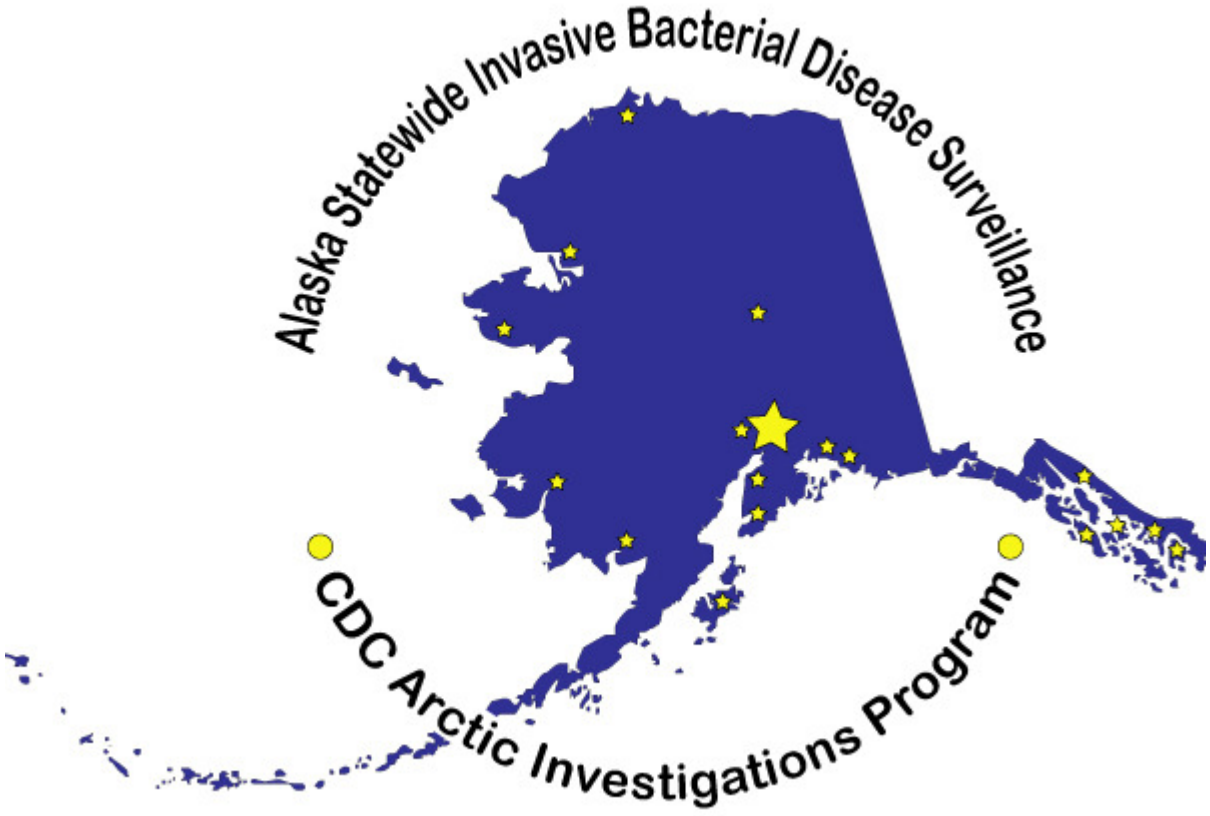


Surveillance of Invasive Bacterial Disease in Alaska, 2006

Arctic Investigations Program
National Center for Preparedness, Detection & Control of Infectious Diseases
Centers for Disease Control and Prevention
4055 Tudor Centre Dr.
Anchorage, AK 99508
(907) 729-3400
ncidaip@cdc.gov

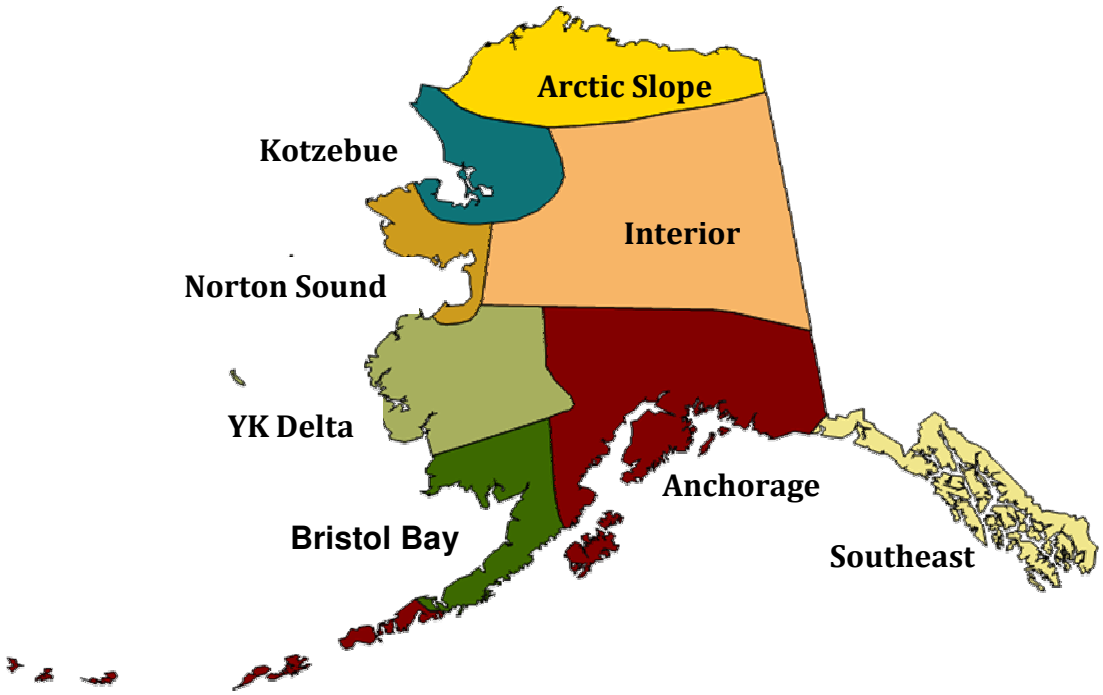
Alaska Statewide Invasive Bacterial Disease

Table of Contents

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, 2006



In 2006, the total numbers of cases of invasive disease caused by these organisms reported to AIP were 138 *S. pneumoniae*, 19 *H. influenzae*, 3 *N. meningitidis*, 39 group A *Streptococci* (GAS) and 25 group B *Streptococci* (GBS). Alaska Native people had higher rates of disease than non-Native people for all surveillance organisms. Rates of invasive pneumococcal disease and *H. influenzae* were highest in the YK Delta. Rates for each organism by region are presented in the following table.

Table 1: Surveillance Organisms Reported by Region – Alaska, 2006

Region	*S. pneumoniae* n (rate*)	*H. influenzae* n (rate*)	*N. meningitidis* n (rate*)	GAS n (rate*)	GBS n (rate*)
Anchorage	80 (18)	7 (1.6)	1 (0.2)	27 (6.1)	17 (3.8)
Arctic Slope	1 (17.3)	0 (0)	0 (0)	2 (34.7)	1 (17.3)
Bristol Bay	0 (0)	1 (14)	0 (0)	0 (0)	1 (14)
Interior	15 (14.8)	2 (2)	0 (0)	6 (5.9)	3 (3)
Kotzebue	5 (62)	0 (0)	1 (12.4)	0 (0)	1 (12.4)
Norton Sound	5 (52.4)	1 (10.5)	0 (0)	0 (0)	0 (0)
Southeast	7 (10)	1 (1.4)	0 (0)	1 (1.4)	2 (2.9)
YK Delta	25 (100.4)	7 (28.1)	1 (4)	3 (12)	0 (0)
Total	138 (20.6)	19 (2.8)	3 (0.4)	39 (5.8)	25 (3.7)

*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 670,053 persons in 2006 [1]. Case detection occurs year-round as participating laboratories send isolates recovered from sterile sites to the AIP laboratory in Anchorage, accompanied by basic demographic and clinical information on the cases. Materials and forms for isolate shipment and data collection are provided to each laboratory by AIP. At year-end, AIP asks that each laboratory review their records and provide information on any cases that may have been overlooked. In 2006, 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.

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.

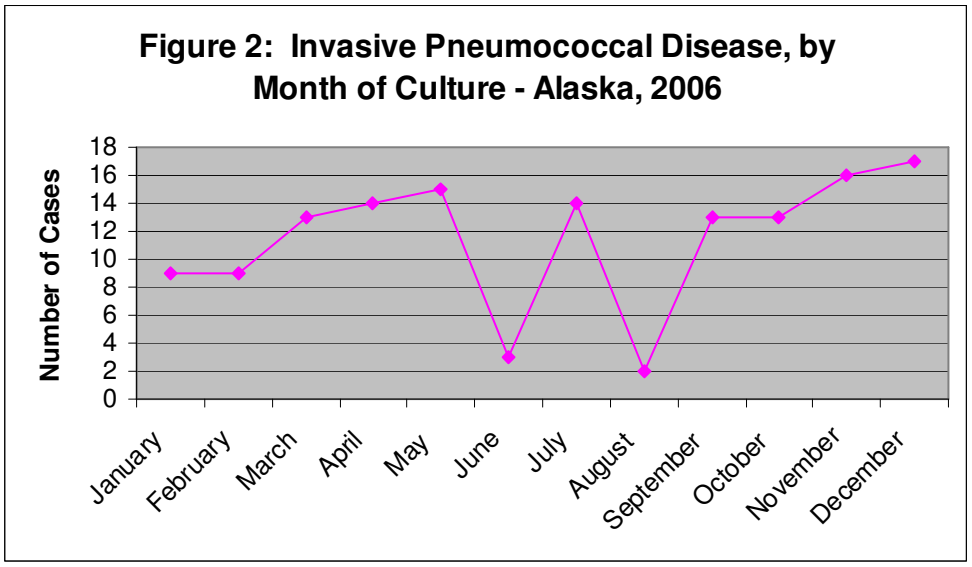
Invasive Pneumococcal Disease

Overall Incidence

A total of 135 pneumococcal isolates were received at AIP in 2006. An additional 3 cases were detected through year-end follow up with participating laboratories throughout the state for a total of 138 cases of invasive pneumococcal disease. The overall rate for invasive pneumococcal disease in 2006 was 20.6 per 100,000 persons per year. Alaska rates for 2006 were higher than the Active Bacterial Core Surveillance (ABCs) 2006 national projected rate of 13.8/100,000 [2]. ABCs is a surveillance system operated in 10 states which covers a population of over 39 million persons.

Seasonality

Invasive *Streptococcus pneumoniae* cases were identified in each month of 2006. The largest number of cases was reported in December.



Race

In 2006, the state population was comprised of 19.6% Alaska Native people *(Alaska Natives 131,002, non-Natives 539,051)* [1]. The percentage of all reported *S. pneumoniae* cases that occurred in 2006 among Alaska Native people was 54%; for a total of 74 cases resulting in an age-adjusted rate of 52.7/100,000 persons per year. Sixty-four cases occurred among the non-Native population for an age-adjusted rate of 11.2/100,000 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 2006 is 4.7.

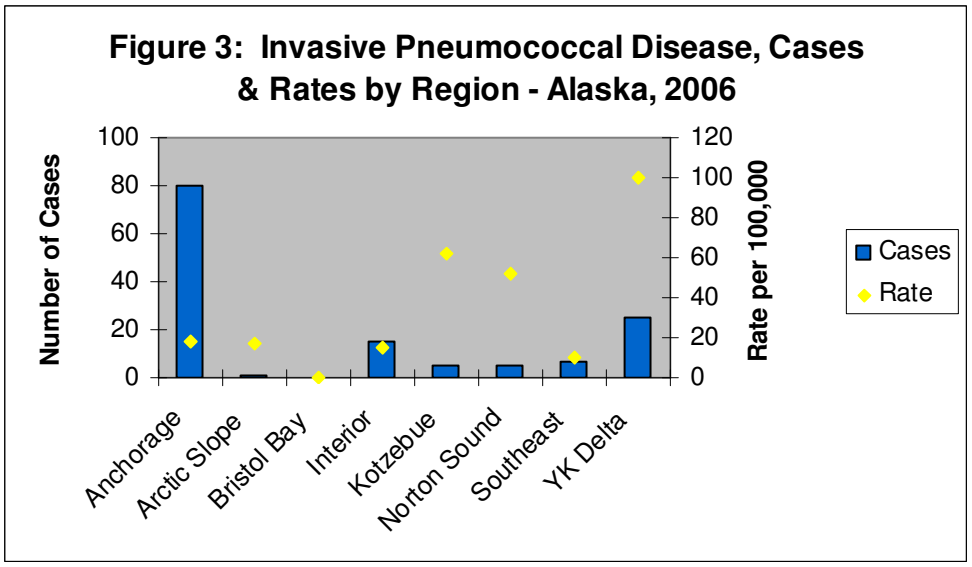
Table 2: Invasive *Streptococcus pneumoniae* Cases by Race – Alaska, 2006

Race	Cases n (%)	Age Adjusted Rate*	% Male	Deaths n (%)
Alaska Native	74 (54)	52.7	48	4 (5)
Non-Native†	64 (46)	11.2	64	7 (11)‡
Total	138		56	11 (8)

*Cases per 100,000 per percent distribution of Alaska 2000 population
†Includes 1 case for which race was unknown
‡Outcome unknown for 1 non-Native case

Region

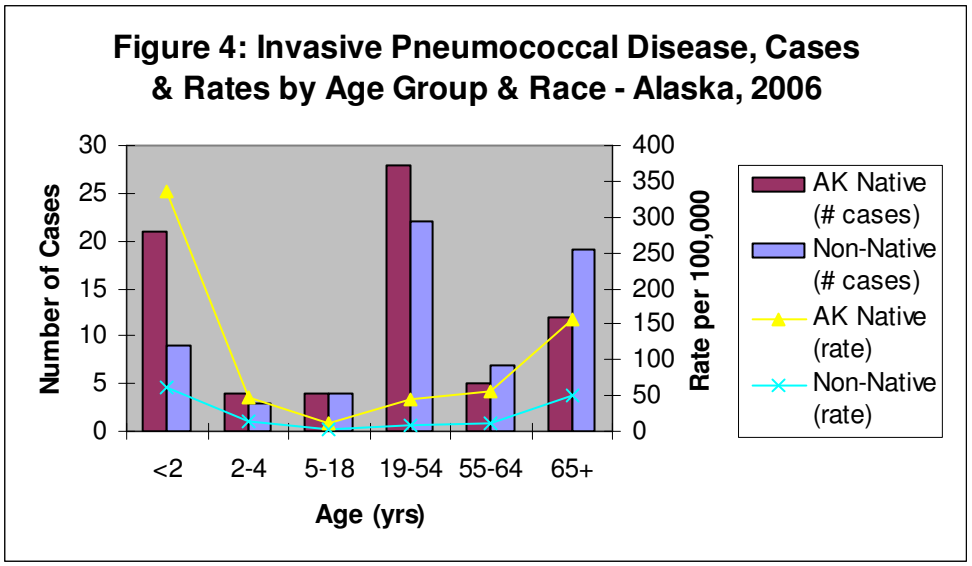
The highest percentage (58%) of invasive pneumococcal disease cases occurred in the Anchorage area in 2006. Rates of disease, however, were highest in the YK Delta (100.4/100,000 persons per year).



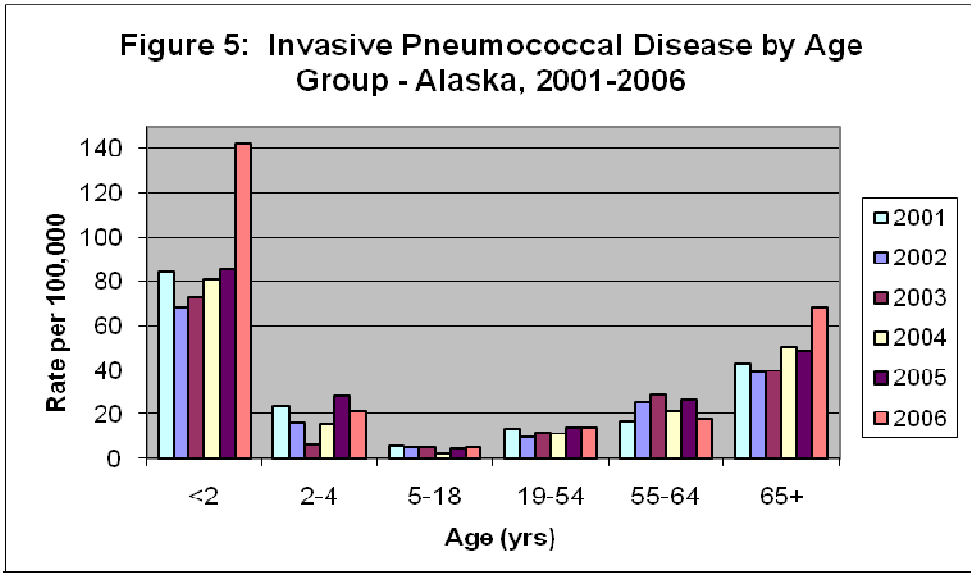
Age

Cases occurred in all age groups in 2006 ranging from 10 days to 101.6 years with a median age of 46 years. Overall, the highest rates of disease occurred in children less than 2 years old.

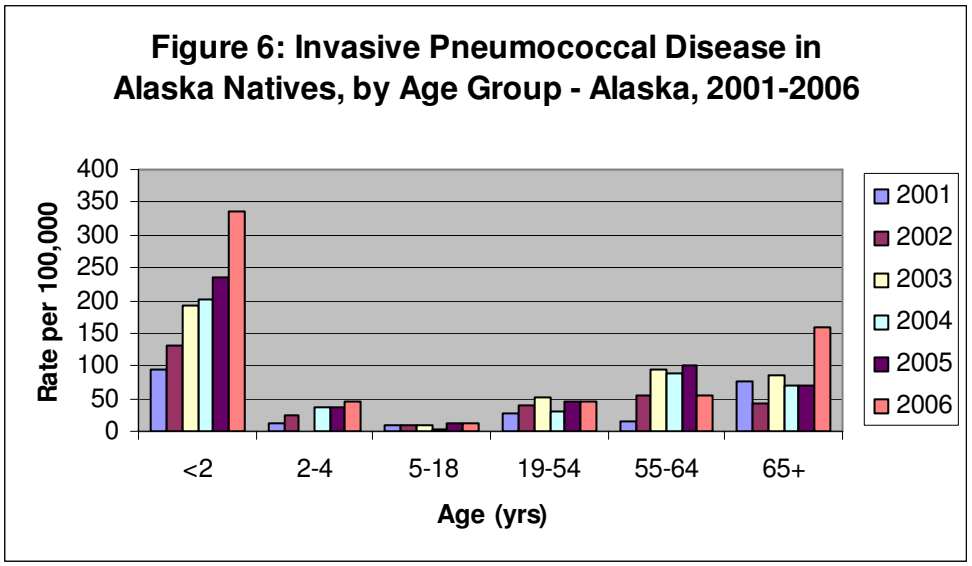
When stratified by age and race, the highest rates of disease in 2006 occurred in Alaska Native children less than 2 years old (335.9/100,000 persons per year).

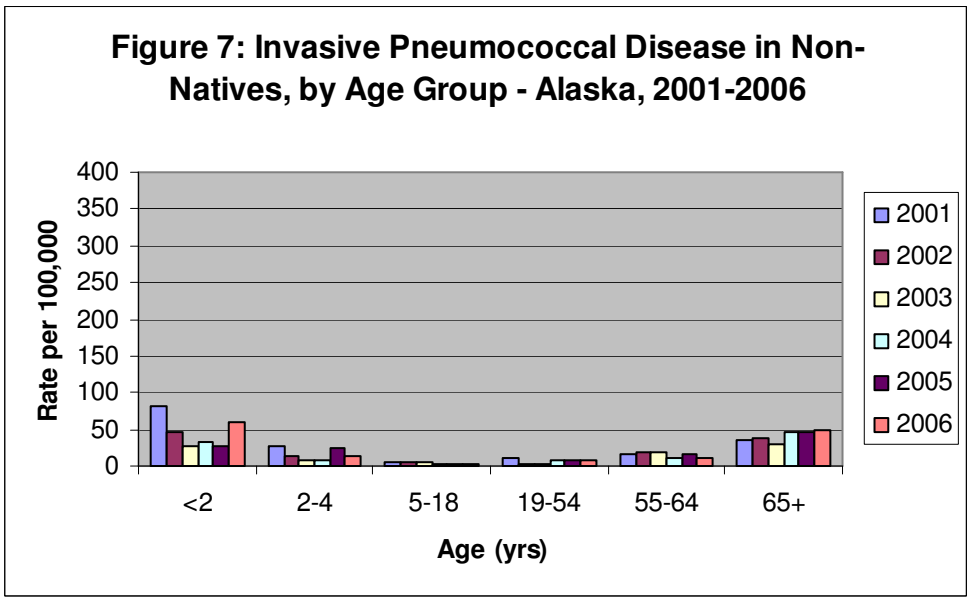


Since the initiation of a pneumococcal conjugate vaccine program in 2001, overall rates of invasive disease have declined dramatically in children less than 2 years of age [3]. In 2000, overall yearly rates of pneumococcal disease in children less than 2 years were 191.2/100,000, dropping to a low of 67.9/100,000 in 2002 and then increasing to 142.2/100,000 in 2006.



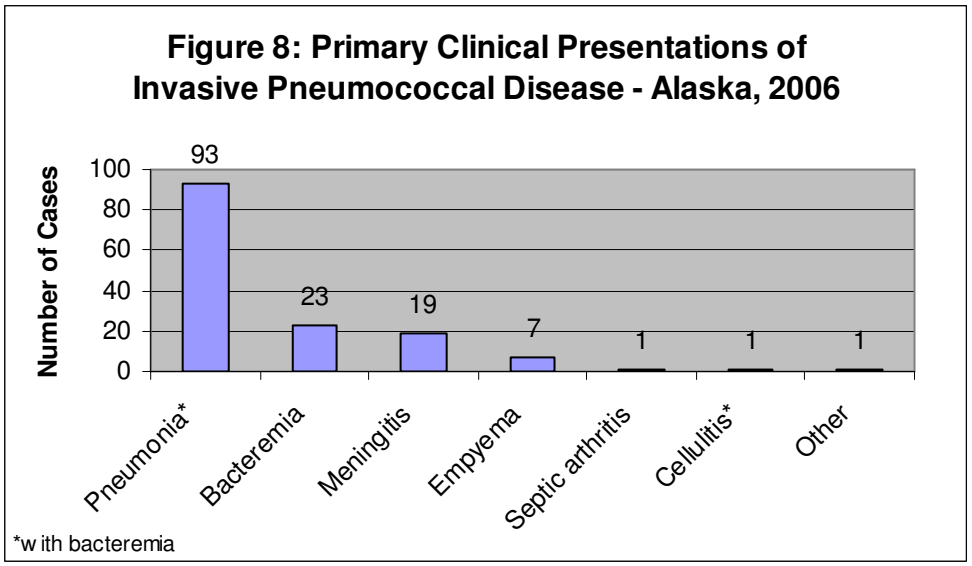
Although pneumococcal disease rates dropped initially in AK Native and non-Native children less than 2 years of age after 2000, the rates of disease in AK Native children less than 2 years have been trending upward from a low of 93.6/100,000 in 2001 to 335.9/100,000 in 2006. Rates of invasive disease in non-Native children less than 2 years declined during the same time period reaching a low of 26.8 in 2005 and increasing to 60.6/100,000 in 2006.





Clinical Presentation

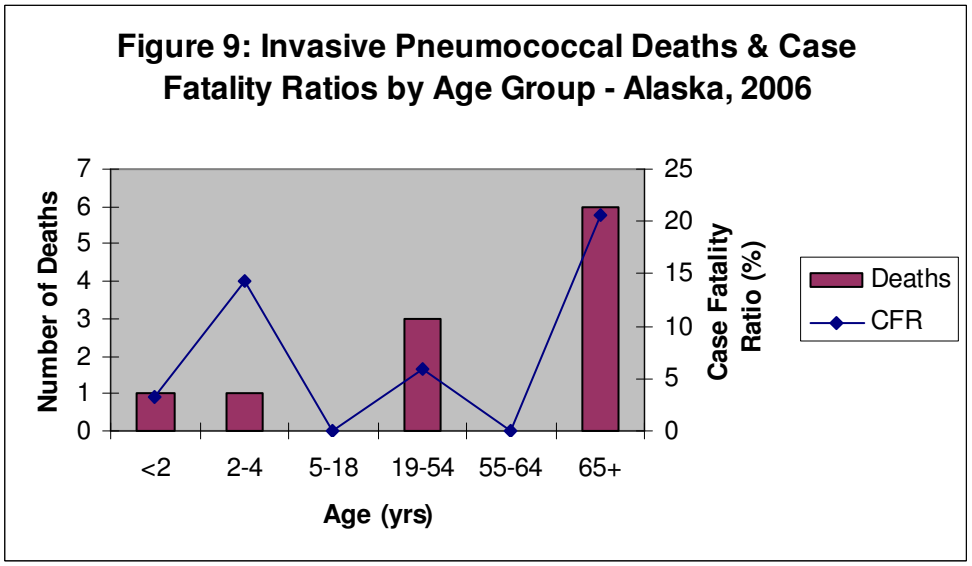
The primary clinical presentation was determined by a review of the discharge diagnoses in each patient's individual medical record associated with the invasive bacterial illness. In cases with multiple discharge diagnoses, the most serious diagnosis related to the pneumococcal infection was recorded as the primary clinical presentation. Pneumonia with bacteremia was the most common primary clinical presentation in 2006 (67%) followed by bacteremia (17%). Twelve cases had a secondary pneumococcal-related diagnosis in 2006 - 11 pneumonia and 1 empyema.



In 2006, blood was the most common source of a positive culture which was used to identify 126 (91%) of 138 cases. Cerebrospinal fluid was the positive site for 5% of cases, 3 cases were identified from autopsy samples and 1 case each was identified through pleural fluid and an unspecified other sterile site.

Mortality

In 2006, the overall case fatality ratio for *S. pneumoniae* in Alaska was 8% (11 deaths out of 137 cases for which outcome was known). The case fatality ratio for non-Natives was higher than Natives; 11.1% (7 deaths) and 5.4% (4 deaths), respectively. The majority of deaths and the highest case fatality ratio occurred in the 65+ age category; 20.7% (6 deaths).



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 two 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, 2006

		Alaska Native				Non-Native				Unknown
Serotype	Total n (%)	<2	2-18	19-64	65+	<2	2-18	19-64	65+	All Ages
01	1 (<1)	-	-	-	-	-	-	-	1	-
03	7 (5)	-	-	-	1	2	1	1	2	-
04	3 (2)	-	-	2	-	-	-	1	-	-
06A	6 (4)	2	-	-	-	1	-	2	-	1
06B	1 (<1)	-	-	-	-	-	-	-	1	-
07C	1 (<1)	-	-	-	-	-	-	1	-	-
07F	23 (17)	4	1	4	2	2	1	8	1	-
08	13 (10)	-	-	7	1	-	-	5	-	-
09N	3 (2)	-	1	-	-	-	-	2	-	-
09V	1 (<1)	-	-	-	-	-	-	-	1	-
10A	1 (<1)	-	-	-	1	-	-	-	-	-
10F	1 (<1)	-	-	-	-	-	1	-	-	-
11A	1 (<1)	-	-	1	-	-	-	-	-	-
12F	12 (9)	2	3	4	2	-	-	1	-	-
14	2 (1.5)	-	-	-	-	-	-	2	-	-
15A	4 (3)	1	-	1	1	-	-	-	1	-
15B	1 (<1)	-	-	-	-	-	-	-	1	-
15C	1 (<1)	-	-	-	-	-	-	1	-	-
16F	2 (1.5)	1	-	-	-	-	1	-	-	-
17F	4 (3)	-	1	1	1	-	1	-	-	-
19A	18 (13)	7	1	1	1	2	-	3	3	-
20	5 (4)	-	-	4	-	-	-	-	1	-
22F	4 (3)	1	-	2	-	-	-	-	1	-
23A	3 (2)	-	-	-	1	-	-	1	1	-
23B	3 (2)	-	-	-	-	1	1	-	1	-
31	1 (<1)	-	-	-	-	-	-	1	-	-
33A	1 (<1)	-	-	-	1	-	-	-	-	-
33F	3 (2)	1	1	1	-	-	-	-	-	-
34	2 (1.5)	-	-	1	-	-	-	-	1	-
35B	2 (1.5)	-	-	1	-	-	-	-	1	-
35F	3 (2)	1	-	-	-	-	1	-	1	-
NT*	1 (<1)	-	-	1	-	-	-	-	-	-
Total	134	20	8	31	12	8	7	29	18	1

*Non-typeable

In 2006, the most common pneumococcal serotype was 7F (23 isolates, 17%). 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 has dropped to a low of 1.2% in 2004 and was 1.5% of serotyped isolates in 2006. However, disease caused by serotypes 7F and 19A, which are not included in the conjugate vaccine, increased. Prior to 2005, yearly numbers of cases of serotype 7F disease and the proportion of total isolates have ranged from 1 to 10 and 0.9% to 9.3%, respectively. Although the majority (62.5%) of serotype 7F disease occurred in AK Natives during 2005, it was more evenly distributed between AK Native people (48%) and non-Natives (52%) in 2006. In 2006, the majority (65%) of serotype 7F cases occurred in the Anchorage

area; serotype 19A cases were more widely distributed throughout the state although the largest proportion (48%) of cases occurred in Anchorage.

Table 4: Invasive Pneumococcal Serotype Distribution by Region – Alaska, 2006

Serotype	Anchorage	Arctic Slope	Interior	Kotzebue	Norton Sound	Southeast	YK Delta
01	1	-	-	-	-	-	-
03	7	-	-	-	-	-	-
04	1	-	1	1	-	-	-
06A	4	-	-	-	-	-	2
06B	1	-	-	-	-	-	-
07C	-	-	1	-	-	-	-
07F	15	-	1	-	-	-	7
08	12	-	-	-	-	1	-
09N	1	-	-	-	-	1	1
09V	-	-	1	-	-	-	-
10A	-	-	-	-	-	-	1
10F	1	-	-	-	-	-	-
11A	-	-	-	-	-	-	1
12F	5	-	-	2	2	-	3
14	1	-	1	-	-	-	-
15A	-	-	1	-	1	1	1
15B	1	-	-	-	-	-	-
15C	1	-	-	-	-	-	-
16F	-	-	-	-	-	-	2
17F	2	-	1	-	-	-	-
19A	11	1	2	1	-	1	3
20	2	-	3	-	-	-	-
22F	2	-	-	1	1	-	-
23A	2	-	-	-	-	-	-
23B	1	-	1	-	-	1	-
31	1	-	-	-	-	-	-
33A	-	-	1	-	-	-	-
33F	-	-	-	-	1	-	2
34	1	-	-	-	-	-	1
35B	1	-	-	-	-	1	-
35F	2	-	-	-	-	1	-
NT*	-	-	1	-	-	-	-
Total	77	1	15	5	5	7	24

*Non-typeable

Vaccine Serotypes

Two vaccine types are licensed for prevention of pneumococcal disease. In 2001, the pneumococcal conjugate vaccine (PCV7) was included in the Alaska childhood vaccination schedule. This vaccine provides protection against the 7 most common pneumococcal serotypes causing invasive disease among children (types 4, 6B, 9V, 14, 18C, 19F, 23F). The table below shows the proportion of invasive infections from 2006 that were due to

serotypes found in the PCV7 vaccine. There were no cases of pneumococcal disease caused by serotypes contained in the PCV7 vaccine in children less than 5 years of age, the age group for which the vaccine is recommended.

Table 5: Proportion of Invasive Isolates Contained in the PCV7 Vaccine by Age Group and Race – Alaska, 2006

Age (yrs)	Alaska Native (%)	Non-Native (%)	Total (%)
<2	0 (0%) of 20	0 (0%) of 9	0 (0%) of 29
2-4	0 (0%) of 4	0 (0%) of 3	0 (0%) of 7
5+	2 (4%) of 47	5 (10%) of 51	7 (7%) of 98
Total	2 (3%) of 71	5 (8%) of 63	7 (5%) of 134

For the year covered by this report, the 23-valent polysaccharide vaccine (Ps23V) was recommended in Alaska for all persons 55 years and older, and for persons over age 2 who are at higher risk for pneumococcal disease. Revaccination was recommended after 6 years [4]. In 2006, for persons 55 years and older, 32 (76%) of 42 cases serotyped were potentially vaccine preventable invasive pneumococcal illnesses.

Vaccine Failures

A PCV7 vaccine failure is defined as invasive pneumococcal disease caused by a serotype contained in the PCV7 vaccine in a child less than five years old who has had at least two doses of vaccine. There were no vaccine failures in 2006.

Potentially Preventable Deaths

In 2006, pneumococcal vaccine status was known for 95 (69%) of the 138 cases; 64 cases (46%) did receive a pneumococcal vaccine prior to illness and 31 cases (22%) had no record of a pneumococcal vaccine.

Table 6: Potentially Vaccine Preventable Invasive Pneumococcal Deaths – Alaska, 2006

Serotypes	< 2 years	2-4	5-18	19-54	55-64	65+	Total
PCV7	0	0	0	0	0	1 (17%)	1 (9%)
Ps23V	1 (100%)*	0	0	1 (33%)	0	4 (66%)	6 (55%)
Non-Vaccine	0	1 (100%)	0	1 (33%)	0	1 (17%)	3 (17%)
Unknown	0	0	0	1 (33%)	0	0	1 (9%)
Total	1	1	0	3	0	6	11

*Ps23V not recommended for use in children < 2

Overall, 45% of all pneumococcal-related mortality in 2006 was potentially preventable with the use of the 23-valent polysaccharide vaccine in persons over 2 years old; 17% of deaths were due to disease caused by serotypes not contained in either the 7 or 23-valent vaccines.

Six of the 11 deaths in 2006 from invasive *S. pneumoniae* occurred from serotypes contained within the Ps23V vaccine; 5 of the deaths were in individuals eligible for the vaccine. Of those five deaths, two occurred in vaccinated individuals; time since vaccination for each was 3 years and 4 years.

Table 7: Invasive Pneumococcal Disease, Serotypes of Fatal Cases – Alaska, 2006

Serotype	Deaths n (%)	Serotype Frequency (n)
01†	1 (100%)	1
03†	1 (14%)	7
06B*†	1 (100%)	1
15B†	1 (100%)	1
19A†	2 (11%)	18
22F†	1 (25%)	4
34	2 (100%)	2
35F	1 (33%)	3
NT	1 (100%)	1

*Serotypes contained in the PCV7 vaccine
†Serotypes contained in the 23-valent polysaccharide vaccine
‡Non-typeable

Associated Medical Conditions

The presence of one or more associated medical conditions was reported in 82% of invasive pneumococcal cases in 2006. Cigarette smoking was the most prevalent risk factor observed in adults followed closely by alcohol abuse.

Table 8: Associated Medical Conditions Identified in Invasive Pneumococcal Cases – Alaska, 2006*

Medical Condition/Risk Factor	Adult Cases (≥ 18 years) n=93, Cases (%)
Cigarette smoking	43 (46)
Alcohol abuse	36 (39)
Chronic lung disease	29 (31)
Diabetes	14 (15)
Immunosuppressive treatment	5 (5)
Injection drug use	1 (1)
Asplenia	0 (0)

*More than one risk factor was identified in several cases

Antibiotic Resistance

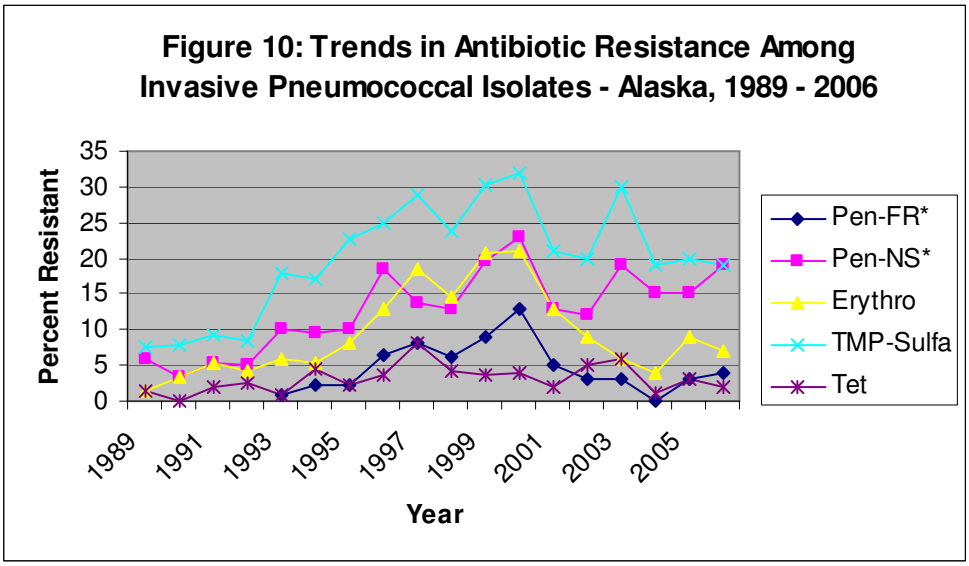
Susceptibility testing was performed on all isolates received in 2006. Results of the testing are presented in the following table.

Table 9: Antibiotic Resistance in Invasive *Streptococcus pneumoniae* Isolates – Alaska, 2006

Antibiotic	Susceptible	Intermediate	Resistant	I + R	Total Tested
Penicillin	104 (78%)	25 (19%)	5 (4%)	29 (22%)	134
TMP-sulfa	108 (81%)	10 (7%)	16 (12%)	26 (19%)	134
Erythromycin	125 (93%)	0 (0%)	9 (7%)	9 (7%)	134
Ceftriaxone	133 (99%)	1 (1%)	0 (0%)	1 (1%)	134
Tetracycline	131 (98%)	0 (0%)	2 (2%)	2 (2%)	133
Chloramphenicol	134 (100%)	0 (0%)	0 (0%)	0 (0%)	134
Rifampin	132 (99%)	2 (1%)	0 (0%)	2 (1%)	134
Vancomycin	133 (100%)	0 (0%)	0 (0%)	0 (0%)	133
Levofloxacin	134 (100%)	0 (0%)	0 (0%)	0 (0%)	134
Clindamycin	132 (99%)	0 (0%)	2 (1%)	2 (1%)	134

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 [5]. The MIC Interpretive Standards definitions of 'susceptible', 'intermediate', and 'resistant' can be found in the Appendix.

Serotypes found in the PCV7 vaccine are more likely to be non-susceptible to penicillin and erythromycin than non-vaccine serotypes. One potential benefit of the use of this vaccine was an anticipated decline in antibiotic resistance among circulating pneumococci. The data in the following graph supports this assumption; since the initiation of the PCV7 vaccine in 2001, antibiotic resistance among invasive pneumococci has dropped. During 2003, TMP-sulfa and penicillin resistance increased, however, both decreased in 2004 to similar levels of resistance seen in 2002 and have remained at those levels in 2006. After steadily declining since 2000 to a low of 4% in 2004, erythromycin resistance increased to 9% of tested isolates in 2005 and decreased slightly to 7% in 2006.



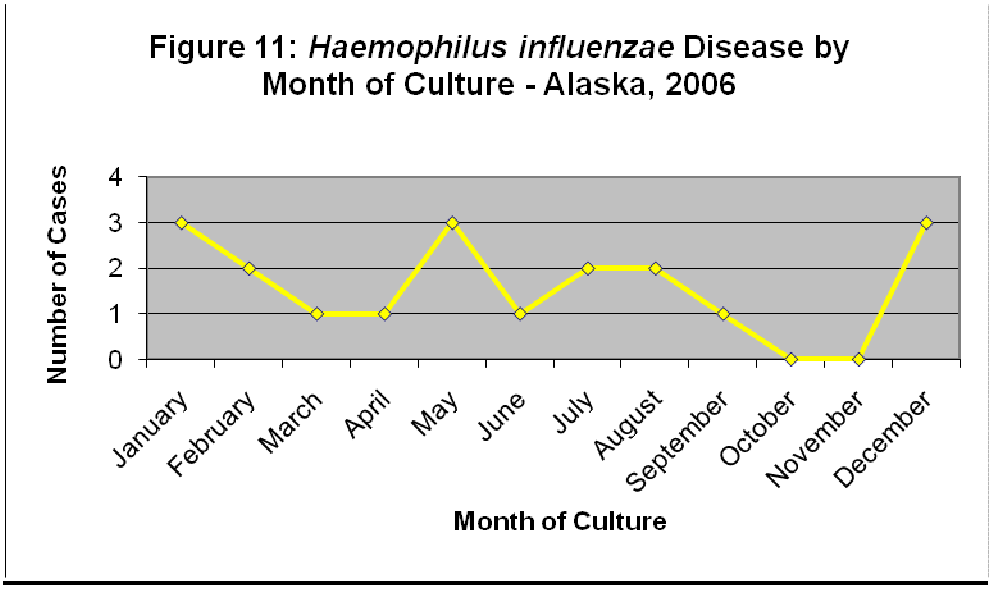
*Pen-FR = fully resistant, Pen-NS = non-susceptible

Invasive *Haemophilus influenzae*

Overall Incidence

In 2006, there were 19 cases of invasive *Haemophilus influenzae* in Alaska, for a statewide rate of 2.8/100,000 persons per year. This rate is higher than the national projected rate of 1.6/100,000 persons per year [6]. There were three deaths caused by *H. influenzae* in 2006 for a case fatality ratio of 15.8%.

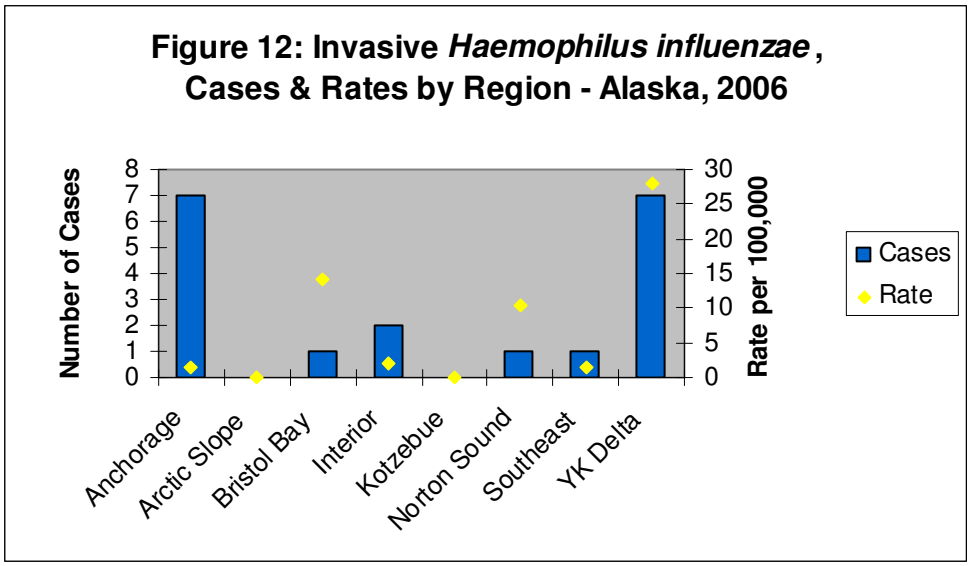
Seasonality



Cases of invasive *H. influenzae* occurred throughout 2006, however, due to the small number of cases, trends in seasonality cannot be determined.

Region

Although the Anchorage and YK Delta areas had the same number of invasive *H. influenzae* cases in 2006 (7 cases each), the rate of disease was significantly higher in the YK Delta (28.1/100,000) than in Anchorage (1.6/100,000). Other areas with high rates of disease were Bristol Bay (14.1/100,000) and Norton Sound (10.5/100,000) although there was only one case in each region.



Race

Table 10: Invasive *Haemophilus influenzae* Cases by Race – Alaska, 2006

Race	Cases n (%)	Age Adjusted Rate*	% Male	Deaths n (%)
Alaska Native	13 (68)	8	46	3 (23)
Non-Native	6 (32)	1	83	0 (0)
Total	19		58	3 (16)

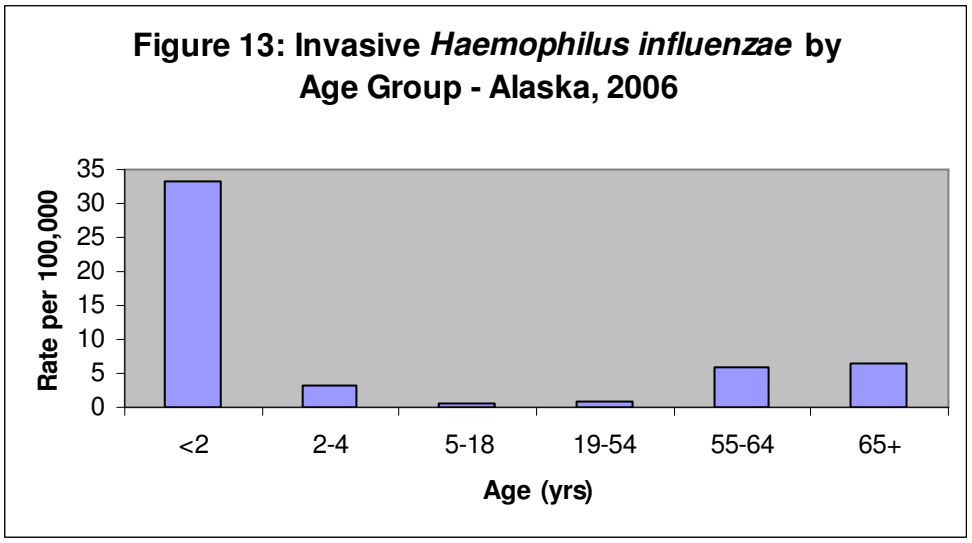
*Cases per 100,000 per percent distribution of Alaska 2000 population

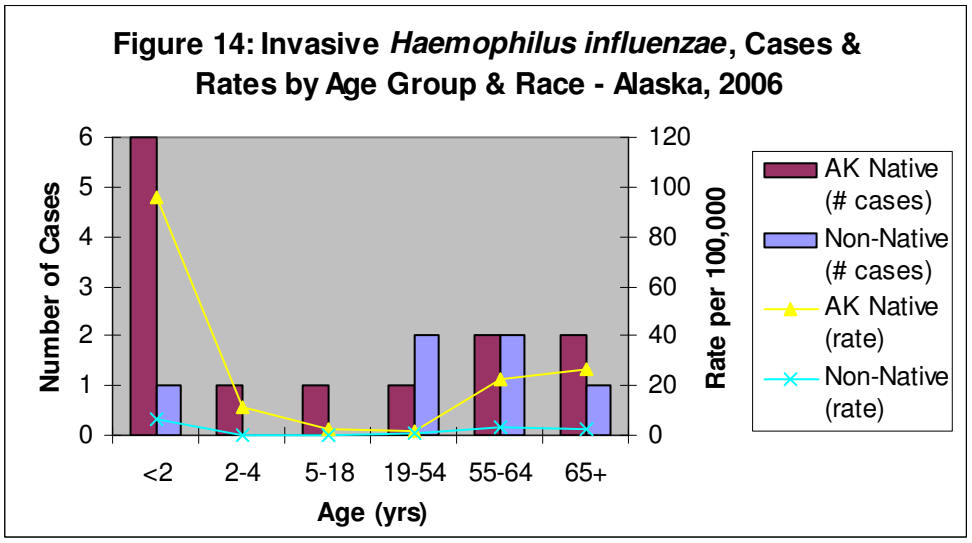
In 2006, 68% of the cases occurred in Alaska Natives. Age-adjusted rates were calculated for Alaska Natives and non-Natives. The age-adjusted rate ratio of *H. influenzae* disease for the Alaska Native population compared with the non-Native population in 2006 was 8.

Age

H. influenzae cases ranged in age from newborn to 73 years of age in 2006 (median 45.7 years). Overall, the highest rates of disease occurred in children less than 2 years old and adults 65 and older.

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 (96/100,000 persons per year) and Alaska Native adults 65 years and older (26.3/100,000 persons per year). In non-Natives, the highest rates of disease were in children less than 2 years old (6.7/100,000 persons per year).





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 2006, pneumonia was the most common presentation (47% of cases).

H. influenzae was isolated from 14 (74%) blood samples, 3 (16%) cerebrospinal fluid samples and 2 (10%) autopsy samples.

Table 11: Primary Clinical Presentation of Invasive *Haemophilus influenzae* - Alaska, 2006

Primary Presentation	n (%)
Pneumonia*	9 (47)
Bacteremia	6 (32)
Meningitis	3 (16)
Unknown	1 (5)
Total	19

*with bacteremia

Serotypes

All isolates received at AIP are serotyped; 18 of the 19 cases in 2006 had isolates and were serotyped. The bacterial capsule is the basis for serotyping and is the primary virulence factor. Serotype b has been 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, 2006

		Alaska Native				Non-Native			
Serotype	Total n (%)	<2	2-18	19-64	65+	<2	2-18	19-64	65+
a	2	2	0	0	0	0	0	0	0
b	3	0	2	0	0	0	0	1	0
d	1	1	0	0	0	0	0	0	0
e	1	0	0	0	0	0	0	1	0
f	4	2	0	0	0	0	0	1	1
NT*	7	1	0	3	1	1	0	1	0
Total	18	6	2	3	1	1	0	4	1

*Non-typable

Hib

In recent years, the prevalence of *H. influenzae* type b has declined due to increased use of a childhood vaccine against this serotype. Three cases of Hib occurred in 2006; two in AK Native children, 2.7 and 7.4 years old, and one in a non-Native adult 54.7 years old. Vaccine status was known for the two children and both were fully vaccinated (3 doses). All three cases presented with pneumonia and bacteremia. The overall Hib rate for 2006 was 0.4/100,000 persons per year; the rate in AK Native people was 1.5/100,000 persons per year.

Antibiotic Resistance

Eighteen *Haemophilus influenzae* isolates received at AIP were tested for susceptibility to chloramphenicol, ceftriaxone and TMP/sulfa. All 18 isolates were susceptible to chloramphenicol and ceftriaxone; 4 isolates were fully resistant to TMP/sulfa, 3 had intermediate resistance and 9 were susceptible.

Table 13: Summary of Invasive *Haemophilus influenzae* Case Characteristics, Alaska, 2006

Sex	Age (Yrs)	Race	Residence	Site of Isolation	Clinical Presentation(s)	Serotype*	Associated Medical Conditions	Survived
F	Newborn	Non-Native	Anchorage	Blood	Bacteremia	NT	None	Yes
F	0.2	AK Native	Other	Autopsy	Unknown	NT	Unknown	No
M	0.4	AK Native	Other	Blood	Pneumonia	F	None	Yes
F	0.5	AK Native	Other	CSF	Meningitis	F	None	Yes
M	0.6	AK Native	Other	Autopsy	Pneumonia	A	Chronic lung disease	No
F	1.0	AK Native	Other	CSF	Meningitis	A	None	Yes
M	1.5	AK Native	Other	Blood	Bacteremia	D	None	Yes
F	2.7	AK Native	Other	Blood	Pneumonia	B	None	Yes
M	7.4	AK Native	Other	Blood	Pneumonia	B	Chronic lung disease	Yes
F	45.7	AK Native	Anchorage	Blood	Bacteremia	NT	Cigarette smoking, alcohol abuse	No
M	52.2	Non-Native	Anchorage	Blood	Pneumonia	NT	None	Yes
M	54.7	Non-Native	Anchorage	Blood	Pneumonia	B	Cigarette smoking, alcohol abuse	Yes
M	56.2	Non-Native	Anchorage	CSF	Meningitis	F	Diabetes	Yes
M	57.9	Non-Native	Anchorage	Blood	Pneumonia	E	Chronic lung disease	Yes
M	62.1	AK Native	Anchorage	Blood	Pneumonia	NT	Cigarette smoking, chronic lung disease, alcohol abuse	Yes
F	62.4	AK Native	Other	Blood	Pneumonia	NT	Cigarette smoking, chronic lung disease, alcohol abuse	Yes
F	65.5	AK Native	Other	Blood	Bacteremia	Unknown	Cigarette smoking, immune suppressive treatment, diabetes	Yes
M	68.4	Non-Native	Other	Blood	Bacteremia	F	None	Yes
M	73.1	AK Native	Other	Blood	Bacteremia	NT	Chronic lung disease, alcohol abuse	Yes

*NT = non-typeable

Invasive *Neisseria meningitidis*

Overall Incidence

A total of 3 cases of invasive *Neisseria meningitidis* were reported to AIP in 2006 for an overall rate of 0.4/100,000. The Alaska rates are similar to the ABCs 2006 national projected rate of 0.3/100,000 [7]. There were no invasive *N. meningitidis*-related deaths in Alaska in 2006.

Seasonality

N. meningitidis cases occurred one each in February, July and November; no clusters of related cases were reported.

Race

In 2006, 67% 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 2006 was 5.

Table 14: Invasive *Neisseria meningitidis* Cases by Race – Alaska, 2006

Race	Cases n (%)	Age Adjusted Rate*	% Male	Deaths n (%)
Alaska Native	2 (67)	1.0	50	0 (0)
Non-Native	1 (33)	0.2	0	0 (0)
Total	3		33	0 (0)

*Cases per 100,000 per percent distribution of Alaska 2000 population

Region

One case of invasive *N. meningitidis* occurred in each of the following regions: Anchorage, Kotzebue and the YK Delta.

Age

Invasive *N. meningitidis* cases reported in 2006 ranged in age from 1.9 to 25.7 years old; the median age was 2 years.

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 *N. meningitidis* infection was recorded as the primary clinical presentation. Two cases presented with meningitis and one with bacteremia.

N. meningitidis was isolated from cerebrospinal fluid in two of three (67%) cases in 2006. The remaining case was isolated from blood.

Mortality

There were no *N. meningitidis*-related deaths reported in Alaska in 2006.

Serogroup

All three invasive *N. meningitidis* cases in 2006 were serogrouped; two were serogroup B and one was serogroup Y.

Table 15: Summary of Invasive *Neisseria Meningitidis* Cases Characteristics, Alaska, 2006

Sex	Age (yrs)	Race	Residence	Site of Isolation	Clinical Presentation(s)	Serogroup	Associated Medical Conditions	Survived
M	1.9	AK Native	Other	CSF	Meningitis	B	None	Yes
F	2.0	AK Native	Other	CSF	Meningitis	B	None	Yes
F	25.7	Non-Native	Anchorage	Blood	Bacteremia	Y	None	Yes

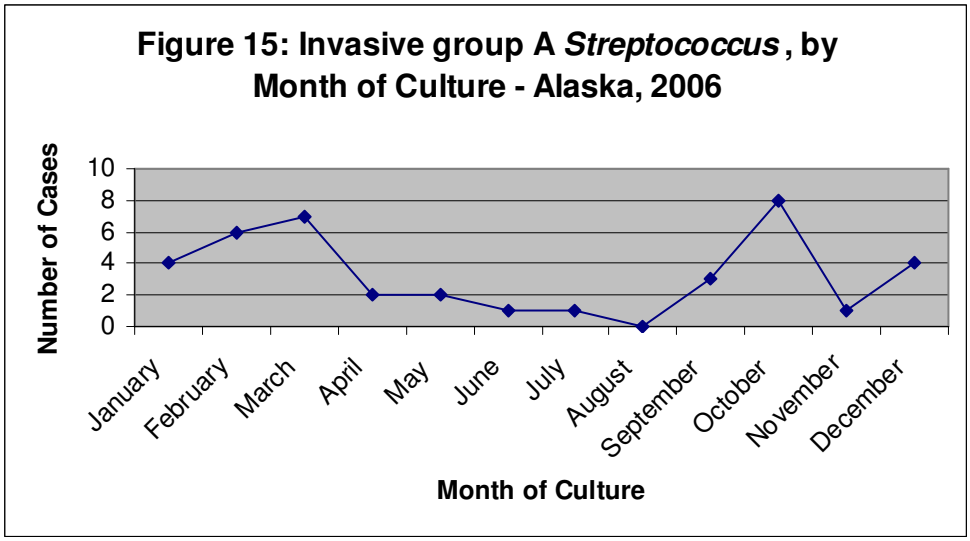
Invasive group A *Streptococcus*

Overall Incidence

A total of 39 cases of invasive group A *Streptococcus* (GAS) were reported to AIP in 2006. The overall rate of invasive GAS disease in the state of Alaska was 5.8/100,000 persons per year. The Alaska rate is higher than the ABCs 2006 national projected rate of 3.8/100,000 [8]. In 2006, there were 3 GAS-related deaths (*emm* types 73 and 92, 1 unknown) for a case fatality ratio of 7.9%; outcome was unknown in one case.

Seasonality

Cases of group A *Streptococcus* occurred throughout the year in 2006 with no apparent trends in seasonality.



Race

In 2006, 51% of invasive GAS cases in Alaska occurred in the Alaska Native population for an age-adjusted rate of 17/100,000 persons per year which was over five times higher the non-Native age-adjusted rate of 3.4/100,000 persons per year.

Table 16: Invasive group A *Streptococcus* Cases by Race – Alaska, 2006

Race	Cases n (%)	Age Adjusted Rate*	% Male	Deaths n (%)
Alaska Native	20 (51)	17	55	1 (5)
Non-Native	19 (49)	3.4	53	2 (11)†
Total	39		54	3 (7.9)

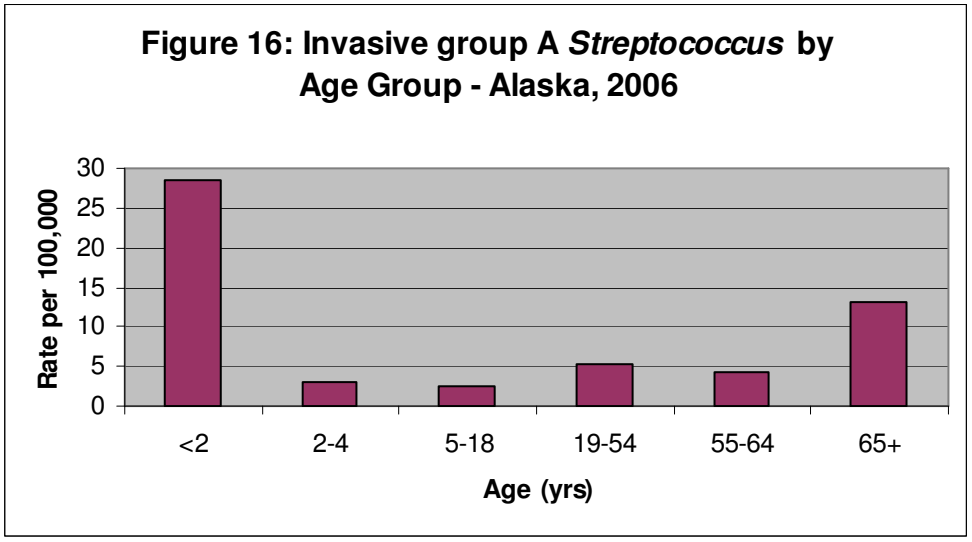
*Cases per 100,000 per percent distribution of Alaska 2000 population
†Outcome unknown in one non-Native case

Region

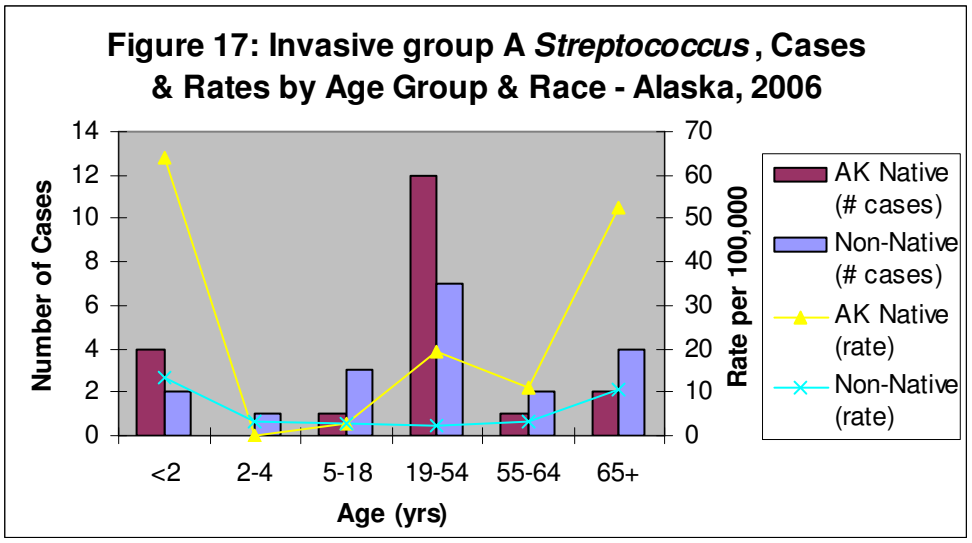
Twenty-seven (69.2%) of the 39 invasive group A *Streptococcus* cases in 2006 were reported in the Anchorage area, 6 cases in the Interior, 3 cases in the YK Delta, 2 cases in the Arctic Slope and one case in Southeast.

Age

Invasive group A *Streptococcus* cases reported in 2006 ranged in age from 0.8 to 93.4 years old; the median age was 39.6 years. Highest rates of disease occurred in children less than 2 years old (28.4/100,000).



When stratified by race, the highest rates of invasive group A streptococcal disease occurred in Alaska Native children less than two years old (64/100,000 persons per year) and Alaska Native persons 65 and older (52.6/100,000 persons per year). The highest GAS disease rate in the non-Native population occurred in children less than 2 years old (13.5/100,000 persons per year).



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 2006. Six cases also presented with secondary diagnoses including septic arthritis, endocarditis, cellulitis and pneumonia.

Group A *Streptococcus* was isolated from blood samples in 28 (72%) of 39 cases, four from joint fluid, two from an abscess, one each from peritoneal fluid, pleural fluid and a wound, and two from other sterile sites.

Table 17: Primary Clinical Presentations of Invasive group A *Streptococcus* – Alaska, 2006

Primary Presentation	n (%)
Cellulitis*	12 (31)
Bacteremia	10 (26)
Septic arthritis	4 (10)
Pneumonia*	4 (10)
Necrotizing fasciitis	3 (8)
Empyema	2 (5)
Bursitis	1 (2.5)
Peritonitis	1 (2.5)
Septic abortion	1 (2.5)
Other	1 (2.5)
Total	39

*with bacteremia

Table 18: Summary of Invasive group A *Streptococcus* Case Characteristics, Alaska, 2006

Sex	Age (yrs)	Race	Residence	Site of Isolation	Clinical Presentation(s)	*emm* Type	Associated Medical Conditions	Survived
F	0.8	AK Native	Anchorage	Blood	Empyema, pneumonia	73	None	Yes
F	0.9	AK Native	Anchorage	Abscess	Cellulitis		None	Yes
F	1.0	Non-Native	Anchorage	Blood	Bacteremia	11	None	Yes
F	1.3	AK Native	Anchorage	Blood	Bacteremia	73	None	Yes
M	1.3	Non-Native	Anchorage	Blood	Bacteremia	44	None	Yes
F	1.9	AK Native	Anchorage	Blood	Septic arthritis	75	None	Yes
M	4.2	Non-Native	Other	Blood	Bacteremia	4	None	Yes
M	8.1	Non-Native	Other	Blood	Bacteremia	89	Unknown	Yes
M	14.1	AK Native	Anchorage	Joint fluid	Septic arthritis, bursitis	87	None	Yes
M	15.3	Non-Native	Anchorage	Blood	Bacteremia	6	None	Yes
F	16.1	Non-Native	Other	Peritoneal fluid	Peritonitis	92	None	Yes
M	19.2	AK Native	Anchorage	Abscess	Cellulitis		None	Yes
M	26.0	AK Native	Anchorage	Wound	Cellulitis, bursitis		Smoking, alcohol abuse	Yes
F	26.3	Non-Native	Other	Blood	Bacteremia	28	None	Yes
M	28.7	AK Native	Anchorage	Joint fluid	Septic arthritis, bursitis	87	Alcohol abuse	Yes
F	29.4	AK Native	Other	Blood	Septic abortion	87	None	Yes
M	29.8	AK Native	Other	Blood	Pneumonia	92	None	Yes
M	31.1	AK Native	Anchorage	Blood	Bacteremia	73	Smoking, alcohol abuse, diabetes	No
F	38.7	AK Native	Other	Joint fluid	Septic arthritis, necrotizing fasciitis	73	Smoking	Yes
M	39.6	Non-Native	Other	Blood	Bacteremia	73	None	Yes
M	43	Non-Native	Other	Blood	Endocarditis, necrotizing fasciitis	1	Alcohol abuse	Unknown
M	45.8	AK Native	Anchorage	Blood	Pneumonia	4	Smoking	Yes
M	46.6	Non-Native	Anchorage	Blood	Pneumonia	92	Smoking, alcohol abuse	No
M	50.5	AK Native	Anchorage	Blood	Cellulitis	49.1	Smoking, alcohol abuse	Yes
M	51.8	Non-Native	Anchorage	Blood	Cellulitis		Diabetes	No
M	52.1	AK Native	Anchorage	Other	Cellulitis		Smoking, alcohol abuse	Yes
M	52.6	AK Native	Anchorage	Blood	Pneumonia	49.1	Smoking, chronic lung disease	Yes
F	53.3	Non-Native	Anchorage	Blood	Cellulitis		None	Yes
M	53.4	Non-Native	Anchorage	Blood	Septic arthritis, necrotizing fasciitis, cellulitis	5.14	Smoking, diabetes	Yes
M	53.4	AK Native	Other	Joint fluid	Bursitis		Alcohol abuse	Yes
F	58.5	Non-Native	Anchorage	Blood	Cellulitis		Chronic lung disease, diabetes	Yes
M	61.2	Non-Native	Anchorage	Blood	Cellulitis	49.1	Diabetes	Yes
F	62.9	AK Native	Anchorage	Other	Other	87	Smoking, chronic lung disease, alcohol abuse	Yes
F	70.4	AK Native	Other	Blood	Bacteremia	71	Immune suppressive treatment	Yes
F	71.6	Non-Native	Anchorage	Pleural fluid	Empyema, pneumonia	3.1	None	Yes
F	72.8	AK Native	Other	Blood	Septic arthritis	11	Diabetes	Yes
F	84.7	Non-Native	Anchorage	Blood	Cellulitis	89	Chronic lung disease	Yes
F	85.1	Non-Native	Anchorage	Blood	Cellulitis		None	Yes
F	93.4	Non-Native	Anchorage	Blood	Cellulitis	44	Diabetes	Yes

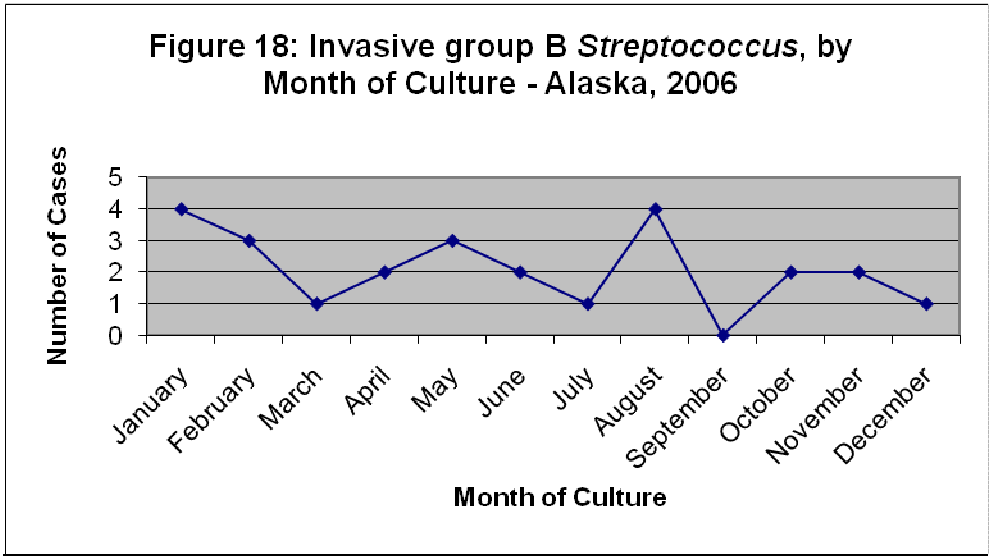
Invasive group B *Streptococcus*

Overall Incidence

A total of 25 cases of invasive group B *Streptococcus* (GBS) were reported to AIP in 2006. Overall rates of invasive GBS disease in the state of Alaska were 3.7/100,000 persons per year. The Alaska rate is lower than the ABCs 2006 national projected rate of 7.1/100,000 [9]. In 2006, there was one GBS-related death for a case fatality ratio of 4% (outcome was unknown in 1 case).

Seasonality

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



Race

In 2006, 32% of invasive group B *Streptococcus* cases in Alaska occurred in the Alaska Native population for an age-adjusted rate of 5.4/100,000 persons per year which is twice the non-Native rate of 2.8/100,000 persons per year.

Table 19: Invasive group B *Streptococcus* Cases by Race – Alaska, 2006

Race	Cases n (%)	Age Adjusted Rate*	% Male	Deaths n (%)
Alaska Native	8 (32)	5.4	75	0 (0)
Non-Native	17 (68)‡	2.8	59	1 (6)
Total	25		64	1 (4)

*Cases per 100,000 per percent distribution of Alaska 2000 population

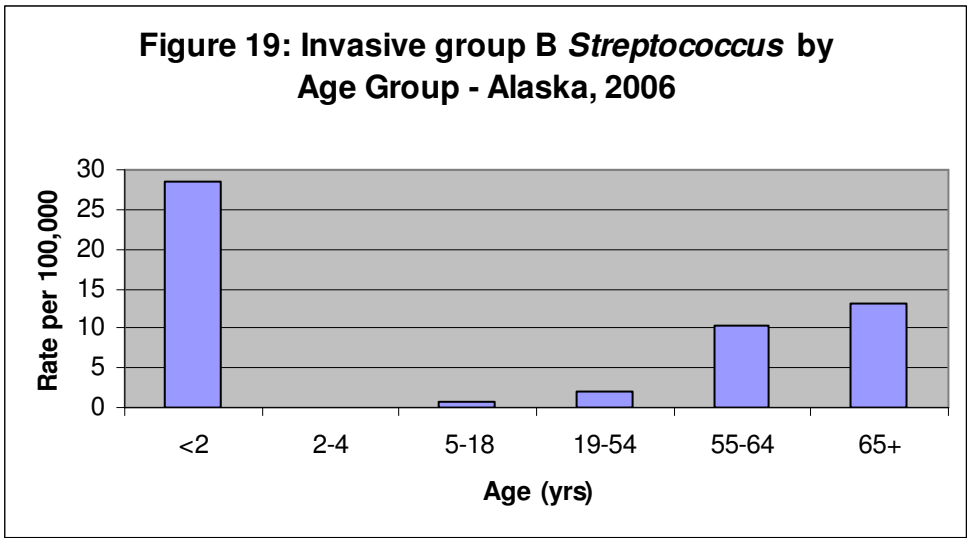
‡Includes one case for which race was unknown

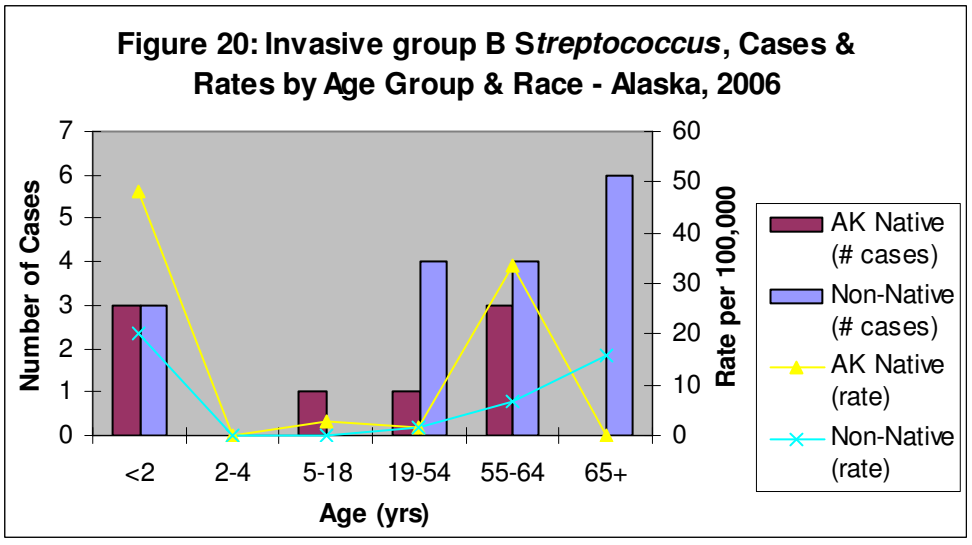
Region

In 2006, 17 (68%) of the 25 reported GBS cases occurred in Anchorage; three cases were reported in the Interior, two cases in Southeast Alaska, and one each in Kotzebue, Bristol Bay and the Arctic Slope.

Age

Invasive group B *Streptococcus* cases reported in 2006 ranged in age from 4 days to 85.7 years old; the median age was 57 years. Highest rates of disease occurred in children less than two years old (28.4/100,000 persons per year).





The highest rates of disease occurred in AK Native children less than 2 years of age (48/100,000 persons per year). There was no early-onset disease (cases less than 7 days old). Of the three cases that occurred in children less than 2 years old in non-Natives, one was early-onset disease for a rate of 0.1/1,000 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 2006, the most common clinical presentation was bacteremia which occurred in 14 cases (56%).

Group B *Streptococcus* was isolated from blood in 22 (88%) of 25 cases in 2006; one case each was isolated from bone, joint fluid and an unspecified sterile site.

Table 20: Primary Clinical Presentations of Invasive group B *Streptococcus* – Alaska, 2006

Primary Presentation	n (%)
Bacteremia	14 (56)
Osteomyelitis	2 (8)
Septic arthritis	2 (8)
Cellulitis*	2 (8)
Meningitis	2 (8)
Endometritis	1 (4)
Endocarditis	1 (4)
Other	1 (4)
Total	25

*with bacteremia

Antibiotic Resistance

Susceptibility testing was performed on 19 GBS isolates received in 2006. Results of the testing are presented in the following table.

Table 21: Antibiotic Resistance in Invasive group B *Streptococcus* Isolates – Alaska, 2006

Antibiotic	Susceptible	Intermediate	Resistant	I + R	Total Tested
Penicillin	18 (100%)	0 (0%)	0 (0%)	0 (0%)	18
Cefotaxime	18 (100%)	0 (0%)	0 (0%)	0 (0%)	18
Erythromycin	16 (84%)	0 (0%)	3 (16%)	3 (16%)	19
Tetracycline	1 (5%)	0 (0%)	18 (85%)	18 (95%)	19
Levofloxacin	19 (100%)	0 (0%)	0 (0%)	0 (0%)	19
Clindamycin	17 (89%)	0 (0%)	2 (11%)	2 (11%)	19

All isolates tested were susceptible to penicillin and cefotaxime. Resistance to erythromycin and clindamycin was seen in 16% and 11%, respectively, of isolates tested. The one early onset case did not have an isolate available for testing.

Table 21: Summary of Invasive group B *Streptococcus* Case Characteristics, Alaska, 2006

Sex	Age (yrs)	Race	Residence	Site of Isolation	Clinical Presentation(s)	Associated Medical Conditions	Survived
M	4 days	Non-Native	Other	CSF	Meningitis	None	Yes
M	15 days	AK Native	Anchorage	Blood	Bacteremia	None	Yes
M	18 days	AK Native	Anchorage	Blood	Bacteremia	None	Yes
F	0.2	Non-Native	Anchorage	Blood	Bacteremia	None	Yes
M	0.2	AK Native	Other	CSF	Meningitis	None	Yes
M	0.2	Unknown	Other	Blood	Bacteremia	None	Yes
F	17.1	AK Native	Anchorage	Blood	Bacteremia	Chronic lung disease	Yes
F	22.3	Non-Native	Anchorage	Blood	Endometritis	None	Yes
M	47.6	Non-Native	Other	Joint fluid	Septic arthritis	Unknown	Yes
F	49.5	Non-Native	Anchorage	Blood	Bacteremia	Diabetes	Yes
F	52.6	Non-Native	Anchorage	Blood	Cellulitis	Smoking	Yes
F	53.4	AK Native	Anchorage	Bone	Osteomyelitis, septic arthritis	Smoking, diabetes	Yes
M	57.0	Non-Native	Anchorage	Blood	Endocarditis	None	No
F	57.1	Non-Native	Anchorage	Blood	Bacteremia	Diabetes	Yes
M	57.7	Non-Native	Other	Blood	Cellulitis	Diabetes	Yes
M	58.9	Non-Native	Other	Blood	Septic arthritis	Diabetes	Yes
M	61.3	AK Native	Anchorage	Blood	Bacteremia	Chronic lung disease, diabetes	Yes
M	64.3	AK Native	Other	Blood	Bacteremia	Smoking, diabetes	Yes
M	64.8	AK Native	Other	Blood	Bacteremia	Chronic lung disease	Yes
M	66.9	Non-Native	Anchorage	Other	Other	None	Yes
M	73.2	Non-Native	Anchorage	Blood	Osteomyelitis	Diabetes	Yes
M	73.7	Non-Native	Anchorage	Blood	Bacteremia	None	Yes
F	76.4	Non-Native	Anchorage	Blood	Bacteremia	Diabetes	Yes
M	77.0	Non-Native	Anchorage	Blood	Bacteremia	None	Yes
F	85.7	Non-Native	Anchorage	Blood	Bacteremia	None	Yes

References

[1] State of Alaska, Department of Labor & Workforce Development. Retrieved 7/16/2007 from http://almis.labor.state.ak.us

[2] Centers for Disease Control and Prevention. 2007. Active Bacterial Core Surveillance Report, Emerging Infections Program Network, *Streptococcus pneumoniae*, 2006.

[3] Hennessy TW, Singleton RJ, Bulkow LR, Bruden DL, Hurlburt DA, Parks, D, Moore M, Parkinson AJ, Schuchat A, Butler JC. Impact of heptavalent pneumococcal conjugate vaccine on invasive disease; antimicrobial resistance and colonization in Alaska Natives: progress towards elimination of a health disparity. *Vaccine* 2005;23:5464-5473.

[4] State of Alaska, Department of Health & Human Services. Retrieved 7/30/2007 from http://www.epi.hss.state.ak.us/id/iz/vaxpacket/vis/vis-PneumoPoly.pdf

[5] Clinical and Laboratory Standards Institute (CLSI). *Performance Standards for Antimicrobial Susceptibility Testing; Nineteenth Informational Supplement.* 2009; 29(3): M100-S19. p.21.

[6] Centers for Disease Control and Prevention. 2007. Active Bacterial Core Surveillance Report, Emerging Infections Program Network, *Haemophilus influenzae*, 2006.

[7] Centers for Disease Control and Prevention. 2007. Active Bacterial Core Surveillance Report, Emerging Infections Program Network, *Neisseria meningitidis*, 2006.

[8] Centers for Disease Control and Prevention. 2007. Active Bacterial Core Surveillance Report, Emerging Infections Program Network, Group A *Streptococcus*, 2006.

[9] Centers for Disease Control and Prevention. 2007. Active Bacterial Core Surveillance Report, Emerging Infections Program Network, Group B *Streptococcus*, 2006.

Appendix

MIC Interpretive Standards Definitions:

CLSI [5] 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.