenance may still be required	Entire PACs; village level

Impact Rating Score	A – Health Effect	B - Duration	C - Magnitude	D - Extent
3 – Very High	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: 1. Not be able to adapt to the health impact or to maintain pre-impact level of health 2. See noticeable major improvements in health and overall quality of life	Extends beyond PACs; regional and state-wide levels

After the intensity level is determined, ADHSS steps 2 and 3 allow the likelihood of the event to be evaluated and a final importance rating is assigned to the potential impact using Table 44. The final result in step 4 is that each impact then receives an overall importance-rating category of 1, 2, 3, or 4.

Table 44. Steps 2, 3, and 4 - Impact Assessment

Step 2 Impact Level (Use Score from Step 1 to choose range)	Step 3 Likelihood Rating: Extremely Unlikely (<1%)	Step 3 Likelihood Rating: Very Unlikely (1-10%)	Step 3 Likelihood Rating: Unlikely (11-33%)	Step 3 Likelihood Rating: About as likely as Not (33-66%)	Step 3 Likelihood Rating: Likely (66-90%)	Step 3 Likelihood Rating: Very Likely (90-99%)	Step 3 Likelihood Rating: Virtually Certain (>99%)
1-3	1	1	1	1	2	2	2
4-6	1	1	1	2	2	2	3
7-9	2	2	2	3	3	3	4
10-12	3	3	3	4	4	4	4

Potential health impacts per HEC were rated (ADHSS steps 2 and 3) for the "Road" and "Other indirect and cumulative impacts of growth" (commercial mining district development) scenarios for the No Action Alternative, Impacts Common to All Alternatives, and Alternatives C HEC#3 Hazardous Materials (Tables 5 through 22). As previously noted, except for potential impacts related to HEC#3 Hazardous Materials, the suite of impacts is otherwise common to all action alternatives; hence, separate Alternative A and B analyses are not shown. All ratings were developed based on direct, collaborative interaction between NewFields and ADHSS HIA specialists.

4.2. Road Impact Analysis

This analysis included impacts from the No Action Alternative, impacts common to all the action alternatives, and impacts from Alternative C.

4.2.1 No Action Alternative

This alternative would likely maintain the current baseline trends in regional mortality and morbidity. Respiratory, digestive, dental, musculoskeletal disease, injury/poisoning, and STI trends are likely to continue to dominate the morbidity burden. Cancer, heart disease, and UI are likely to continue to be the leading causes of mortality. Underlying rates of smoking, alcohol use, and obesity will continue to be significant drivers of morbidity and mortality.

4.2.2 Impacts Common to All Action Alternatives

SDH. Some potential impacts are related to socioeconomic improvements in household income and employment during active construction. As discussed in the AE–Baseline (Chapter 3 of the HIA), improvements in income and employment can have a variety of effects and subsequent health consequences. Not all households will experience (or choose to experience) direct income/employment changes which can produce a "have and have not situation" with increases in psychosocial stress. Increases in goods and service distribution could occur—access to better and cheaper building and supply materials. Similarly, the road could increase substance abuse due to greater alcohol and tobacco product distribution. Changes in intimate partner violence or suicide rates could worsen (or improve) depending upon whether family/community cohesion worsens or strengthens. Sudden changes in income/employment are often seen when large projects occur in remote, rural settings—known as a "boom and bust cycle." Boom and bust is typically associated with marked changes in substance abuse use, a phenomenon noted during the recent shale oil boom in rural parts of the U.S. This cycle is further discussed in the analysis of the "other indirect and cumulative impacts of growth" scenario. Psychosocial effects can have consequences that persist well after road construction completion.

Accidents and Injuries. Improvements in surface and air (new landing strips associated with road construction and maintenance) infrastructure could facilitate improved emergency response times and evacuation efficiency. The potential increase in interaction between community members and commercial road traffic could result in increased serious accidents and injuries. There is already a significant burden of UI in the PACs (Baseline Chapter 3, HEC#2). Additional interaction between community members and construction vehicles could result in additional accidents and injuries.

Exposure to Potentially Hazardous Materials. Road construction could increase distribution and consequent exposure to NOA materials. The experience with NOA in the general Ambler area is well documented in the Section 3.2.1 Geology and Minerals. NOA materials can be safely handled and managed; however, this requires a significant effort and careful development of detailed management plans. Management/mitigation plans are discussed in Chapter 5 of this HIA. Increases in accidental releases (such as fuels or construction materials) could impact land and water resources, although the geographical extent is potentially limited. Despite numerous stakeholder concerns/comments, the HIA Team believes that impacts on flora and fauna are likely to be very geographically restricted without major impacts to individuals or communities.

Food, Nutrition, and Subsistence Activity. The HIA ratings are primarily based on the analysis per the Subsistence Uses and Resources analysis (EIS Section 3.4.7 and Appendix L). Increased economic benefits could decrease the number of food-insecure households, as there would be more disposable income to buy commercial food products. If limited commercial road access is provided, transportation costs associated with commercial food product delivery could fall.

As described in the Subsistence Uses and Resources analysis, there are potential impacts to access, quantity, and quality (real or perceived) related to construction activities (such as NOA and other dusts), noise, physical barriers, habitat fragmentation, and competition for resources. Changes in diet

composition (a decline in subsistence and associated rise in commercial foodstuffs) could occur as a function of both rising incomes and access to commercial food products combined with decreased per capita subsistence. Changes in subsistence can have numerous cascading health effects on psychosocial wellbeing, community cohesion, and long-term non-communicable disease rates.

Infectious Diseases including STIs. Changes in overall burden of STIs above baseline are a concern. Changes in respiratory communicable diseases are considered to be unlikely given the limited number of construction workers, locations of construction camps (not close to PACs), and a closed camp strategy that will be in effect. Changes in underlying vector-borne, parasitic, and zoonotic disease rates are considered as unlikely. While there is likely to be some movement and mixing between workers from the PACs and "outside workers," this is unlikely to generate meaningful changes in underlying non-STI infectious disease rates over the duration of construction. However, a communicable infectious disease outbreak is always a risk in a work camp setting and has been well documented in the medical literature.

Water and Sanitation. Potential improvements due to improved access and lower distribution costs for industrial materials could occur. Historically there is significant underinvestment in water and sanitation services and maintenance at the community level. This observation was clearly made during the HIA workshop by regional health professionals. Therefore, improvements in incomes for households and regional corporations could result in tangible improvements in water/sanitation services and maintenance.

Non-Communicable and Chronic Diseases. Changes in diet composition (increased access to and lower costs for processed foods) in addition to impacts on per capita subsistence could produce long-term increases in non-communicable disease (NCD) rates. Changes in cardiovascular NCD rates do not occur within short time frames (days or weeks); however, changes in the level of obesity, hypertension, and diabetes can be seen over shorter time periods (months).

Health Services Infrastructure and Capacity. There are potential improvements due to access to fiber optic cable infrastructure (faster and more stable internet/telecommunications). There could also be improved access and lower distribution costs for clinic supplies. Improvements in access for medical staff and greater efficiency for emergency evacuations are a potential outcome. During the HIA workshop, the consensus among attending health professionals was that the proposed project would likely improve health services infrastructure and capacity during construction and operations.

4.2.3 Alternative C

Impacts for Alternative C are identical to Alternatives A and B with some exceptions: (1) exposure to NOA materials is likely to be less of an issue as the geographical distribution of known NOA is generally avoided and (2) Hughes community would be closer to the road and would be more likely to experience the suite of identified impacts. However, the overall non-NOA impacts associated with Alternative C are otherwise not materially different from Alternatives A and B.

4.3. Other Indirect and Cumulative Impacts/Indirect and Cumulative Impacts of Growth Impact Analysis

The growth impact analysis identified other indirect and cumulative impacts common to all the action alternatives as well as specific impacts from Alternative C.

4.3.1 Impacts Common to All Action Alternatives

SDH. Potential impacts are related to socioeconomic changes in household income and employment during active construction. Increases in psychosocial stress and community social cohesion at either a

household or individual level are possible. A “fly-in-fly out” workforce could have mixed effects on community cohesion (employed adults may relocate to urban areas but send remittances) and psychological stress (difficulties with scheduling time off work with local subsistence activities). Increases in goods and service distribution could result in access to better and cheaper building and supply materials. Increases in substance abuse due to greater distribution of alcohol and tobacco products are a possibility and concern. Changes in intimate partner violence and suicide rates could worsen (or improve) depending upon whether family/community cohesion declines or strengthens.

The mining development scenario is much more likely to generate a “boom and bust” cycle across PACs. After more than 40 years of study in various locations, the potential social and health impacts arising from rapid natural resource development are widely recognized. The effects can vary based on the nature of the resource activity, the stage or phase of activity, and the characteristics of the affected communities. The existing literature provides a useful background in the types of effects to consider. Chapter 3 of the HIA provides an overview of the “boom and bust” literature.

Community investigations across numerous areas in the Bakken shale oil/gas development areas in North Dakota have clearly demonstrated impacts on population; labor and jobs; housing and cost of living; infrastructure; education; services (both public and private including health); crime and changes in accident/injury rates; substance abuse; and STIs. Experience with large extractive developments clearly indicates that the Ambler PACs will likely experience one or more major boom and bust cycles over the course of mining development. Within these cycles, health impacts are likely over short- and long-term timeframes.

Accidents and Injuries. Improvements in surface and air (new landing strips associated with road construction and maintenance) infrastructure could facilitate improved emergency response times and evacuation efficiency. Possible increased interaction between community members and commercial road traffic could result in increased serious accidents and injuries. Experience with major extractive industry projects in generally remote rural settings indicates that a rise in UIs should be anticipated

Exposure to Potentially Hazardous Materials. Road development could increase the distribution and consequent inadvertent exposure to NOA materials. Increases in accidental releases (such as fuels or construction materials) could impact land and water resources. Community members believe that future mining activities, regardless of whether state and federal environmental standards are met, will result in significant release of toxic metals to local soils and rivers, resulting in flora and fauna uptake with adverse health impacts. In recent major U.S. extractive industry projects (shale/oil), there have been numerous issues raised regarding hazardous materials impacts and exposures (Konkel 2016). The suite of chemicals and process that potentially generate chemical releases and exposures are different with oil and gas development versus mining. Regardless of these process differences, stakeholders clearly expressed numerous concerns regarding the general environmental impacts of extractive industry development. Hence, these stakeholder concerns were considered in the overall ratings.

Food, Nutrition, and Subsistence Activity. The overall ratings were informed by the analysis in the Subsistence Uses and Resources analysis (EIS Section 3.4.7 and Appendix L). Increased economic benefits may decrease the number of food-insecure households. Improved incomes may allow for purchase of better snowmachines and hunting/fishing supplies that would facilitate subsistence activities. There may be potential impacts to access, quantity, and quality (real or perceived) related to increased competition for resources (induced access), negative changes in large animal migration patterns, and habitat fragmentation related to physical structures and linear features development. Impacts on the overall quantity of subsistence harvesting can have cascading effects on long-term non-communicable disease rates, such as diabetes. There is a consistently expressed stakeholder concern that mining

activities could impact subsistence quality ("toxic contamination"), particularly related to fish resources, but also affecting mammals and critical plants.

Infectious Diseases including STIs. Increases in STIs related to in-migration and increased incomes (transactional sex) are a concern and often associated with the "boom and bust" cycle. Changes in zoonotic, vector-borne disease transmission are considered unlikely. Increases in vaccine preventable diseases are possible in association with large construction work camps.

Water and Sanitation. Potential improvements due to improved access and lower distribution costs for industrial materials could occur. There will likely enhanced opportunities for sustainable community level infrastructure investments and improvements.

Non-Communicable and Chronic Diseases. Changes in diet (increased access to and lower costs for processed foods) in addition to impacts on per capita subsistence are associated with long-term increases in NCD rates, particularly cardiovascular/stroke. Changes in levels of obesity, hypertension, and diabetes could be experienced across the PACs.

Health Services Infrastructure and Capacity. There are potential improvements due to access to fiber optic cable infrastructure (faster and more stable internet/telecommunications). Improved access and lower distribution costs for clinic supplies could occur. Improvements in access for medical staff and greater efficiency for emergency evacuations are a potential outcome. During the HIA workshop, the consensus among attending health professionals was that the mining development scenario would likely improve overall health services infrastructure and capacity.

4.3.2 Alternative C

Impacts are identical to Alternatives A and B with the following exceptions:

- Exposure to NOA materials is likely to be less of an issue as the geographical distribution of known NOA is generally avoided; hence, the long-term potential exposure effects to NOA are less likely.
- Hughes community would be closer to the road and would be more likely to experience the same suite of described impacts. However, the overall non-NOA impacts associated with Alternative C are otherwise not materially different from Alternatives A and B.

4.4. Understanding Impact Ratings

The initial Impact ratings are transformed from a numerical rating into four different categories (Step 4). As described in the ADHSS 2015 guidelines, Table 45 presents the categories, potential action steps, and health monitoring that should be considered.

Table 45. Impact Categories

Category	Action Steps	Monitoring	NEPA Correlation
1	None	Standard health surveillance	Not Significant
2	Described	Standard health surveillance	Not Significant
3	Recommended	Impact specific monitoring	Significant
4	Strongly recommend	Impact specific monitoring	Significant

For impacts rated as **Categories 1 and 2**, action steps are typically not needed, and any monitoring of health impacts can be completed by standard public health surveillance methods already in effect. Impacts rated as **Categories 3 and 4 are considered significant** and would potentially trigger periodic active surveillance in order to assess whether important health changes were occurring.

Potential action steps to assess the variety of potential impacts to health are presented in Chapter 5 of the HIA.

4.4.1 Impacts Common to All Alternatives HECs #1-8

The following tables summarize health impacts for each HEC.

Table 46. Summary of HEC 1 Impact: Social Determinants of Health – Road (Direct Effects)

Health Impact	Health Effect	Duration	Magnitude	Extent	Total	Likelihood Rating	Impact Rating	Impact Level
Increase in household incomes, employment, and education attainment	2	2	2	2	8	***	**Category 3**	**Significant**
Increases in psychological stress and stability for individual and family (includes teen pregnancy)	2	3	2	2	9	***	**Category 3**	**Significant**
Increases in substance abuse (including drug, tobacco, and alcohol)	3	3	3	2	11	****	**Category 4**	**Significant**
Increases in intentional injuries, including gender-based violence	2	3	2	2	9	***	**Category 3**	**Significant**
Increase in suicide rates	2	3	2	2	9	***	**Category 3**	**Significant**
Changes in family/community cohesion	1	2	2	2	7	***	**Category 3**	**Significant**

Table 47. Summary of HEC 2 Impact: Accidents and Injuries – Road (Direct Effects)

Health Impact	Health Effect	Duration	Magnitude	Extent	Total	Likelihood Rating	Impact Rating	Impact Level
Improvements in emergency response times and evacuation	1	3	2	2	8	***	**Category 3**	**Significant**
Increases in unintentional accidents and injuries (surface/water/air modalities) morbidity and mortality rates due to village interaction with road transportation traffic	2	3	2	2	9	***	**Category 3**	**Significant**

Table 48. Summary of HEC 3 Impact: Hazardous Materials – Road (Direct Effects)

Health Impact	Health Effect	Duration	Magnitude	Extent	Total	Likelihood Rating	Impact Rating	Impact Level
Increased risk of exposure to Naturally Occurring Asbestos (NOA)	3	3	3	2	11	****	**Category 4**	**Significant**
Increased exposure to non-NOA potentially hazardous chemicals in air, water and soils	1	2	1	2	6	**	**Category 2**	**Not Significant**
Bioaccumulation in flora (plants) and fauna (animals)	0	2	1	1	4	*	**Category 1**	**Not Significant**
Increased risk of release event due to a road traffic accident	2	3	3	2	10	****	**Category 4**	**Significant**
Increased risk of community driven fuel release events at road transfer points	1	2	1	2	6	**	**Category 2**	**Not Significant**

Table 49. Summary of HEC 4 Impact: Food, Nutrition and Subsistence – Road (Direct Effects)

Health Impact	Health Effect	Duration	Magnitude	Extent	Total	Likelihood Rating	Impact Rating	Impact Level
Decrease in food transportation costs to trade stores (assumes road access to commercial transport vehicles)	2	3	2	2	9	***	**Category 3**	**Significant**
Decreased access to subsistence flora and fauna	2	3	2	2	9	***	**Category 3**	**Significant**
Decreased quantity of subsistence flora and fauna, includes competition for resource and changes in animal migration patterns	2	3	2	2	9	***	**Category 3**	**Significant**
Decreased quality (perceived or actual) of subsistence flora and fauna due to dusts including NOA	2	3	2	2	9	***	**Category 3**	**Significant**

Health Impact	Health Effect	Duration	Magnitude	Extent	Total	Likelihood Rating	Impact Rating	Impact Level
Decrease in food security due to changes in access, quantity, and quality of subsistence resources	2	3	2	2	9	***	**Category 3**	**Significant**
Change in overall diet composition—increase processed/commercial foods versus subsistence	2	3	3	2	10	***	**Category 4**	**Significant**

Table 50. Summary of HEC 5 Impact: Infectious Diseases – Road (Direct Effects)

Health Impact	Health Effect	Duration	Magnitude	Extent	Total	Likelihood Rating	Impact Rating	Impact Level
Increase in STI rates (including gonorrhea, chlamydia, Hepatitis C, and HIV)	2	3	2	3	10	****	**Category 4**	**Significant**
Increase in infectious (respiratory) disease morbidity and mortality rates (such as influenza, pneumonia, and TB)	2	2	2	2	8	**	**Category 2**	**Not Significant**
Increase in rates of foodborne illness	1	2	1	2	6	**	**Category 2**	**Not Significant**
Introduction of new infectious diseases—zoonotic, parasitic and vector borne	1	2	1	2	6	**	**Category 2**	**Not Significant**
Increase in rates of vaccine preventable diseases	2	3	2	3	10	***	**Category 3**	**Significant**

Table 51. Summary of HEC 6 Impact: Water and Sanitation – Road (Direct Effects)

Health Impact	Health Effect	Duration	Magnitude	Extent	Total	Likelihood Rating	Impact Rating	Impact Level
Decrease in morbidity and mortality rates due to improvements in access, quantity, and quality of water and sanitation facilities (improved income [employment] and village finances)	2	2	2	2	8	***	**Category 3**	**Significant**
Increase in morbidity and mortality rates due to changes in access, quantity and quality of water and sanitation facilities	1	2	1	2	6	**	**Category 2**	**Not Significant**

Table 52. Summary of HEC 7 Impact: Non-Communicable Diseases – Road (Direct Effects)

Health Impact	Health Effect	Duration	Magnitude	Extent	Total	Likelihood Rating	Impact Rating	Impact Level
Increase in cancer, respiratory, and cardiovascular morbidity and mortality rates due to changes in diet and activity associated with decline in subsistence versus trade store food products	2	2	2	2	8	***	**Category 3**	**Significant**

Table 53. Summary of HEC 8 Impact: Health Services Infrastructure Capacity – Road (Direct Effects)

Health Impact	Health Effect	Duration	Magnitude	Extent	Total	Likelihood Rating	Impact Rating	Impact Level
Improved telecommunications including access to Ambler Project fiber cable	2	2	2	2	8	***	**Category 3**	**Significant**
Broader public use, particularly for emergency accident response	2	2	2	2	8	***	**Category 3**	**Significant**

4.4.2 Alternative C Road Direct Effects

Direct effects from Alternative C are summarized in Table 55.

Table 54. Summary of HEC 3 Impact: Hazardous Materials – Alternative C Road Direct Effects

Health Impact	Health Effect	Duration	Magnitude	Extent	Total	Likelihood Rating	Impact Rating	Impact Level
Increased risk of exposure to NOA	3	3	3	1	10	***	**Category 3**	**Significant**

4.5. Other Indirect and Cumulative Impacts/Indirect and Cumulative Impacts of Growth (Mining Development Scenario)

Other indirect and cumulative impacts common to all the action alternatives as well as specific impacts from Alternative C are summarized in tables within this section.

4.5.1 Impacts Common to All Alternatives HECs #1-8

The following tables summarize the impacts common to all action alternatives for each HEC.

Table 55. Summary of HEC 1 Impact: Social Determinants of Health – Future Mining (Indirect and Cumulative Effects)

Health Impact	Health Effect	Duration	Magnitude	Extent	Total	Likelihood Rating	Impact Rating	Impact Level
Increase in household incomes, employment, and education attainment	3	3	3	3	12	****	**Category 4**	**Significant**
Increases in psychological stress and stability for individual and family (includes teen pregnancy)	3	3	3	3	12	****	**Category 4**	**Significant**
Increases in substance abuse (including drug, tobacco, and alcohol)	3	3	3	3	12	****	**Category 4**	**Significant**

Health Impact	Health Effect	Duration	Magnitude	Extent	Total	Likelihood Rating	Impact Rating	Impact Level
Increases in intentional injuries, including gender-based violence	2	3	2	2	9	***	**Category 3**	**Significant**
Increase in suicide rates	2	3	2	2	9	***	**Category 3**	**Significant**
Changes in family/community cohesion	2	3	2	2	9	***	**Category 3**	**Significant**

Table 56. Summary of HEC 2 Impact: Accidents and Injuries – Future Mining (Indirect and Cumulative Effects)

Health Impact	Health Effect	Duration	Magnitude	Extent	Total	Likelihood Rating	Impact Rating	Impact Level
Improvements in emergency response times and evacuation	3	3	3	2	11	****	**Category 4**	**Significant**
Increases in unintentional accidents and injuries (surface/water/air modalities) morbidity and mortality rates due to village interaction with road transportation traffic	2	3	2	2	9	***	**Category 3**	**Significant**

Table 57. Summary of HEC 3 Impact: Hazardous Materials – Future Mining (Indirect and Cumulative Effects)

Health Impact	Health Effect	Duration	Magnitude	Extent	Total	Likelihood Rating	Impact Rating	Impact Level
Increased risk of exposure to NOA	3	3	3	1	10	****	**Category 4**	**Significant**
Increased exposure to non-NOA potentially hazardous chemicals in air, water and soils	2	3	2	2	9	***	**Category 3**	**Significant**
Bioaccumulation in flora (plants) and fauna (animals) non NOA	2	3	2	2	9	***	**Category 3**	**Significant**
Increased risk of release event due to a road traffic accident	2	3	2	2	9	***	**Category 3**	**Significant**

Health Impact	Health Effect	Duration	Magnitude	Extent	Total	Likelihood Rating	Impact Rating	Impact Level
Increased risk of community driven fuel release events at road transfer and potential spur points (Kobuk, Ambler, and Shungnak)	2	3	2	2	8	***	**Category 3**	**Significant**

Table 58. Summary of HEC 4 Impact: Food, Nutrition and Subsistence – Future Mining (Indirect and Cumulative Effects)

Health Impact	Health Effect	Duration	Magnitude	Extent	Total	Likelihood Rating	Impact Rating	Impact Level
Decrease in food transportation costs to trade stores (assumes road access to commercial transport vehicles)	2	3	2	2	9	****	**Category 4**	**Significant**
Decrease in overall household level/community food insecurity due to increased availability of commercial food products	2	3	2	2	9	***	**Category 3**	**Significant**
Decreased access to subsistence flora and fauna	3	3	3	2	11	****	**Category 4**	**Significant**
Decreased quantity of subsistence flora and fauna, includes competition for resource and changes in animal migration patterns	3	3	3	2	11	****	**Category 4**	**Significant**
Decreased quality (perceived or actual) of subsistence flora and fauna due to dusts including NOA	3	3	3	2	11	****	**Category 4**	**Significant**
Decrease in food security due to changes in access, quantity and quality of subsistence resources	3	3	3	2	11	****	**Category 4**	**Significant**
Change in overall diet composition—increase processed/commercial foods versus subsistence	3	3	3	2	11	****	**Category 4**	**Significant**

Table 59. Summary of HEC 5 Impact: Infectious Diseases – Future Mining (Indirect and Cumulative Effects)

Health Impact	Health Effect	Duration	Magnitude	Extent	Total	Likelihood Rating	Impact Rating	Impact Level
Increase in sexually transmitted infection rates (including gonorrhea, chlamydia, Hepatitis C, and HIV)	2	3	2	2	9	***	**Category 3**	**Significant**
Increase in infectious (respiratory) disease morbidity and mortality rates (such as influenza, pneumonia, and TB)	2	3	2	2	8	***	**Category 3**	**Significant**
Increase in rates of foodborne illness	1	3	1	2	7	**	**Category 2**	**Not Significant**
Introduction of new infectious diseases—zoonotic, parasitic and vector borne	1	3	1	2	7	**	**Category 2**	**Not Significant**
Increase in vaccine preventable diseases	2	3	2	2	9	***	**Category 3**	**Significant**

Table 60. Summary of HEC 6 Impact: Water and Sanitation – Future Mining (Indirect and Cumulative Effects)

Health Impact	Health Effect	Duration	Magnitude	Extent	Total	Likelihood Rating	Impact Rating	Impact Level
Decrease in morbidity and mortality rates due to improvements in access, quantity and quality of water and sanitation facilities (improved income [employment] and village finances)	2	3	2	2	9	***	**Category 3**	**Significant**
Increase in morbidity and mortality rates due to changes in access, quantity and quality of water and sanitation facilities	2	3	2	2	8	***	**Category 3**	**Significant**

Table 61. Summary of HEC 7 Impact: Non-Communicable Diseases – Future Mining (Indirect and Cumulative Effects)

Health Impact	Health Effect	Duration	Magnitude	Extent	Total	Likelihood Rating	Impact Rating	Impact Level
Increase in cancer, respiratory, and cardiovascular morbidity and mortality rates due to changes in diet and activity associated with decline in subsistence versus trade store food products	3	3	3	2	11	****	**Category 4**	**Significant**

Table 62. Summary of HEC 8 Impact: Health Services Infrastructure Capacity – Future Mining (Indirect and Cumulative Effects)

Health Impact	Health Effect	Duration	Magnitude	Extent	Total	Likelihood Rating	Impact Rating	Impact Level
Improved telecommunications including access to Ambler Project fiber cable	2	3	2	2	9	***	**Category 3**	**Significant**
Broader public use, particularly for emergency accident response	2	3	2	2	9	***	**Category 3**	**Significant**
Improved income streams/royalties with increases in overall investment in health services including staffing	2	3	2	2	8	***	**Category 3**	**Significant**
Improvement in ability to perform search and rescue access and funding	2	3	2	2	8	***	**Category 3**	**Significant**
Decreased availability of CHAPs due to employment at local mines	2	3	2	2	9	***	**Category 3**	**Significant**

4.5.2 Alternative C Impacts

Table 63 summarizes impacts from Alternative C.

Table 63. Summary of HEC 3 Impact: Hazardous Materials – Future Mining (Indirect and Cumulative Effects)

Health Impact	Health Effect	Duration	Magnitude	Extent	Total	Likelihood Rating	Impact Rating	Impact Level
Increased risk of exposure to NOA	3	3	3	1	10	***	**Category 4**	**Significant**

5. Recommendations

Recommendations in this section are based on the importance ratings from Chapter 4. Impacts provide all stakeholders an opportunity to see how the proposed project could affect the health and wellbeing of the PACs.

5.1. Approach

Potential mitigation strategies include participatory monitoring, health education and promotion. These strategies are all well established and recognized in the preventive medicine and public health literature. The following considerations are important for health mitigations:

- Type of prevention activity required (such as primary versus secondary or tertiary prevention)
- Availability of different strategies (such as engineering intervention affecting water quantity, sanitation, etc.)
- Availability of interim measures or modifications
- Local stakeholder input and participation regarding the proposed recommendations
- Recognition of the primary role of environmental regulators/agencies in measuring, monitoring and managing potential impacts of hazardous materials
- Roles and responsibilities for implementing the recommendations.

Potential impacts were developed based on detailed and extensive analysis of project description, available environmental and social studies, characteristics of PACs, and within the framework of ADHSS HECs.

A combination of health promotion/education and primary prevention is likely to be the most efficient and cost-effective method of managing potential impacts. Therefore, the management recommendations propose a series of practical approaches that are evidence based and consistent with existing local, state, and national health directives.

Finally, impact management strategies should consider that a variety of community-level impacts could occur. For example, rapid changes in household income and employment could produce improvement in overall population-level health status. Therefore, the monitoring and management system should be capable of capturing a variety of trends across the communities over different time scales.

5.2. Management Recommendations

Potential controversy associated with projects and community polarizations are known situations for complex transportation and extractive industry projects that are developed in remote, rural settings. There is substantial experience in the U.S. and other countries in managing this challenge. It is very important to manage the development process proactively and collaboratively and consider some of the established good practice approaches and principles that have been developed over decades of worldwide experience in similar situations.

One of the overall resources for developing programs to manage potential impacts is informed by: (1) public health strategies development by the CDC, (2) published, peer-reviewed public health literature,

(3) ADHSS and ANTHC public health guidance, (4) leading international development agencies (such as World Bank group), and (5) industry trade association such as the International Council on Mining and Metals. Community-based participatory monitoring is a potential strategy that can be considered, as it is increasingly associated with enhanced community "buy-in." There is potential to impact the social/health situation with a coordinated effort among tribal organizations. Regardless of strategy it is critical that a suite of measurable and objective key performance indicators be developed. Fortunately, there is an extensive and well-developed public health surveillance system managed by both ADHSS and ANTHC.

Community health management actions are measures that aim to avoid, minimize, eliminate or remedy an adverse effect, or maximize a potential benefit. The process to develop health management programs should include a reassessment component to ensure that the strategies and programs selected are effective. Based on the focus of the intervention, impact management measures can be divided into different categories:

- Actions under the project proponents' direct control
- Activities requiring action through others (such as contractors and sub-contractors and/or host communities and their governing structures).

Health management strategies that address these two categories are typically organized around anticipating, recognizing and evaluating impacts. Implementation plans focus on control strategies such as prevention, elimination and minimization.

5.3. Impact Management Summary

Table 64 summarizes health impacts, mitigations, and monitoring and evaluation strategies that have been developed for Category 3 and 4 impacts. Many of the management measures require collaboration with local community members and Tribal government structures and should be very carefully planned and coordinated to maximize communication, cultural sensitivity, awareness, and effectiveness.

Table 64. Health Management Plan

HEC	Potential Impacts	Action Steps	Monitoring and Evaluation Approaches
SDH	Increase in household incomes, employment, and education attainment Increases in psychological stress and stability, individual and family (includes teen pregnancy) Increases in substance abuse (including drug, tobacco, and alcohol) Increases in intentional injuries, including gender-based violence Increase in suicide rates Changes in family/community cohesion	**Provide worker education and support community programs regarding:** • Suicide prevention, mental health, and personal wellness • Substance abuse prevention and smoking cessation • Family cohesion, prevention of domestic violence and child abuse • Sexual health and preventing unwanted pregnancy • Financial planning • Community engagement with mining project and plans **Implement best practices for workforce management:** • Dry, drug-free, and closed work camps • Workplace alcohol, drug, and sexual harassment policies • Prioritize local hire according to project needs	**Monitor health outcomes:** • Suicide rates • Substance use/abuse/treatment rates • Intimate partner violence, sexual assault, child abuse • Unwanted pregnancy rates **Monitor health determinants:** • Divorce rates • Verify closed work camps through site audits • Median household income, percentage of unemployment • Percentage living below poverty line • Percentage of workers who complete health and wellness course • Population influx and outmigration • Crime statistics, school absences, academic achievement • Housing inflation, food costs **Evaluate best practices for workforce management:** • Use of closed, dry, drug-free work camps • Percentage of local hires suitable to project needs • Work shift schedules suitable to cultural and family cohesion

HEC	Potential Impacts	Action Steps	Monitoring and Evaluation Approaches
Accidents and Injuries	Improvements in emergency response times and evacuation. Increases in unintentional accidents and injuries (surface/water/air modalities) morbidity and mortality rates due to Village interaction with road transportation traffic	**Provide workplace training and certification modules:** • Assure driver/operator training and annual certification • Implement strict alcohol and drug policies • Implement fatigue management policies • Investigate all accidents • Implement journey management plans **Employ transportation planning cycles:** • Identify key interaction points between project transport activities and community transportation needs • Establish emergency response plans for off-site accidents, injuries, and hazardous materials releases • Perform drills coordinated with local emergency response services	**Monitor health outcomes:** • Fatal and non-fatal transportation incidents • All fatal and non-fatal injuries **Monitor health determinants:** • VPSO presence in communities • Percentage of incidents that involve alcohol or drugs • Monitor Alaska Trauma Registry data annually • Effectiveness of workplace motor vehicle safety programs

HEC	Potential Impacts	Action Steps	Monitoring and Evaluation Approaches
Exposure to Potentially Hazardous Materials	Increased risk of exposure to NOA Impacts on air, water, soil quality Increased exposure to potentially hazardous chemicals in air, water and soils Bioaccumulation in flora and fauna Increased risk of release event due to a road traffic accident Increased risk of community driven fuel release events at road transfer points	**Follow standard regulatory requirements for NOA management** **Provide workplace training and certification modules:** • Assure driver/operator training and annual certification • Implement strict alcohol and drug policies • Implement fatigue management policies • Investigate all accidents • Implement journey management plans **Employ transportation planning cycles:** • Identify key interaction points between project transport activities and community transportation needs • In collaboration with local emergency response organizations and health organizations, establish emergency response plans for off-site hazardous materials releases • Perform drills coordinated with local emergency response services	**Monitor for key health outcomes:** • Fatal and non-fatal transportation incidents • All fatal and non-fatal injuries and illnesses **Monitor for key health determinants:** • Changes in fish and berry/vegetable consumption from Alaska Department of Fish and Game surveys • Subsistence participation rates
Food, Nutrition, and Subsistence	Decrease in food transportation costs to trade stores (assumes road access to commercial transport vehicles) Increased risk of adverse effects on access to subsistence flora and fauna	**Provide workforce and community education regarding:** • Health benefits and safety of subsistence foods • Healthy diet and nutritional practices • Results of fish and wildlife sampling on an ongoing basis **Provide workforce opportunities for subsistence participation through rotation schedules that allow for subsistence**	**Monitor key health outcomes:** • Rates and trends for diabetes, obesity, metabolic syndrome **Monitor key health determinants:** • Change in the percentage of food secure households • Changes to subsistence consumption estimated from harvest surveys

HEC	Potential Impacts	Action Steps	Monitoring and Evaluation Approaches
	Increased risk of adverse effects on quantity of subsistence flora and fauna, includes competition for resource and changes in animal migration patterns Increased risk of adverse effects on quality (perceived or actual) of subsistence flora and fauna due to dusts including NOA Decrease in food security due to changes in access, quantity and quality of subsistence resources Change in overall diet composition - increase processed/commercial foods versus subsistence Decrease in subsistence consumption based on harvest survey data	**practices during key seasons in the home village** **Conduct ongoing monitoring of animal migration patterns** **Communicate any hazardous materials sampling results (such as NOA) to local communities and educate regarding results**	
Infectious Diseases	Increase in the rates of STIs such as gonorrhea, chlamydia, syphilis and HIV	**Implement closed alcohol and drug-free camps for non-resident workforce at mine sites, and at major transport/construction sites:** • Mandatory STI education for all new employees • Diagnosis and treatment of STIs at the occupational medicine clinics sponsored by applicant • Offer Expedited Partner Therapy and promptly report cases of workers	**Monitor key health outcomes:** • Regional rates of STIs **Monitor key health determinants:** • Presence of STI education programs for workers • Presence of disease intervention resources in the community

HEC	Potential Impacts	Action Steps	Monitoring and Evaluation Approaches
		diagnosed with chlamydia, gonorrhea, syphilis, and HIV	
Infectious Diseases	Increase in infectious (respiratory) disease morbidity and mortality rates (such as influenza, pneumonia and TB)	**Implement a respiratory disease prevention and control strategy in the workplace that includes:** • Assure that all workers are given annual influenza vaccination • Provide worker education on respiratory hygiene • Assure worker TB testing/treatment • Assure written policies and procedures for appropriate isolation of ill workers in camps • Construct work camps according to applicable state and federal space per occupant and ventilation requirements • Make hand sanitizer readily available in communal areas of work camps	**Monitor key health outcomes:** • Regional rates of infectious respiratory disease • Regional outbreaks of respiratory disease **Monitor key health determinants:** • Occupancy rates/overcrowding in work camp accommodations • Presence of respiratory disease prevention programs for TB, influenza, pneumonia in workforce • Presence of selected screening programs (such as TB) for non-resident workers
Infectious Diseases	Increase in the rates of vaccine preventable diseases	**Require documentation that all workers are up to date with all CDC-recommended vaccines for adults** **Provide workforce education and collaborate with community health providers to conduct community education regarding vaccination importance/efficacy and disease prevention/outcomes**	**Monitor key health outcomes:** • Review the vaccination status of all workers annually • Monitor rates of vaccine preventable disease • Monitor regional outbreaks of vaccine preventable diseases
Infectious Diseases	Increase in rates of foodborne illness	**Implement food safety and disposal strategy in the workplace that emphasizes:** • Adequate hand washing and sanitary policies for all catering services • Industry standard food storage, preparation, and disposal policies	**Monitor key health outcomes:** • Foodborne illness or outbreaks in camps or in local communities

HEC	Potential Impacts	Action Steps	Monitoring and Evaluation Approaches
Infectious Diseases	Introduction of new infectious diseases—zoonotic, parasitic and vector borne	**Monitor zoonotic, parasitic, and vector related diseases in the project areas** **Develop and implement disease prevention, control and monitoring plans as new health risks arise**	**Monitor key health outcomes:** • Regional outbreaks **Monitor key health determinants:** • Vector presence in project areas
Water and Sanitation	Decrease in morbidity and mortality rates due to improvements in access, quantity and quality of water and sanitation facilities (improved income [employment] and village finances)	**Collaborate with Tribal organizations to coordinate road drop off point locations that will be conducive for the delivery of water/sanitation equipment necessary for to construct water/sanitation facilities locally**	**Monitor key health outcomes:** • Regional outbreaks in water / sanitation related diseases **Monitor key health determinants:** • Compliance with worker water/sanitation requirements • Presence and use of safe water/ sanitation facilities in project areas
Water and Sanitation	Increase in morbidity and mortality rates due to changes in access, quantity and quality of water and sanitation facilities	**Provide temporary worker sanitation facilities during construction activities according to regulatory requirements** **Provide workforce education and collaborate with community tribal organizations to support community education and participatory programs regarding water/sanitation and disease prevention/outcomes**	**Monitor key health outcomes:** • Regional outbreaks in water/sanitation related diseases **Monitor key health determinants:** • Compliance with worker water/sanitation requirements • Presence and use of safe water/ sanitation facilities in project areas

HEC	Potential Impacts	Action Steps	Monitoring and Evaluation Approaches
Non-Communicable and Chronic Diseases	Increase in cancer, respiratory, and cardiovascular morbidity and mortality rates due to changes in diet and activity associated with decline in subsistence versus trade store food products	**Provide workforce education and support community education regarding:** • Health benefits and safety of subsistence foods • Healthy diet choices and nutritional practices • Healthy physical activity habits • Importance of screening for chronic diseases • Depression and anxiety **Provide workplace wellness programming that includes fitness facilities, screening for chronic diseases, and incentives for physical wellness:** • Obesity and overweight • Diabetes • Hyperlipidemia • Hypertension • Smoking cessation • Increasing physical activity	**Monitor key health outcomes:** • Regional rates of chronic diseases such as obesity, diabetes, hyperlipidemia, hypertension • Regional rates of lung cancer and colon cancer • Regional rates of heart disease and cerebrovascular diseases **Monitor key health determinants:** • Cost of regional food items • Culturally and regionally appropriate opportunities for increasing physical activity • Screening rates for chronic diseases including cancer
Health Infrastructure and Capacity	Improved telecommunications including access to Ambler Project fiber cable	**Consider the importance of improved telecommunications during construction that provides for improved telecommunications for health centers**	**Monitor key health outcomes influenced by health care infrastructure and capacity, such as:** • Percentage receiving adequate or better pre-natal care • Percentage screened for chronic diseases including cancer **Monitor key health determinants related to health care infrastructure and capacity:** • Number of community health aide practitioners present in the region • Presence of collaborative emergency response plans

HEC	Potential Impacts	Action Steps	Monitoring and Evaluation Approaches
Health Infrastructure and Capacity	Broader public use, particularly for emergency accident response	**Allow roadway access for emergency care transport from one village to another village that has adequate air strip conditions to improve emergency response times**	**Monitor key health determinants related to health care infrastructure and capacity:** • Emergency response times
Health Infrastructure and Capacity	Improved income streams/royalties with increases in overall investment in health services including staffing and housing for health workers	**Collaborate with local Tribal organizations to develop overall plan addressing health worker housing to attract workers**	**Monitor key health determinants related to health care infrastructure and capacity:** • CHAP staffing, turnover and utilization rates
Health Infrastructure and Capacity	Decreased availability of CHAPs and other health workers due to employment at local mines	**Collaborate with local Tribal organizations to develop overall plan addressing local health staffing needs, including:** • Public health rotation program for medical school residents • Return for service tuition reimbursement programs for CHAPs	**Monitor key health determinants related to health care infrastructure and capacity:** • Health care staffing, turnover, and use rates

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