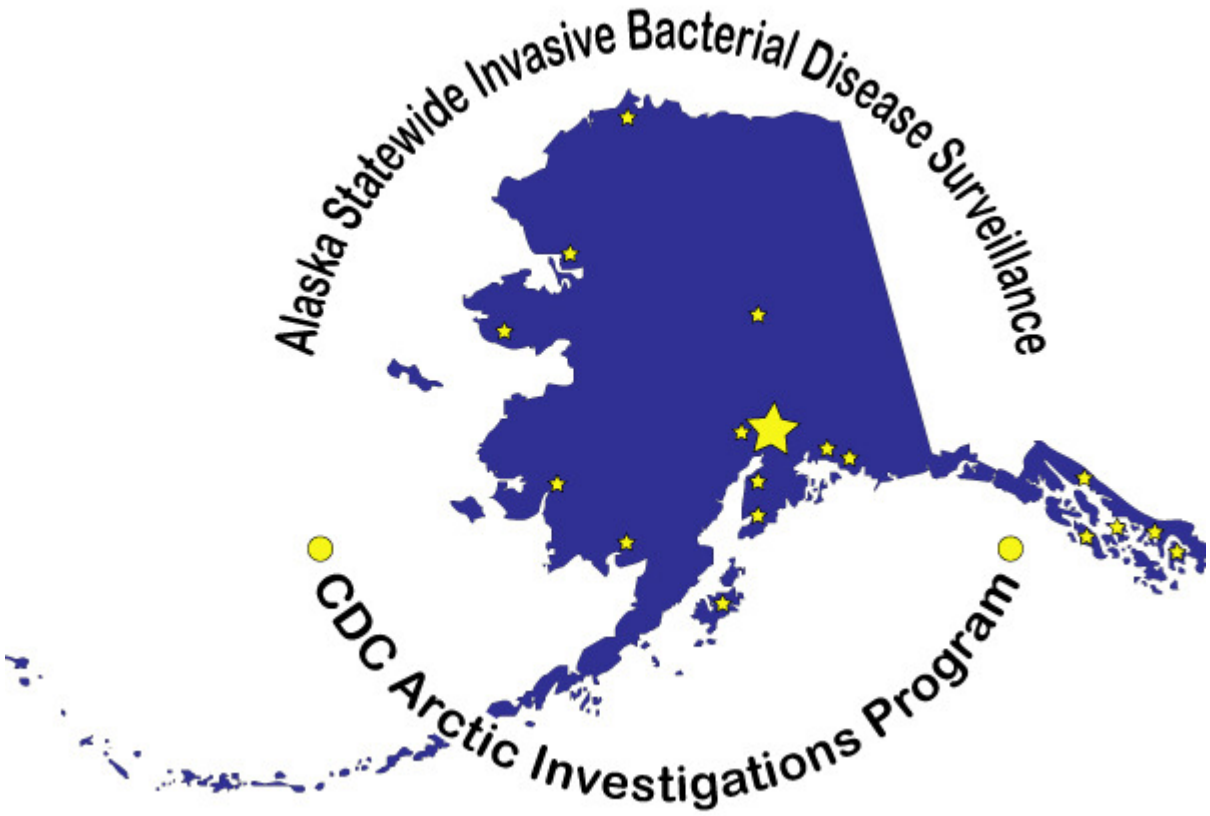

Surveillance of Invasive Bacterial Disease in Alaska, 2011

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Alaska Statewide Invasive Bacterial Disease

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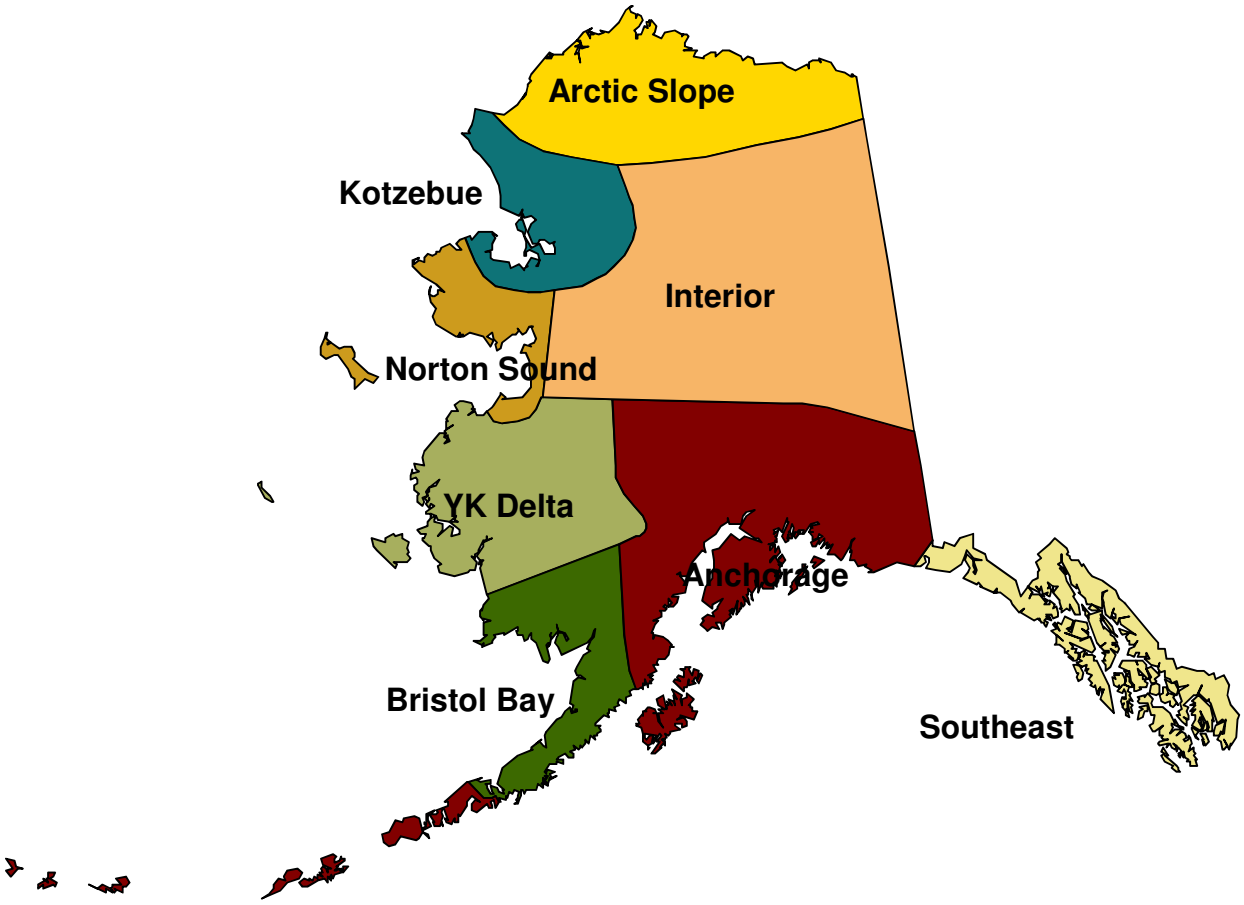
Summary

The Centers for Disease Control and Prevention's Arctic Investigations Program (AIP) in Anchorage, Alaska, maintains a statewide surveillance system for invasive diseases caused by *Streptococcus pneumoniae*, *Haemophilus influenzae, Neisseria meningitidis,* and groups A and B streptococci. Laboratories throughout the state are requested to send to AIP any isolates of these organisms recovered from a blood culture, CSF, or other normally sterile site in an Alaska resident. Isolate identification is confirmed and, when appropriate, serotyped and tested for antimicrobial susceptibility. The objectives of this system are to provide information on disease rates within the state, monitor the emergence of antimicrobial resistance, and to monitor the effectiveness of implemented vaccine programs, such as the 23-valent pneumococcal polysaccharide vaccine, the pneumococcal conjugate vaccine and *Haemophilus influenzae* type b vaccines.

Figure 1: Invasive Bacterial Disease Surveillance Regions – Alaska, 2011



In 2011, the total numbers of cases of invasive disease caused by these organisms reported to AIP were 141 *S. pneumoniae*, 24 *H. influenzae*, 2 *N. meningitidis*, 74 group A streptococci (GAS) and 40 group B streptococci (GBS). Alaska Native people had higher rates of disease overall than non-Native people for

all surveillance organisms. Rates of invasive pneumococcal disease were highest in the YK Delta and Kotzebue regions. Rates for each organism by region are presented in the following table.

Table 1: Surveillance Organisms Reported by Region – Alaska, 2011

Region	*S. pneumoniae* n (rate*)	*H. influenzae* n (rate*)	*N. meningitidis* n (rate*)	GAS n (rate*)	GBS n (rate*)
Anchorage	97 (20.3)	12 (2.5)	1 (0.2)	54 (11.3)	29 (6.1)
Arctic Slope	1 (11.6)	0 (0)	0 (0)	4 (46.5)	0 (0)
Bristol Bay	1 (13.7)	1 (13.7)	0 (0)	0 (0)	2 (27.4)
Interior	17 (15.2)	1 (0.9)	0 (0)	5 (4.5)	4 (3.6)
Kotzebue	4 (48.2)	0 (0)	0 (0)	0 (0)	0 (0)
Norton Sound	0 (0)	0 (0)	0 (0)	1 (10.3)	0 (0)
Southeast	10 (13.6)	2 (2.7)	1 (1.4)	3 (4.1)	5 (6.8)
YK Delta	11 (43.3)	8 (31.5)	0 (0)	7 (27.6)	0 (0)
Total	141 (19.5)	24 (3.3)	2 (0.3)	74 (10.2)	40 (5.5)

*Cases per 100,000 population

Introduction

AIP conducts statewide surveillance of invasive *Streptococcus pneumoniae*, *Haemophilus influenzae*, *Neisseria meningitidis*, and groups A and B *Streptococcus*. This program is part of a passive, laboratory-based surveillance system in which laboratories from all hospitals throughout the state are encouraged to participate. The population included in the AIP surveillance is the State of Alaska, which totaled 723,424 persons in 2011 [1]. Case detection occurs year-round as participating laboratories send isolates recovered from sterile sites to the AIP laboratory in Anchorage; materials and forms for isolate shipment and data collection are provided to each laboratory by AIP. Demographic and clinical information on the cases are collected from a review of medical records. At year-end, AIP asks that each laboratory review their records and provide information on any cases that may have been overlooked. In 2011, 23 laboratories in Alaska participated in the invasive disease surveillance system, either by sending isolates to the AIP laboratory throughout the year, conducting year-end record reviews, or both. Beginning in January, 2007, invasive *S. pneumoniae*, GAS and GBS became reportable conditions to the State of Alaska Division of Public Health (DPH). Reports of cases of disease caused by these organisms, along with cases of invasive *H. influenzae* and *N. meningitidis* which were previously reportable, are shared between AIP and DPH.

AIP defines a case of invasive *S. pneumoniae, H. influenzae*, *N. meningitidis*, GAS or GBS as an isolate of the bacteria from a normally sterile site, including blood, cerebrospinal fluid, pleural fluid, peritoneal fluid or joint fluid that has been taken from a resident of Alaska. In addition, for GAS, isolates are requested from deep tissue infections such as might be collected from surgical debridement of cases of necrotizing fasciitis.

Invasive Pneumococcal Disease

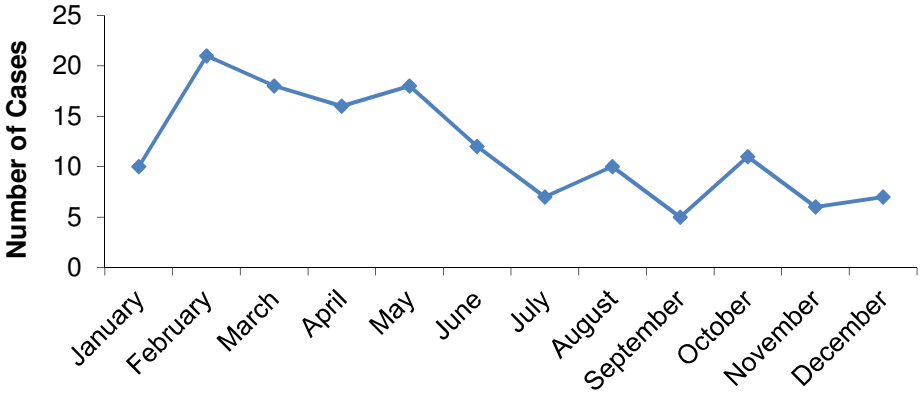
Overall Incidence

A total of 130 pneumococcal isolates were received at AIP in 2011. An additional 3 cases were detected through year-end follow up with participating laboratories and 8 cases through shared surveillance with the State DPH for a total of 141 cases of invasive pneumococcal disease. The overall rate for invasive pneumococcal disease in 2011 was 19.5 cases per 100,000 persons per year. Alaska rates for 2011 were higher than the Active Bacterial Core surveillance (ABCs) 2011 national projected rate of 11.8/100,000 [2]. ABCs is a surveillance system operated in 10 states which covers a population of up to 42 million persons.

Seasonality

Invasive *Streptococcus pneumoniae* cases were identified in each month of 2011. The largest number of cases (n=21) was reported in February.

Figure 2: Invasive Pneumococcal Disease, by Month of Culture - Alaska, 2011



Race

In 2011, the state population was comprised of 19.7% Alaska Native people *(Alaska Natives 142,162, non-Natives 582,262)* [1]. Of all reported *S. pneumoniae* cases in 2011, 40% occurred among Alaska Native people for a total of 56 cases; the age-adjusted rate was 45.1/100,000 persons per year. Eighty-five cases occurred among the non-Native population for an age-adjusted rate of 14/100,000 persons per year. The rate ratio of age-adjusted rates of *S. pneumoniae* disease for the Alaska Native population compared with the non-Native population in 2011 was 3.2.

Table 2: Invasive *Streptococcus pneumoniae* Cases by Race – Alaska, 2011

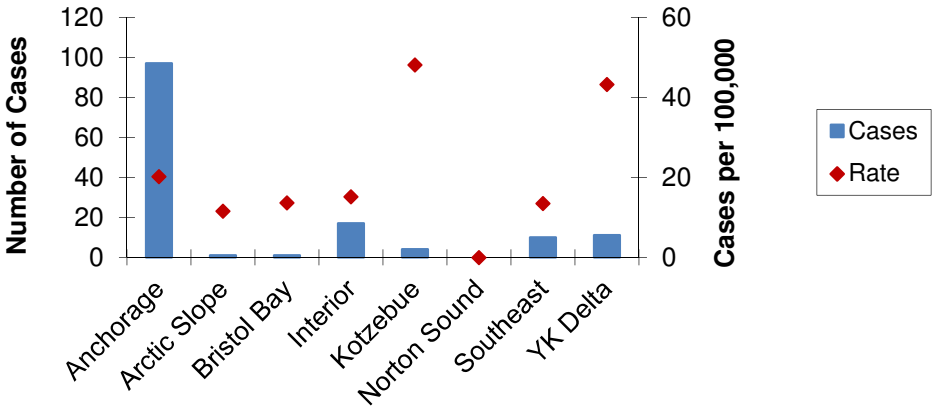
Race	Cases n (%)	Age Adjusted Rate*	% Male	Deaths n (%)
Alaska Native	56 (40)	45.1	63%	9 (16.1)
Non-Native†	85 (60)†	14	58%	12 (14.1)
Total	141		60%	21 (14.9)

*Cases per 100,000 per percent distribution of Alaska 2010 population
†Includes 17 cases for which race was unknown

Region

The highest percentage (69%) of invasive pneumococcal disease cases occurred in the Anchorage area in 2011. Rates of disease, however, were highest in the Kotzebue region (48.2/100,000 persons per year) and the YK Delta (43.3/100,000 persons per year).

Figure 3: Invasive Pneumococcal Disease, Cases & Rates by Region - Alaska, 2011

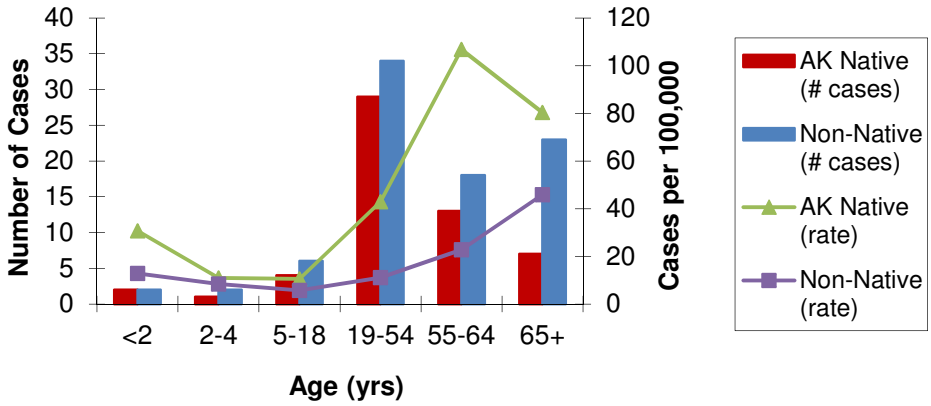


Age

Cases occurred in all age groups in 2011 ranging from 2 months to 88 years with a median age of 52 years. Overall, the highest rates of disease occurred in adults 55-64 years old.

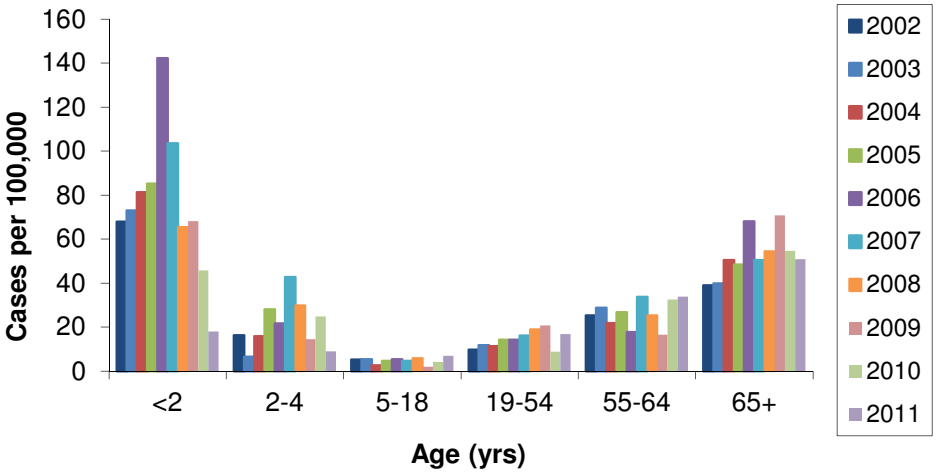
When stratified by age and race, the highest rates of disease in 2011 occurred in Alaska Native 55-64 years old (106.8/100,000 persons per year).

Figure 4: Invasive Pneumococcal Disease, Cases & Rates by Age Group & Race - Alaska, 2011



Since the initiation of a pneumococcal 7-valent conjugate vaccine program in 2001, overall rates of invasive disease declined dramatically in children less than 2 years of age [3]. In 2002, overall yearly rates of pneumococcal disease in children less than 2 years dropped to a low of 67.9/100,000 and then increased to 142.2/100,000 in 2006. In 2008, the rate of invasive pneumococcal disease in children less than 2 years declined to 65.6/100,000 which was the lowest rate observed in this age group since introduction of the 7-valent vaccine. Following introduction of a 13-valent conjugate vaccine in 2010, rates of disease observed in children less than 2 years old declined to 18/100,000 in 2011.

Figure 5: Invasive Pneumococcal Disease by Age Group - Alaska, 2002-2011



Although pneumococcal disease rates dropped initially in AK Native and non-Native children less than 2 years of age after introduction of the 7-valent vaccine, the rates of disease in AK Native children less than 2 years trended upward from a low of 93.6/100,000 in 2001 to 335.9/100,000 in 2006. This increase in rates was due primarily to disease caused by serotypes not contained in the pneumococcal conjugate vaccine [4,5]. In 2009, rates of disease in AK Native children less than 2 years declined to 87.1/100,000 which was the lowest rate since the introduction of the seven-valent pneumococcal vaccine. After introduction of the 13-valent vaccine in 2010, the rate was 116.9/100,000; this reflects

only an additional two cases from 2009 and is not statistically significant (p=0.6). Rates of invasive disease in non-Native children less than 2 years declined during the same time period reaching 26.8/100,000 in 2005, and following an increase to 64.4/100,000 in 2007, declined in 2008 to 6.2/100,000. In 2009, the rate of disease in non-Native children less than 2 years increased to 60.3/100,000, but declined to 13.3/100,000 in 2010 following introduction of the 13-valent vaccine. In 2011, disease rates in both Alaska Native and non-Native children less than 2 years decreased to 30.7/100,000 and 12.8/100,000, respectively.

Figure 6: Invasive Pneumococcal Disease in Alaska Natives, by Age Group - Alaska, 2002-2011

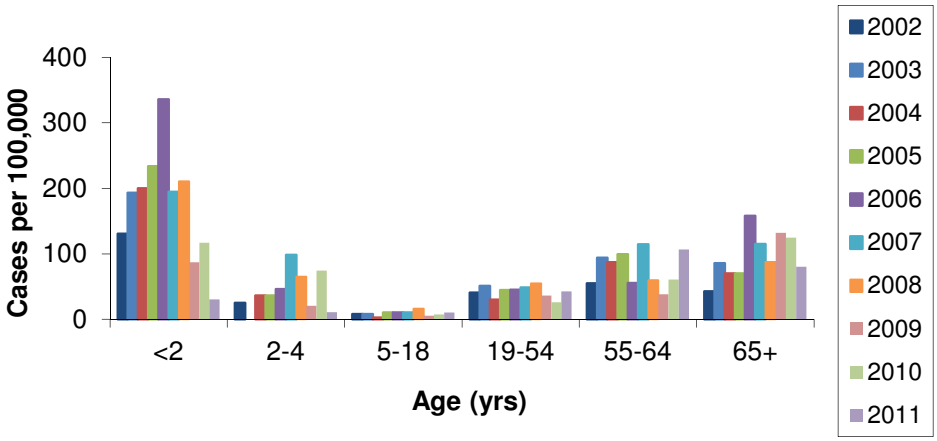
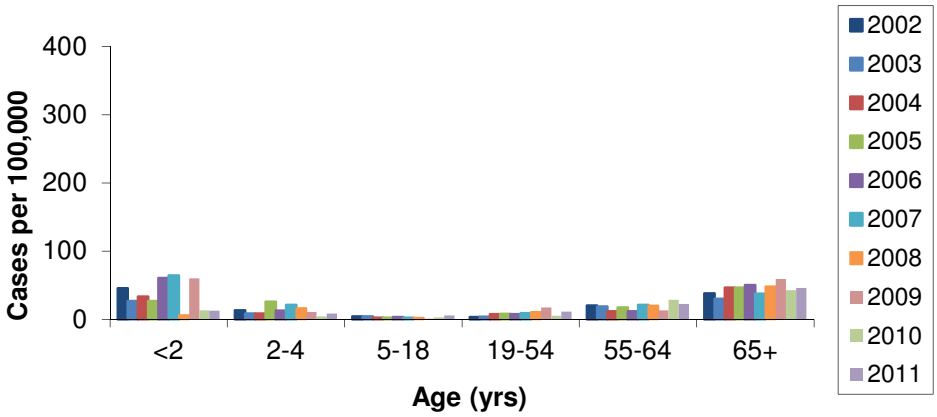


Figure 7: Invasive Pneumococcal Disease in Non-Natives, by Age Group - Alaska, 2002-2011

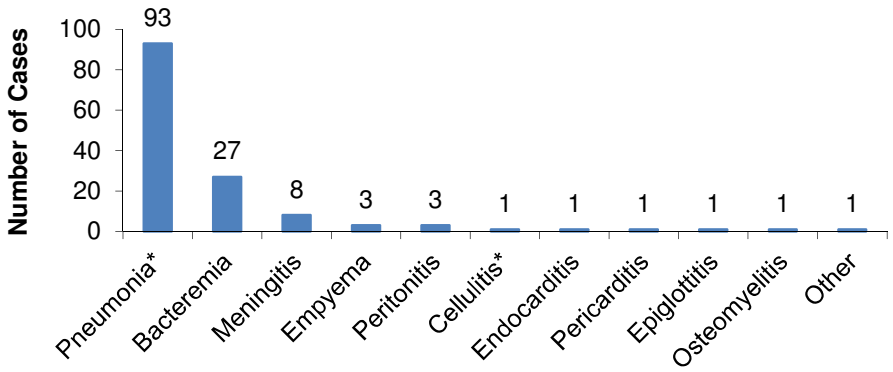


Clinical Presentation

The primary clinical presentation was determined by a review of the discharge diagnoses in each patient's individual medical record associated with the invasive bacterial illness. In cases with multiple discharge diagnoses, the most serious diagnosis related to the pneumococcal infection was recorded as the primary clinical presentation. Pneumonia with bacteremia was the most common primary clinical presentation in 2011 (66%) followed by bacteremia (19%). Fifteen cases had a secondary

pneumococcal-related diagnosis in 2011 - 10 pneumonia, 1 cellulitis, 1 endocarditis, 1 septic arthritis, 1 osteomyelitis and 1 pericarditis.

Figure 8: Primary Clinical Presentations of Invasive Pneumococcal Disease - Alaska, 2011



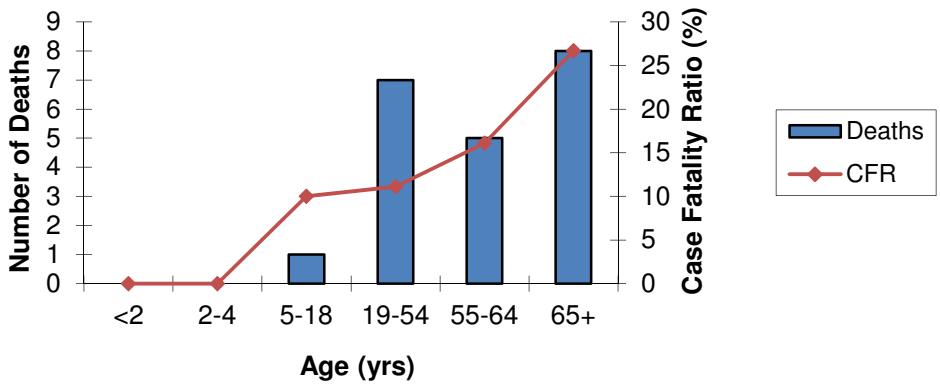
*with bacteremia

In 2011, blood was the most common source of a positive culture which was used to identify 132 (94%) of 141 cases. Cerebrospinal fluid was the positive site for 5 (4%) of cases; one case each was identified from pleural fluid, peritoneal fluid and a surgical specimen. One case was identified using PCR on CSF from a person pre-treated with antibiotics.

Mortality

In 2010, the overall case fatality ratio for *S. pneumoniae* in Alaska was 14.9% (21 deaths out of 141 cases). The case fatality ratio for AK Natives was slightly higher (16.1%, 9 deaths) than non-Natives (14.1%, 12 deaths). The largest number of deaths and the highest case fatality ratio occurred in the 65+ age category (8 deaths) 26.7%.

Figure 9: Invasive Pneumococcal Deaths & Case Fatality Ratios by Age Group - Alaska, 2011



Serotype

Serotyping of invasive pneumococcal isolates is performed at AIP using internationally standardized methods. Serotype identification is based on the organism's polysaccharide capsule which is a principal virulence factor for pneumococci. This information provides a way to categorize organisms and to determine if the infection was due to a type that could be prevented by use of one of the available pneumococcal vaccines. Serotyping was performed on all of the *S. pneumoniae* cases for which an isolate was available.

Table 3: Invasive Pneumococcal Serotype Distribution by Race and Age Group – Alaska, 2011

		Alaska Native				Non-Native			
Serotype	Total n (%)	<2	2-18	19-64	65+	<2	2-18	19-64	65+
01	1 (1)	-	-	-	-	-	-	1	-
03	12 (9)	-	-	2	1	-	-	6	3
06C	6 (5)	-	1	1	2	-	-	-	2
07C	1 (1)	-	-	-	-	-	-	1	-
07F	28 (22)	-	2	7	-	1	4	11	3
08	11 (9)	-	1	6	1	-	-	2	1
09N	4 (3)	-	-	-	-	-	-	4	-
10A	2 (2)	-	-	2	-	-	-	-	-
11A	3 (2)	-	-	1	1	-	-	-	1
12F	1 (1)	-	-	-	-	-	-	1	-
15A	6 (5)	-	1	1	-	-	-	1	3
15B	2 (2)	-	-	-	-	1	1	-	-
15C	1 (1)	1	-	-	-	-	-	-	-
16F	6 (5)	-	-	2	-	-	-	2	2
17F	1 (1)	-	-	-	-	-	-	1	-
19A	8 (6)	1	-	2	-	-	1	3	1
19F	2 (2)	-	-	-	-	-	-	2	-
20	3 (2)	-	-	2	-	-	-	1	-
22F	10 (8)	-	-	3	1	-	-	3	3
23A	4 (3)	-	-	1	-	-	-	2	1
23B	2 (2)	-	-	-	-	-	1	1	-
29	1 (1)	-	-	1	-	-	-	-	-
31	6 (5)	-	-	4	-	-	-	1	1
33A	1 (1)	-	-	1	-	-	-	-	-
33F	1 (1)	-	-	-	-	-	-	-	1
34	1 (1)	-	-	-	-	-	-	1	-
35B	1 (1)	-	-	-	-	-	-	1	-
38	3 (2)	-	-	2	-	-	1	-	-
42	1 (1)	-	-	1	-	-	-	-	-
Total	129	2	5	39	6	2	8	45	22

In 2011, the most common pneumococcal serotypes were 7F (28 isolates, 22%), 8 (11 isolates, 9%), and 22F (10 isolates, 8%). From 1986 through 2001, serotype 14 was the most common invasive pneumococcal serotype ranging from 7.4% to 23.5% of isolates. Following introduction in 2001 of the pneumococcal conjugate vaccine which includes serotype 14, the proportion of serotype 14 isolates dropped to 1.5% of serotyped isolates in 2006 and the last case was in 2009. Disease caused by serotypes 7F and 19A, which are not included in the 7-valent conjugate vaccine, continually increased until the introduction of the 13-valent vaccine in 2010 which does include these two serotypes. Although 7F cases continue to cause the most cases of invasive pneumococcal disease, the proportion of cases caused by serotype 19A has dropped from 20% in 2010 to 6% in 2011. It is anticipated that the number of cases of invasive pneumococcal disease caused by serotypes 7F and 19A will continue to decline. The majority (75%) of serotype 7F cases occurred in the Anchorage area in 2011.

Table 4: Invasive Pneumococcal Serotype Distribution by Region – Alaska, 2011

Serotype	Anchorage	Arctic Slope	Bristol Bay	Interior	Kotzebue	Norton Sound	Southeast	YK Delta
01	1	-	-	-	-	-	-	-
03	7	-	-	3	-	-	2	-
06C	4	-	-	1	-	-	-	1
07C	1	-	-	-	-	-	-	-
07F	21	-	-	2	-	-	3	2
08	6	-	-	1	-	-	-	4
09N	3	-	-	1	-	-	-	-
10A	1	-	-	-	-	-	-	1
11A	2	-	-	1	-	-	-	-
12F	-	-	-	1	-	-	-	-
15A	4	-	-	-	-	-	1	1
15B	2	-	-	-	-	-	-	-
15C	1	-	-	-	-	-	-	-
16F	4	-	-	1	-	-	-	1
17F	1	-	-	-	-	-	-	-
19A	6	-	-	-	-	-	2	-
19F	2	-	-	-	-	-	-	-
20	1	-	-	-	-	-	1	1
22F	7	-	-	3	-	-	-	-
23A	4	-	-	-	-	-	-	-
23B	2	-	-	-	-	-	-	-
29	-	-	-	1	-	-	-	-
31	5	-	-	1	-	-	-	-
33A	-	1	-	-	-	-	-	-
33F	1	-	-	-	-	-	-	-
34	1	-	-	-	-	-	-	-
35B	1	-	-	-	-	-	-	-
38	1	-	1	1	-	-	-	-
42	1	-	-	-	-	-	-	-
Unknown	7	-	-	-	4	-	1	-
Total	97	1	1	17	4	0	10	11

Vaccine Serotypes

In 2001, the pneumococcal conjugate vaccine (PCV7) was included in the Alaska childhood vaccination schedule. This vaccine provided protection against the 7 most common pneumococcal serotypes causing invasive disease among children (types 4, 6B, 9V, 14, 18C, 19F, 23F). In early 2010, a new pneumococcal conjugate vaccine (PCV13) was introduced into the Alaska childhood vaccination schedule. This vaccine provided protection against the 7 pneumococcal serotypes contained in the PCV7 vaccine plus six additional serotypes (1, 3, 5, 6A, 7F, 19A) that have caused invasive disease since the introduction of the PCV7 vaccine. The table below shows the proportion of invasive infections from 2011 that were due to serotypes found in the PCV13 vaccine. There were three cases of

pneumococcal disease caused by serotypes contained in the PCV13 vaccine in children less than 5 years of age, the age group for which the vaccine is recommended. It is anticipated that the number of cases caused by these serotypes will decrease as coverage by this vaccine increases over time.

Table 5: Proportion of Invasive Isolates Contained in the PCV13 Vaccine by Age Group and Race – Alaska, 2011

Age (yrs)	Alaska Native (%)	Non-Native (%)	Total (%)
<2	1 (50%) of 2	1 (50%) of 2	2 (50%) of 4
2-4	1 (100%) of 1	0 (0%) of 2	1 (33%) of 3
5+	13 (27%) of 49	35 (48%) of 73	48 (39%) of 122
Total	15 (29%) of 52	36 (48%) of 77	51 (40%) of 129

For the year covered by this report, the 23-valent polysaccharide vaccine (Ps23V) was recommended in Alaska for all persons 65 years and older, and for persons over age 2 who are at higher risk for pneumococcal disease [5]. In 2011, for persons 65 years and older, 17 (61%) of 28 cases serotyped were potentially vaccine preventable invasive pneumococcal illnesses.

Vaccine Failures

In 2011, pneumococcal vaccine status was known for 95 (67%) of the 141 cases; 55 cases (58%) of cases with known vaccine status did receive a pneumococcal vaccine prior to illness and 40 cases (42%) had no record of a pneumococcal vaccine.

A PCV13 vaccine failure is defined as invasive pneumococcal disease caused by a serotype contained in the PCV13 vaccine in a child less than five years old who has had at least two doses of vaccine. There was one vaccine failure in 2011; the child was 2 years old, was a premature infant and had multiple underlying conditions including chronic lung disease. Serotype of the case was 19A.

Preventable Deaths

Overall, 67% of all pneumococcal-related mortality in 2011 was preventable with the use of the 23-valent polysaccharide vaccine in persons over 2 years old; 28.5% of deaths were due to disease caused by serotypes not contained in the 23-valent vaccine.

Table 6: Vaccine Preventable Invasive Pneumococcal Deaths – Alaska, 2011

Serotypes	< 2 years	2-4	5-18	19-54	55-64	65+	Total
PCV13	0	0	0	0	0	0	0
Ps23V	0	0	0	5 (71%)	3 (60%)	6 (75%)	14 (67%)
Non-Vaccine	0	0	0	2 (29%)	1 (20%)	2 (25%)	6 (28.5%)
Unknown	0	0	0	0	1 (20%)	0	1 (4.5%)
Total	0	0	0	7	5	8	21

Fourteen of the 21 deaths in 2011 from invasive *S. pneumoniae* occurred from serotypes contained within the Ps23V vaccine; 6 of the deaths were in individuals eligible for the vaccine. Of those six deaths, five occurred in vaccinated individuals; time since vaccination ranged from 10 months to nine years.

Table 7: Invasive Pneumococcal Disease, Serotypes of Fatal Cases – Alaska, 2011

Serotype	Deaths n (%)	Serotype Frequency (n)
03†*	2 (17%)	12
07C	1 (100%)	1
07F†*	1 (4%)	28
08*	3 (27%)	11
09N*	1 (25%)	4
10A*	2 (100%)	2
11A*	2 (67%)	3
15A	2 (33%)	6
16F	1 (17%)	6
19A†*	1 (13%)	8
22F*	2 (20%)	10
23B	1 (50%)	2
34	1 (100%)	1

† Serotypes contained in the 13-valent conjugate vaccine
*Serotypes contained in the 23-valent polysaccharide vaccine

Associated Risk Factors

The presence of one or more associated risk factors was reported in 89% of invasive pneumococcal cases in 2011. Cigarette smoking was the most prevalent risk factor observed in adults followed by alcohol abuse and chronic lung disease.

Table 8: Associated Risk Factors Identified in Invasive Pneumococcal Cases – Alaska, 2011*

Medical Condition/Risk Factor	Adult Cases (≥ 18 years) n=121, Cases (%)
Cigarette smoking	59 (49%)
Alcohol abuse	39 (32%)
Chronic lung disease	32 (26%)
Diabetes	28 (23%)
Immunosuppressive treatment	6 (5%)
Injection drug use	2 (2%)
Asplenia	0 (0%)

*More than one risk factor was identified in several cases

Antibiotic Resistance

Susceptibility testing was performed on 129 isolates received in 2011. Results of the testing are presented in the following table.

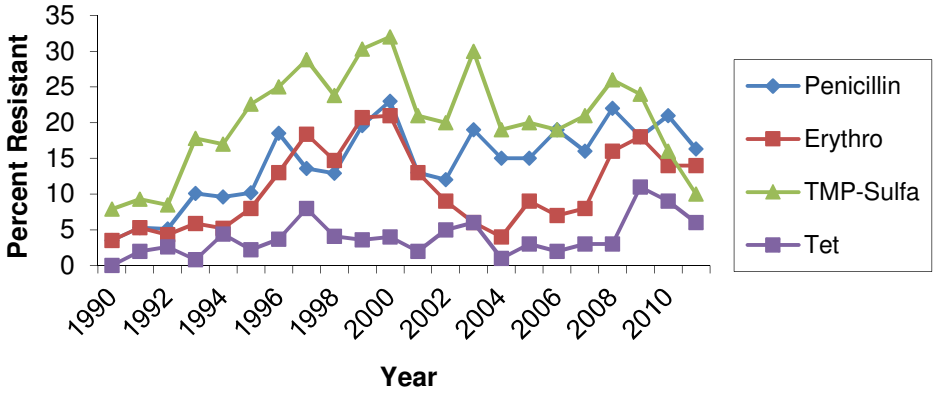
Table 9: Antibiotic Resistance in Invasive *Streptococcus pneumoniae* Isolates – Alaska, 2011

Antibiotic	Susceptible	Intermediate	Resistant	I + R	Total Tested
Penicillin	106 (84%)	0 (0%)	21 (16%)	21 (16%)	129
TMP-sulfa	116 (90%)	5 (4%)	8 (6%)	13 (10%)	129
Erythromycin	111 (86%)	0 (0%)	18 (14%)	18 (14%)	129
Ceftriaxone	124 (96%)	2 (2%)	3 (2%)	5 (4%)	129
Tetracycline	121 (94%)	0 (0%)	8 (6%)	8 (6%)	129
Chloramphenicol	128 (99%)	0 (0%)	1 (1%)	1 (1%)	129
Vancomycin	129 (100%)	0 (0%)	0 (0%)	0 (0%)	129
Levofloxacin	128 (99%)	1 (1%)	0 (0%)	1 (1%)	129
Clindamycin	125 (97%)	0 (0%)	4 (3%)	4 (3%)	129

Cut points from the Minimum Inhibitory Concentration (MIC) Interpretive Standards were used to determine if an isolate was 'susceptible', 'intermediate', or 'resistant' to the antibiotic being tested [7]. The MIC Interpretive Standards definitions of 'susceptible', 'intermediate', and 'resistant' can be found in the Appendix.

Serotypes found in the PCV7 and PCV13 vaccines are more likely to be non-susceptible to penicillin and erythromycin than non-vaccine serotypes. One potential benefit of the use of these vaccines was an anticipated decline in antibiotic resistance among circulating pneumococci. Following the initiation of the PCV7 vaccine in 2001, antibiotic resistance among invasive pneumococci dropped. During 2003, TMP-sulfa and penicillin resistance increased, however, following an increase in disease caused by serotype 19A. This serotype is included in the PCV13 vaccine; decreasing proportions of resistant isolates tested in 2011 may be due to the introduction of the vaccine last year.

Figure 10: Trends in Antibiotic Resistance Among Invasive Pneumococcal Isolates - Alaska, 1990 - 2011



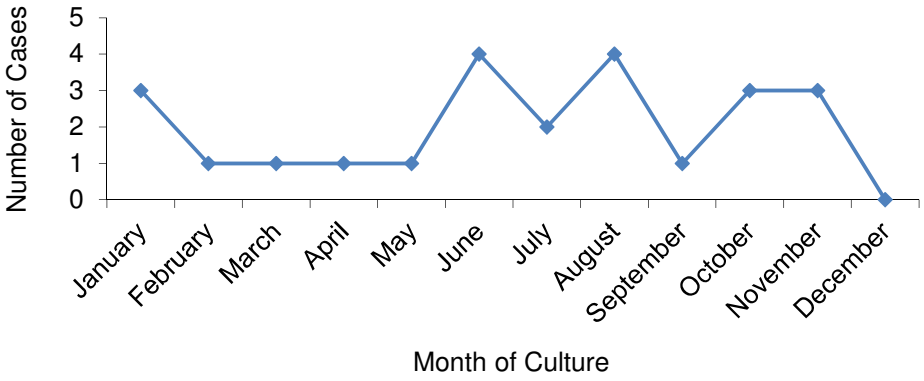
Invasive *Haemophilus influenzae*

Overall Incidence

In 2011, there were 24 cases of invasive *Haemophilus influenzae* in Alaska, for a statewide rate of 3.3/100,000 persons per year. This rate is higher than the national projected rate of 1.66/100,000 persons per year [8]. There were two deaths caused by *H. influenzae* in 2011 for a case fatality ratio of 9%.

Seasonality

Figure 11: *Haemophilus influenzae* Disease by Month of Culture - Alaska, 2011

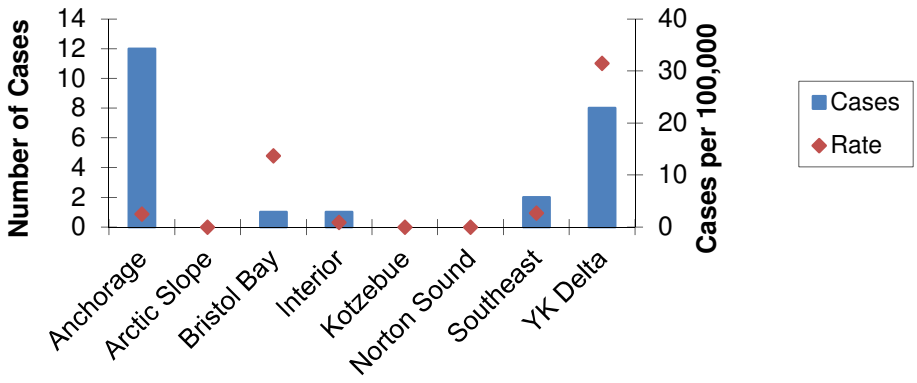


Cases of invasive *H. influenzae* occurred throughout 2011; however, due to the small number of cases, trends in seasonality cannot be determined.

Region

The highest rates of disease caused by invasive *H. influenzae* cases in 2011 were in YK Delta, 31.5/100,000 (8 cases), and Bristol Bay, 13.7/100,000 (1 case). Although a large number of cases occurred in the Anchorage area (12 cases), the rate was much lower (2.5/100,000).

Figure 12: Invasive *Haemophilus influenzae*, Cases & Rates by Region - Alaska, 2011



Race

Table 10: Invasive *Haemophilus influenzae* Cases by Race – Alaska, 2011

Race	Cases n (%)	Age Adjusted Rate*	% Male	Deaths n (%)
Alaska Native	15 (62.5%)	8.8	60%	1 (7%)
Non-Native	9 (37.5%)	1.4	33%	1 (11%)
Total	24		50%	2 (8%)

*Cases per 100,000 per percent distribution of Alaska 2010 population

In 2011, 62.5% of the cases occurred in Alaska Natives. Age-adjusted rates were calculated for Alaska Natives and non-Natives. The age-adjusted rate ratio of *H. influenzae* disease for the Alaska Native population compared with the non-Native population in 2011 was 6.3.

Age

H. influenzae cases ranged in age from newborn to 101 years of age in 2011 (median 18.2 years). Overall, the highest rates of disease occurred in children less than 2 years old.

Rates of disease in Alaska Native versus non-Native populations by age group were variable; overall numbers of cases and rates by race and age group are presented in Figure 14. The highest rates of disease occurred in Alaska Native children less than two years of age, 168.8/100,000 persons per year and Alaska Native adults 65 years and older, 23/100,000 persons per year.

Figure 13: Invasive *Haemophilus influenzae* by Age Group - Alaska, 2011

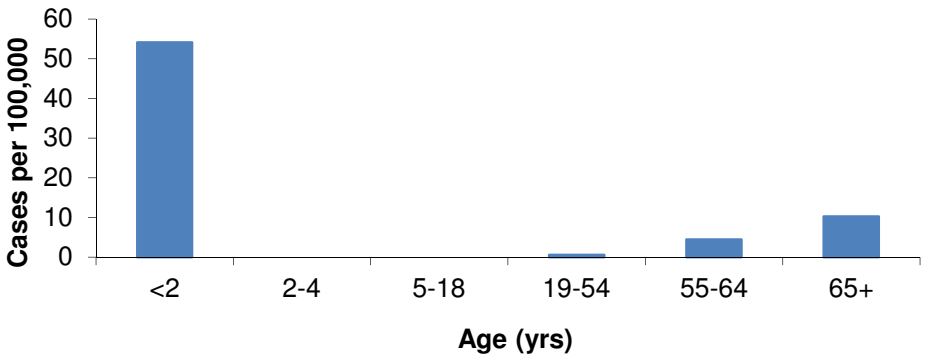
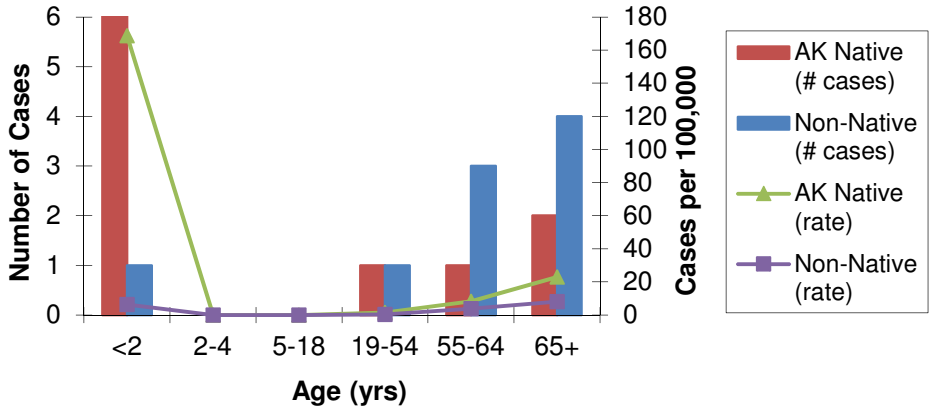


Figure 14: Invasive *Haemophilus influenzae*, Cases & Rates by Age Group & Race - Alaska, 2011



Clinical Presentation

The primary clinical presentation was determined by a review of the discharge diagnoses in each patient's individual medical record associated with the invasive bacterial illness. For cases with more than one diagnosis, the most serious *H. influenzae*-related diagnosis was recorded as the primary clinical presentation. In 2011, pneumonia with bacteremia was the most common presentation (29% of cases).

Nineteen (79%) of *H. influenzae* isolates were from blood samples in 2011, two from cerebral spinal fluid, one from joint fluid and two cases were from surgical sites, one of those identified *H. influenzae* by PCR only.

Table 11: Primary Clinical Presentation of Invasive *Haemophilus influenzae* - Alaska, 2011

Primary Presentation	n (%)
Pneumonia*	7 (29%)
Bacteremia	4 (17%)
Meningitis	4 (17%)
Empyema	3 (13%)
Cellulitis	2 (8%)
Septic arthritis	1 (4%)
Epiglottitis	1 (4%)
Endocarditis	1 (4%)
Other	1 (4%)
Total	24

*with bacteremia

Serotypes

All isolates received at AIP are serotyped; 22 of the 24 cases in 2011 had isolates and were serotyped. One case was also identified and serotyped using PCR technology (one serotype a case). The bacterial capsule is the basis for serotyping and is the primary virulence factor. Serotype b was the most common serotype in the past, but its prevalence has decreased with use of the childhood Hib vaccine. Surveillance of serotypes is important for monitoring vaccine effectiveness and emergence of non-vaccine serotypes.

Table 12: Serotypes of Invasive *Haemophilus influenzae* Cases by Race – Alaska, 2011

		Alaska Native				Non-Native			
Serotype	Total n (%)	<2	2-18	19-64	65+	<2	2-18	19-64	65+
a	7 (30%)	7	0	0	0	0	0	0	0
b	2 (9%)	2	0	0	0	0	0	0	0
e	1 (4%)	0	0	1	0	0	0	0	0
f	3 (13%)	0	0	0	0	0	0	2	1
NT*	10 (44%)	2	0	0	2	1	0	2	3
Total	23	11	0	1	2	1	0	4	4

*Non-typeable

Hib

In recent years, the prevalence of *H. influenzae* type b has declined due to increased use of a childhood vaccine against this serotype. Two cases of Hib occurred in 2011 in vaccinated children. Both children were under the age of 2 years; one child had received one dose and the second two doses of the PRP-OMP vaccine.

Hia

Prior to 2002, *H. influenzae* type a (Hia) had not been detected in Alaska. Following an outbreak in 2003 [9], cases have occurred sporadically until 2010 when an outbreak began in the YK Delta and continued through 2011 [10]. Seven cases of Hia were detected in 2011; all occurred in AK Native children less than 2 years old. The rate of invasive disease caused by Hia in AK Native children less than 2 years old for 2011 was 107.4/100,000.

Antibiotic Resistance

Twenty-two *Haemophilus influenzae* isolates received at AIP were tested for susceptibility to chloramphenicol, ceftriaxone and TMP/sulfa. All 22 isolates were susceptible to chloramphenicol and ceftriaxone; 5 isolates were fully resistant to TMP/sulfa, 2 had intermediate resistance and 15 were susceptible.

Table 13: Summary of Invasive *Haemophilus influenzae* Case Characteristics, Alaska, 2011

Sex	Age (Yrs)	Race	Residence	Site of Isolation	Clinical Presentation(s)	Serotype*	Associated Medical Conditions	Survived
M	Newborn	Non-Native	Anchorage	Blood	Bacteremia	NT	None	Yes
M	0.2	AK Native	Other	Blood	Cellulitis	b	None	Yes
M	0.3	AK Native	Other	CSF	Meningitis	a	None	Yes
F	0.4	AK Native	Other	CSF	Meningitis	a	None	No
M	0.6	AK Native	Other	Blood	Meningitis	a	None	Yes
F	0.6	AK Native	Other	PCR+	Cellulitis	a	None	Yes
F	0.8	AK Native	Other	Blood	Meningitis	b	None	Yes
M	1.0	AK Native	Other	Blood	Empyema, pneumonia	NT	None	Yes
M	1.1	AK Native	Anchorage	Surgical aspirate	Other	NT	None	Yes
M	1.3	AK Native	Anchorage	Joint fluid	Septic arthritis	a	None	Yes
F	1.3	AK Native	Other	Blood	Pneumonia	a	None	Yes
M	1.5	AK Native	Other	Blood	Pneumonia	a	None	Yes
F	34.8	Non-Native	Anchorage	Blood	Pneumonia	NT	Diabetes	No
F	47.3	AK Native	Anchorage	Blood	Bacteremia	Unknown	Diabetes	Yes
F	58.4	Non-Native	Anchorage	Blood	Bacteremia	NT	Diabetes	Yes
F	62.5	Non-Native	Anchorage	Blood	Empyema, pneumonia	f	Smoking	Yes
F	62.9	Non-Native	Anchorage	Blood	Bacteremia	f	Diabetes	Yes
M	64.6	AK Native	Other	Blood	Pneumonia	e	Smoking, alcohol abuse	Yes
F	66	AK Native	Anchorage	Blood	Endocarditis	NT	Immune suppressive treatment	Yes
F	66.2	Non-Native	Anchorage	Blood	Pneumonia	NT	Unknown	Yes
M	66.4	Non-Native	Anchorage	Blood	Epiglottitis, pneumonia	f	Diabetes	Yes
M	73.8	Non-Native	Other	Blood	Pneumonia	NT	Smoking, chronic lung disease, alcohol abuse	Yes
M	80.6	AK Native	Other	Blood	Pneumonia	NT	Diabetes	Yes
F	101.1	Non-Native	Anchorage	Blood	Empyema, pneumonia	NT	None	Yes

*NT = non-typeable

Invasive *Neisseria meningitidis*

Overall Incidence

Two cases of invasive *Neisseria meningitidis* were reported to AIP in 2011 for an overall rate of 0.3/100,000. The Alaska rate is similar to the ABCs 2011 national projected rate of 0.2/100,000 [11]. There were no invasive *N. meningitidis*-related deaths in Alaska in 2011.

Race

Table 14: Invasive *Neisseria meningitidis* Cases by Race – Alaska, 2011

Race	Cases n (%)	Age Adjusted Rate*	% Male	Deaths n (%)
Alaska Native	1 (50%)	0.8	0%	0 (0%)
Non-Native	1 (50%)	0.2	100%	0 (0%)
Total	2		50%	0 (0%)

*Cases per 100,000 per percent distribution of Alaska 2010 population

In 2011, 50% of the cases occurred in Alaska Natives. Age-adjusted rates were calculated for Alaska Natives and non-Natives. The age-adjusted rate ratio of *N. meningitidis* disease for the Alaska Native population compared with the non-Native population in 2011 was 4.

Table 15: Summary of Invasive *Neisseria meningitidis* Case Characteristics, Alaska, 2011

Sex	Age (Yrs)	Race	Residence	Site of Isolation	Clinical Presentation(s)	Serogroup	Associated Medical Conditions	Survived
M	13.8	Non-Native	Other	Blood	Bacteremia	C	None	Yes
F	41.5	AK Native	Anchorage	Blood	Bacteremia	B	Smoking, chronic lung disease, alcohol abuse	Yes

Invasive group A *Streptococcus*

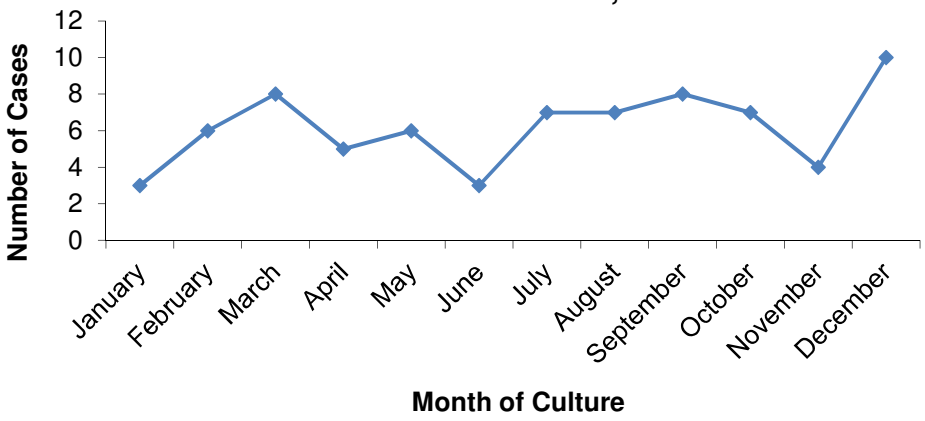
Overall Incidence

A total of 74 cases of invasive group A *Streptococcus* (GAS) were reported to AIP in 2011. The overall rate of invasive GAS disease in the state of Alaska was 10.2/100,000 persons per year. The Alaska rate is higher than the ABCs 2011 national projected rate of 4.3/100,000 [12]. In 2011, there were 7 GAS-related deaths for a case fatality ratio of 9.5%.

Seasonality

Cases of group A *Streptococcus* occurred throughout the year in 2011 with no apparent trends in seasonality. The largest number of cases (n=10) occurred in December.

Figure 15: Invasive group A *Streptococcus*, by Month of Culture - Alaska, 2011



Race

In 2011, 50% of invasive GAS cases in Alaska occurred in the Alaska Native population. The age-adjusted rate ratio of invasive GAS disease for the Alaska Native population compared with the non-Native population in 2011 was 4.7.

Table 16: Invasive group A *Streptococcus* Cases by Race – Alaska, 2011

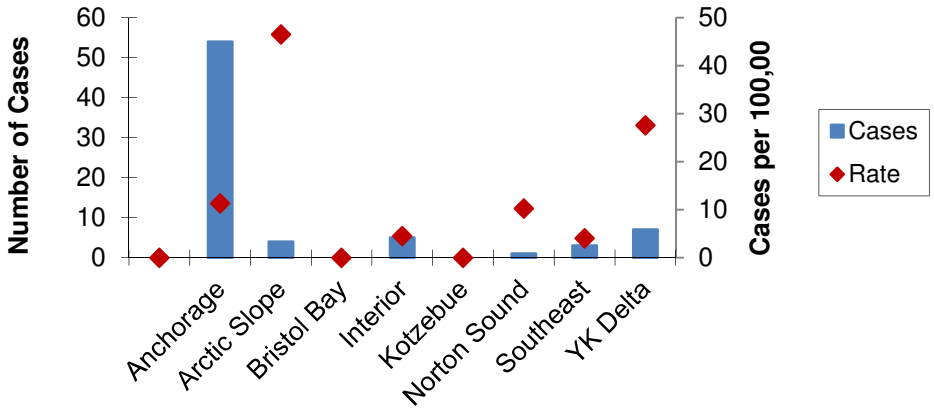
Race	Cases n (%)	Age Adjusted Rate*	% Male	Deaths n (%)
Alaska Native	37 (50%)	28.8	51%	2 (5%)
Non-Native	37† (50%)	6.1	65%	5 (13.5%)
Total	74		58%	7 (9.5%)

*Cases per 100,000 per percent distribution of Alaska 2010 population
†Includes seven cases for which race is unknown

Region

Fifty-four (73%) of the 74 invasive group A *Streptococcus* cases in 2011 were reported in the Anchorage area, 7 cases in the YK Delta, 5 cases in the Interior, 4 cases in the Arctic Slope, 3 cases in the Interior and one case in Norton Sound. The highest rates of disease occurred in the Arctic Slope region (46.5/100,000) and the YK Delta (27.6/100,000).

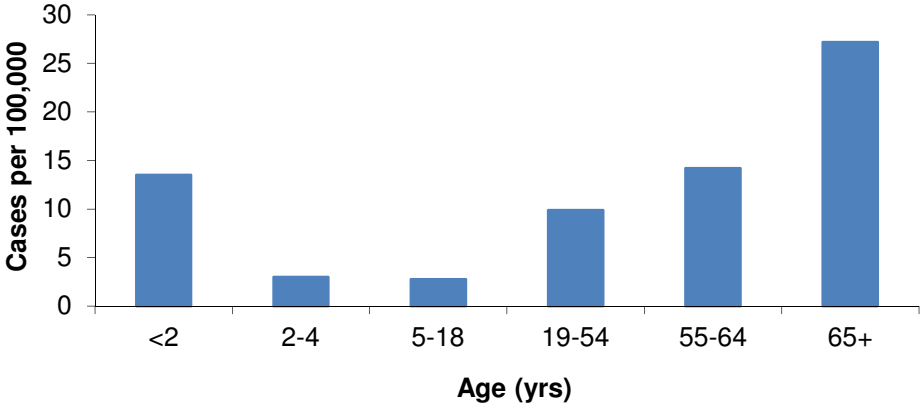
Figure 16: Invasive GAS Disease, Cases & Rates by Region - Alaska, 2011



Age

Invasive group A *Streptococcus* cases reported in 2011 ranged in age from 8 months to 90 years old; the median age was 49.3 years. Highest rates of disease occurred in adults 65 years and older (27.2/100,000).

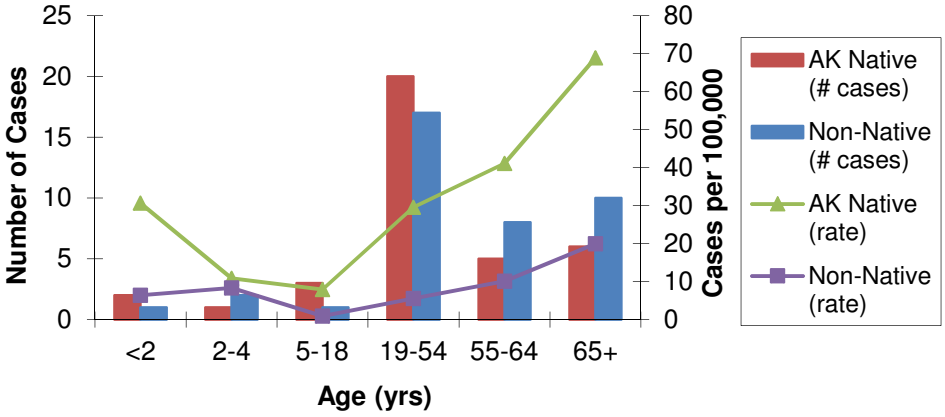
Figure 17: Invasive group A *Streptococcus* by Age Group - Alaska, 2011



When stratified by race, the highest rates of invasive group A streptococcal disease occurred in Alaska Native adults 65 years and older (68.9/100,000 persons per year). The highest GAS

disease rate in the non-Native population also occurred in adults 65 and older (19.9/100,000 persons per year).

Figure 18: Invasive group A *Streptococcus*, Cases & Rates by Age Group & Race - Alaska, 2011



Clinical Presentation

The primary clinical presentation was determined by a review of the discharge diagnoses in each patient's individual medical record associated with the invasive bacterial illness. In cases with multiple discharge diagnoses, the most serious diagnosis related to the GAS infection was recorded as the primary clinical presentation. Table 17 shows the primary clinical presentations of invasive group A *Streptococcus* in Alaska for 2011. Twenty-five cases also presented with secondary diagnoses including pneumonia, septic arthritis and cellulitis.

Group A *Streptococcus* was isolated from blood samples in 67 (91%) of 74 cases, three from joint fluid and four from other sterile sites.

Table 17: Primary Clinical Presentations of Invasive group A *Streptococcus* – Alaska, 2011

Primary Presentation	n (%)
Bacteremia	20 (27%)
Cellulitis*	18 (24%)
Pneumonia*	12 (16%)
Endocarditis	6 (8%)
Septic arthritis	5 (7%)
Necrotizing fasciitis	4 (5%)
Empyema	3 (4%)
Meningitis	1 (1%)
Appendicitis	1 (1%)
Epiglottitis	1 (1%)
Other	3 (4%)
Total	74

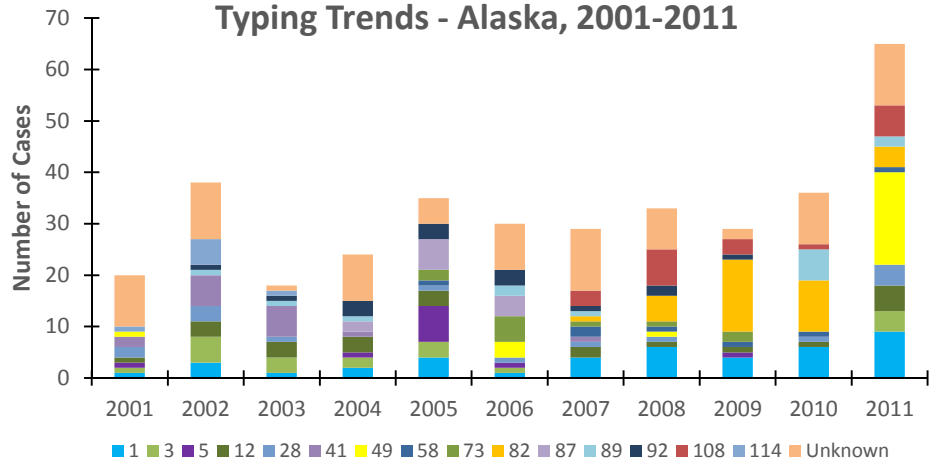
*with bacteremia

Molecular Typing

Strain characterization of GAS has traditionally been based on serological identification of the M protein which is a major surface protein and an important GAS virulence factor. In the mid-1990s, many reference labs started using a molecular approach based on sequencing of the N-terminal region of the M protein gene (*emm* gene). To date, more than 200 different *emm* types have been reported. While there are currently no vaccines available to protect against invasive GAS disease, baseline data on the burden of GAS disease to include *emm* typing are critical to evaluate the potential utility of any candidate vaccines.

In 2011, 62 invasive GAS isolates were *emm* typed at AIP. The most common *emm* types were *emm* 49 (28.5%), followed by *emm* 1 (14%) and *emm* 108 (9.5%). The following graph shows *emm* typing trends over time. Strains that totaled ≤ 5 over the time period were not included.

Figure 19: Invasive group A *Streptococcus emm* Typing Trends - Alaska, 2001-2011



Associated Risk Factors

The presence of one or more associated risk factors was reported in 96% of invasive GAS cases in 2011. Cigarette smoking was the most prevalent risk factor observed in adults followed by alcohol abuse and diabetes.

Table 18: Associated Risk Factors Identified in Invasive GAS Cases – Alaska, 2011*

Medical Condition/Risk Factor	Adult Cases (≥ 18 years) n=66, Cases (%)
Cigarette smoking	23 (35%)
Alcohol abuse	18 (27%)
Diabetes	14 (21%)
Chronic lung disease	6 (9%)
Injection drug use	2 (3%)
Immunosuppressive treatment	1 (2%)
Asplenia	0 (0%)

*More than one risk factor was identified in several cases

Antibiotic Resistance

Sixty-one GAS isolates received at AIP were tested for susceptibility to penicillin, ceftriaxone, erythromycin, vancomycin, levofloxacin and clindamycin. All isolates tested were susceptible to penicillin, ceftriaxone, vancomycin and levofloxacin. Two isolates were resistant to erythromycin, and one of those was also resistant to clindamycin. The multi-drug resistant isolate was *emm* type 94.

Table 19: Summary of Invasive group A *Streptococcus* Case Characteristics, Alaska, 2011

Sex	Age (yrs)	Race	Residence	Site of Isolation	Clinical Presentation(s)	*emm* Type	Associated Medical Conditions	Survived
F	0.7	AK Native	Other	Blood	Endocarditis, cellulitis	12	None	Yes
M	1.4	AK Native	Anchorage	Blood	Pneumonia	28	None	Yes
M	1.5	Unknown	Anchorage	Blood	Bacteremia	12	None	Yes
F	2.9	AK Native	Other	Pleural fluid	Empyema, pneumonia	1	Chronic lung disease	No
M	7.9	Non-Native	Anchorage	Blood	Septic arthritis, osteomyelitis	12	None	Yes
M	8.9	AK Native	Other	Blood	Other	49	None	Yes
M	12.1	AK Native	Anchorage	Blood	Bacteremia	ND	None	Yes
F	15	AK Native	Anchorage	Blood	Bacteremia	58	Injection drug use	No
F	19.2	AK Native	Other	Blood	Pneumonia	1	None	Yes
F	25.9	Non-Native	Anchorage	Blood	Other	22	Injection drug use	Yes
F	27.2	AK Native	Anchorage	Blood	Cellulitis	33	Diabetes	Yes
F	28.6	AK Native	Anchorage	Blood	Pneumonia, cellulitis	49	Smoking, alcohol abuse	Yes
F	31.9	AK Native	Anchorage	Blood	Cellulitis	49	Smoking, alcohol abuse	Yes
F	33.5	Non-Native	Other	Blood	Bacteremia	ND	None	Yes
M	34.2	AK Native	Other	Joint fluid	Cellulitis	49	None	Yes
F	35.3	AK Native	Anchorage	Blood	Appendicitis	94	Smoking	Yes
M	35.4	Non-Native	Anchorage	Blood	Endocarditis, septic arthritis, cellulitis	3	None	Yes
M	35.7	Non-Native	Anchorage	Blood	Pneumonia	49	Smoking, injection drug use	Yes
F	36.9	Unknown	Anchorage	Blood	Endocarditis, osteomyelitis, cellulitis	28	Diabetes	Yes
F	37.3	AK Native	Anchorage	Joint fluid	Pneumonia, bursitis	49	Smoking, alcohol abuse	Yes
F	38	Unknown	Anchorage	Blood	Bacteremia	49	Smoking, alcohol abuse	No
M	38.6	Non-Native	Other	Joint fluid	Cellulitis, bursitis	ND	Smoking	Yes
M	41.1	Non-Native	Anchorage	Blood	Bacteremia	108	Smoking	Yes
M	41.4	AK Native	Anchorage	Blood	Bacteremia	11	Smoking, chronic lung disease	Yes
M	42.2	Non-Native	Other	Blood	Bacteremia	108	Alcohol abuse	No
M	42.4	Non-Native	Other	Blood	Cellulitis	91	Diabetes	Yes
M	44.3	Non-Native	Anchorage	Blood	Pneumonia	3	None	Yes
M	44.5	AK Native	Anchorage	Blood	Pneumonia, cellulitis	82	Smoking, alcohol abuse	Yes
F	45.4	Non-Native	Anchorage	Blood	Necrotizing fasciitis, STSS	1	None	Yes
F	45.9	Non-Native	Anchorage	Blood	Necrotizing fasciitis	12	None	No
M	46.1	AK Native	Anchorage	Blood	Septic arthritis	89	Smoking, alcohol abuse	Yes
F	46.1	AK Native	Anchorage	Blood	Cellulitis	49	Smoking, alcohol abuse	Yes
M	47.4	AK Native	Other	Wound	Necrotizing fasciitis, cellulitis	ND	Alcohol abuse	Yes
F	47.5	AK Native	Anchorage	Blood	Cellulitis	108	None	Yes
F	49	AK Native	Anchorage	Blood	Other	44	None	Yes
M	49.2	Unknown	Anchorage	Blood	Cellulitis	49	None	Yes
M	49.3	AK Native	Anchorage	Blood	Pneumonia, cellulitis	49	Alcohol abuse	Yes
M	49.3	AK Native	Anchorage	Blood	Bacteremia	ND	Alcohol abuse	Yes
M	50	Non-Native	Other	Blood	Cellulitis	12	None	Yes
F	50.9	Non-Native	Anchorage	Blood	Cellulitis	ND	None	Yes
M	52.6	AK Native	Anchorage	Blood	Cellulitis	49	Smoking, alcohol abuse, diabetes	Yes
M	52.7	AK Native	Other	Blood	Septic arthritis	ND	Smoking	Yes
M	52.8	Non-Native	Anchorage	Blood	Cellulitis	49	Smoking, diabetes	Yes
M	53.2	AK Native	Anchorage	Blood	Bacteremia	49	Smoking, alcohol abuse, diabetes	Yes
F	54.8	AK Native	Anchorage	Blood	Pneumonia	89	Smoking, chronic lung disease, alcohol abuse	Yes
M	55.1	Non-Native	Anchorage	Blood	Epiglottitis	3	Chronic lung disease	Yes
M	55.1	Non-Native	Anchorage	Blood	Pneumonia	1	Smoking	Yes
M	55.3	AK Native	Other	Blood	Pneumonia, cellulitis	91	Smoking	Yes

Sex	Age (yrs)	Race	Residence	Site of Isolation	Clinical Presentation(s)	*emm* Type	Associated Medical Conditions	Survived
F	55.4	AK Native	Anchorage	Blood	Bacteremia	ND	None	Yes
F	56	Non-Native	Anchorage	Blood	Septic arthritis	1	Diabetes	Yes
M	56.7	Non-Native	Anchorage	Blood	Endocarditis, septic arthritis	49	Smoking	No
M	56.7	Non-Native	Anchorage	Blood	Empyema, pneumonia	ND	Immune suppressive treatment, diabetes	Yes
M	57.3	Non-Native	Anchorage	Blood	Bacteremia	82	Diabetes	Yes
M	57.9	Non-Native	Anchorage	Blood	Endocarditis	49	Diabetes	Yes
M	58.4	Non-Native	Anchorage	Blood	Cellulitis	82	None	Yes
M	59.2	AK Native	Other	Blood	Cellulitis	108	Alcohol abuse	Yes
M	60.9	AK Native	Other	Blood	Endocarditis	108	Smoking, alcohol abuse	Yes
F	63.3	AK Native	Other	Blood	Bacteremia	18	Smoking	Yes
M	66.5	AK Native	Anchorage	Blood	Bacteremia	1	Chronic lung disease	Yes
F	68.6	Non-Native	Anchorage	Surgical specimen	Necrotizing fasciitis, STSS, cellulitis	1	None	Yes
M	69.1	AK Native	Anchorage	Blood	Bacteremia	49	Chronic lung disease, diabetes	Yes
M	69.4	Non-Native	Other	Blood	Cellulitis	stG6.0	Alcohol abuse, diabetes	Yes
F	70.3	Non-Native	Anchorage	Blood	Bacteremia	22	None	Yes
M	70.5	Non-Native	Anchorage	Blood	Bacteremia	ND	Alcohol abuse	Yes
F	70.9	Unknown	Anchorage	Blood	Cellulitis	108	Diabetes	Yes
F	73.5	AK Native	Other	Blood	Bacteremia	82	None	Yes
F	73.8	AK Native	Anchorage	Blood	Septic arthritis, cellulitis	28	Smoking	Yes
F	76.4	AK Native	Other	Blood	Meningitis	1	None	Yes
M	76.8	Non-Native	Anchorage	Blood	Pneumonia	3	None	Yes
M	82.4	AK Native	Other	Pleural fluid	Empyema, pneumonia	ND	None	Yes
F	84.3	Non-Native	Anchorage	Blood	Bacteremia	49	None	Yes
M	85	Unknown	Anchorage	Blood	Bacteremia	28	Chronic lung disease, diabetes	Yes
M	87.7	Non-Native	Anchorage	Blood	Cellulitis	49	None	No
F	90	Unknown	Anchorage	Blood	Cellulitis	1	None	Yes

STSS = Streptococcal toxic shock syndrome
ND = typing not done

Invasive group B *Streptococcus*

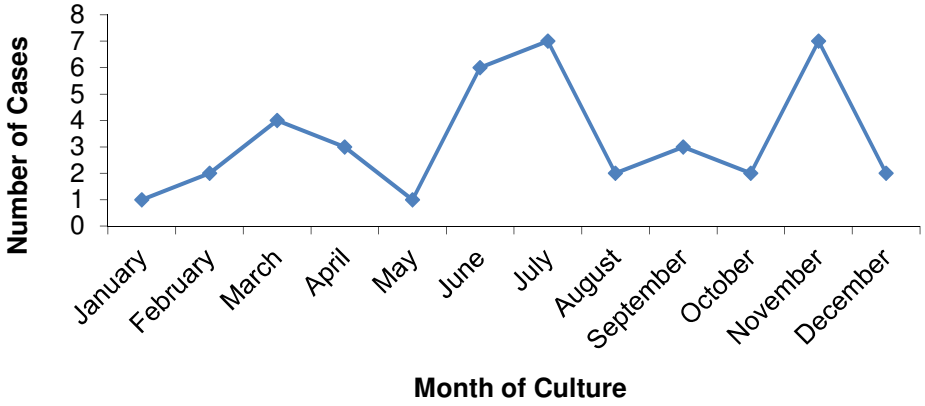
Overall Incidence

A total of 40 cases of invasive group B *Streptococcus* (GBS) were reported to AIP in 2011. The overall rate of invasive GBS disease in the state of Alaska was 5.5/100,000 persons per year. The Alaska rate is lower than the ABCs 2011 national projected rate of 8.7/100,000 [13]. In 2011, there were four GBS-related deaths for a case fatality ratio of 10%.

Seasonality

Cases of group B *Streptococcus* occurred throughout the year with no apparent trends in seasonality.

Figure 20: Invasive group B *Streptococcus*, by Month of Culture - Alaska, 2011



Race

In 2011, 28% of invasive group B *Streptococcus* cases in Alaska occurred in the Alaska Native population; the age-adjusted rate was 9.2/100,000 persons per year which is nearly twice the non-Native rate of 4.7/100,000 persons per year.

Table 20: Invasive group B *Streptococcus* Cases by Race – Alaska, 2011

Race	Cases n (%)	Age Adjusted Rate*	% Male	Deaths n (%)
Alaska Native	11 (28)	9.2	18	2 (18)
Non-Native	29 (72)‡	4.7	52	2 (7)
Total	40		43	4 (10)

*Cases per 100,000 per percent distribution of Alaska 2010 population
‡Includes six cases for which race was unknown

Region

In 2011, 29 (72%) of the 40 reported GBS cases occurred in Anchorage; five cases were reported in Southeast Alaska, four cases in the Interior, and two cases in Bristol Bay. The highest rates of disease occurred in the Bristol Bay region (27.4/100,000).

Age

Invasive group B *Streptococcus* cases reported in 2011 ranged in age from newborn to 93.8 years old; the median age was 60.3 years. Highest rates of disease overall occurred in adults 65 years and older (28.9/100,000 persons per year).

Figure 21: Invasive group B *Streptococcus* by Age Group - Alaska, 2011

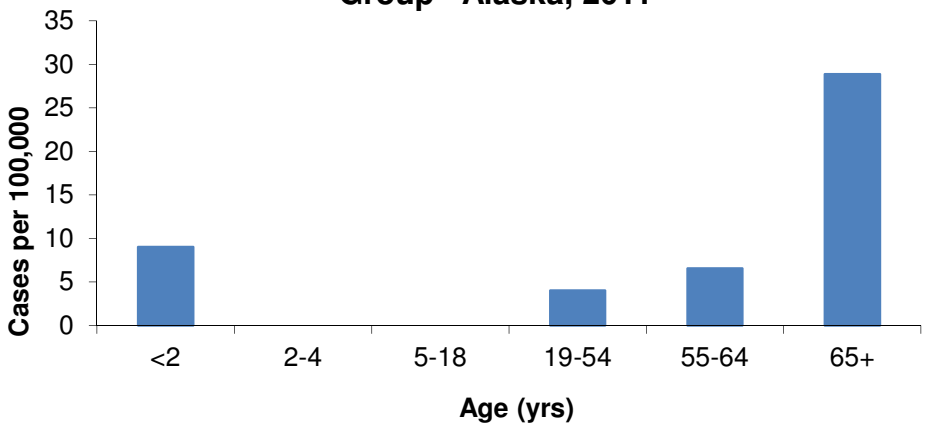
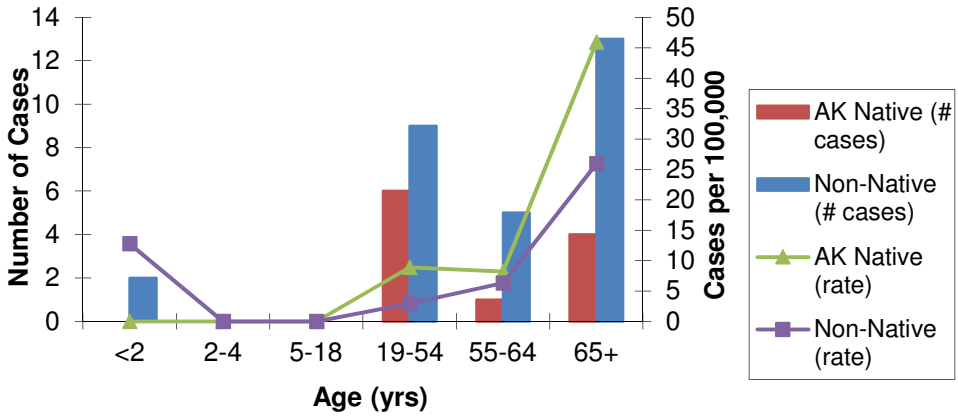


Figure 22: Invasive group B S*treptococcus*, Cases & Rates by Age Group & Race - Alaska, 2011



When stratified by race, the highest rates of disease occurred in AK Native adults 65 and older (45.9/100,000 persons per year). There was one case of early-onset disease (less than 7 days old) for a rate of 0.1/1,000 live births.

Clinical Presentation

The primary clinical presentation was determined by a review of the discharge diagnoses in each patient's individual medical record associated with the invasive bacterial illness. In cases with multiple discharge diagnoses, the most serious diagnosis related to the GBS infection was recorded as the primary clinical presentation. In 2011, the most common clinical presentation was cellulitis with bacteremia which occurred in 14 cases (35%).

Group B *Streptococcus* was isolated from blood in 37 (92.5%) of 40 cases in 2011; one each was isolated from joint fluid, a surgical aspirate and other sterile site.

Table 21: Primary Clinical Presentations of Invasive group B *Streptococcus* – Alaska, 2011

Primary Presentation	n (%)
Cellulitis*	14 (35%)
Bacteremia	10 (25%)
Pneumonia*	4 (10%)
Peritonitis	3 (7.5%)
Meningitis	2 (5%)
Endocarditis	2 (5%)
Osteomyelitis	2 (5%)
Bursitis	1 (2.5%)
Septic abortion	1 (2.5%)
Other	1 (2.5%)
Total	40

*with bacteremia

Antibiotic Resistance

Susceptibility testing was performed on 35 GBS isolates received in 2011. Results of the testing are presented in the following table.

Table 22: Antibiotic Resistance in Invasive group B *Streptococcus* Isolates – Alaska, 2011

Antibiotic	Susceptible	Intermediate	Resistant	I + R	Total Tested
Penicillin	35 (100%)	0 (0%)	0 (0%)	0 (0%)	35
Ceftriaxone	35 (100%)	0 (0%)	0 (0%)	0 (0%)	35
Erythromycin	19 (54%)	0 (0%)	16 (46%)	16 (46%)	35
Tetracycline	8 (23%)	0 (0%)	27 (77%)	27 (77%)	35
Levofloxacin	35 (100%)	0 (0%)	0 (0%)	0 (0%)	35
Clindamycin	24 (69%)	0 (0%)	11 (31%)	11 (31%)	35
Vancomycin	35 (100%)	0 (0%)	0 (0%)	0 (0%)	35

All isolates tested were susceptible to penicillin, ceftriaxone, levofloxacin and vancomycin. Resistance to tetracycline, erythromycin and clindamycin was seen in 86%, 50% and 26%, respectively, of isolates tested. The isolate from the one early onset case was resistant to tetracycline and erythromycin.

Table 23: Summary of Invasive group B *Streptococcus* Case Characteristics, Alaska, 2011

Sex	Age (yrs)	Race	Residence	Site of Isolation	Clinical Presentation(s)	Associated Medical Conditions	Survived
M	Newborn	Non-Native	Anchorage	Blood	Bacteremia	None	Yes
F	0.2	Non-Native	Anchorage	CSF	Meningitis	None	Yes
M	25.1	Unknown	Anchorage	Blood	Endocarditis, pneumonia	None	Yes
F	25.5	AK Native	Anchorage	Other	Septic abortion	None	Yes
M	43.6	Unknown	Anchorage	Blood	Cellulitis	None	Yes
F	46.2	Non-Native	Anchorage	Blood	Cellulitis	Smoking, alcohol abuse	Yes
F	46.3	Non-Native	Anchorage	Joint fluid	Bursitis	None	Yes
F	46.5	AK Native	Anchorage	Blood	Pneumonia	Smoking, alcohol abuse	No
F	46.8	Unknown	Anchorage	CSF	Meningitis	Smoking	Yes
F	48.3	Non-Native	Anchorage	Blood	Pneumonia	Diabetes	Yes
F	48.5	Non-Native	Anchorage	Blood	Pneumonia, other	Chronic lung disease, diabetes	Yes
F	49.9	AK Native	Other	Blood	Bacteremia	None	No
F	50	AK Native	Other	Blood	Peritonitis, pneumonia	Alcohol abuse	No
M	50.3	AK Native	Other	Surgical aspirate	Osteomyelitis	Smoking	Yes
M	51.8	Non-Native	Anchorage	Peritoneal fluid	Peritonitis	Alcohol abuse	Yes
F	52.7	AK Native	Anchorage	Blood	Peritonitis	Smoking, chronic lung disease, alcohol abuse	No
F	53.4	Non-Native	Anchorage	Blood	Pneumonia	None	Yes
F	57.2	AK Native	Anchorage	Blood	Cellulitis	Chronic lung disease, alcohol abuse	Yes
M	57.8	Non-Native	Anchorage	Blood	Endocarditis, septic arthritis	Chronic lung disease	Yes
F	59.2	Non-Native	Anchorage	Blood	Cellulitis	Diabetes	Yes
M	61.4	Non-Native	Other	Blood	Other	Smoking, chronic lung disease	Yes
F	63.5	Unknown	Anchorage	Blood	Cellulitis	Unknown	Yes
F	65	Non-Native	Anchorage	Blood	Cellulitis	None	Yes
M	65.1	Non-Native	Anchorage	Blood	Cellulitis	Diabetes	Yes
F	67.1	Unknown	Anchorage	Blood	Cellulitis	Chronic lung disease, diabetes	Yes
F	68.3	AK Native	Anchorage	Blood	Bacteremia	Chronic lung disease, diabetes	Yes
M	68.5	Non-Native	Anchorage	Blood	Cellulitis	None	Yes
M	71.8	Unknown	Anchorage	Blood	Cellulitis	None	Yes
F	72.6	AK Native	Anchorage	Blood	Bacteremia	Diabetes	Yes
M	73.4	Non-Native	Anchorage	Blood	Cellulitis	Chronic lung disease	Yes
M	74.8	Non-Native	Other	Blood	Bacteremia	Diabetes	Yes
F	76.1	Non-Native	Other	Blood	Cellulitis	None	Yes
M	76.8	AK Native	Other	Blood	Bacteremia	None	Yes
M	78.4	Non-Native	Anchorage	Blood	Bacteremia	None	Yes
M	79.8	Non-Native	Anchorage	Blood	Osteomyelitis	Diabetes	Yes
M	80	Non-Native	Other	Blood	Bacteremia	None	Yes
F	82.4	AK Native	Other	Blood	Bacteremia	None	Yes
M	83.5	Non-Native	Anchorage	Blood	Cellulitis	Chronic lung disease, diabetes	Yes
F	87.3	Non-Native	Other	Blood	Bacteremia	None	Yes
F	93.8	Non-Native	Other	Blood	Cellulitis	None	Yes

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Appendix

MIC Interpretive Standards Definitions:

CLSI [7] provides recommended interpretive categories for various Minimum Inhibitory Concentration values (cut points) for each organism/antibiotic combination which are defined as follows:

1. Susceptible (S):

The "susceptible" category implies that isolates are inhibited by the usually achievable concentrations of antimicrobial agent when the recommended dosage is used for the site of infection.

2. Intermediate (I):

The "intermediate" category includes isolates with antimicrobial agent MICs that approach usually attainable blood and tissue levels and for which response rates may be lower than for susceptible isolates. The "intermediate" category implies clinical efficacy applicability in body sites where the drugs are physiologically concentrated (e.g., quinolones and β-lactams in urine) or when a higher dosage of a drug can be used (e.g., β-lactams). The "intermediate" category also includes a buffer zone which should prevent small, uncontrolled technical factors from causing major discrepancies in interpretations, especially for drugs with narrow pharmacotoxicity margins.

3. Resistant (R):

Resistant strains are not inhibited by the usually achievable concentrations of the agent with normal dosage schedules, and/or that demonstrate MICs or zone diameters that fall in the range where specific microbial resistance mechanisms are likely (e.g., β-lactamases) are likely, and clinical efficacy of the agent against the isolate has not been reliably shown in treatment studies.