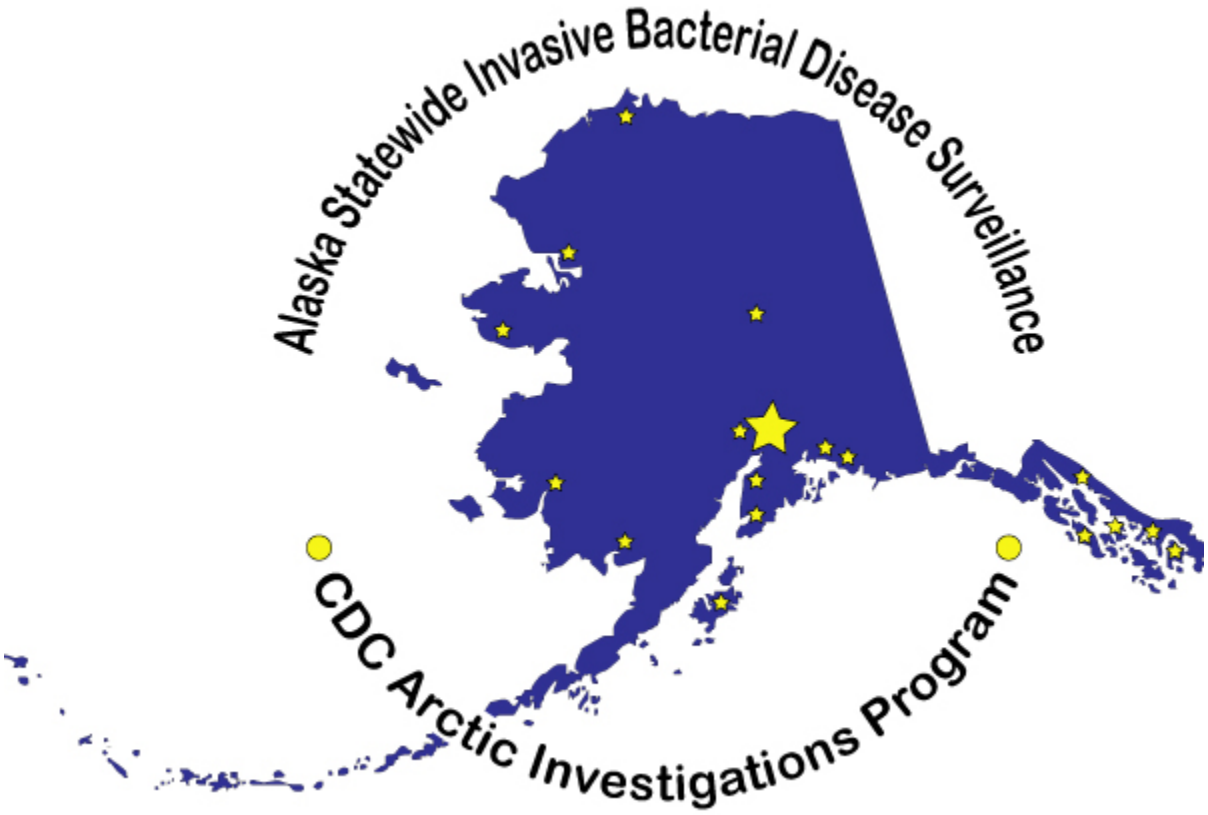


Surveillance of Invasive Bacterial Disease in Alaska, 2005

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

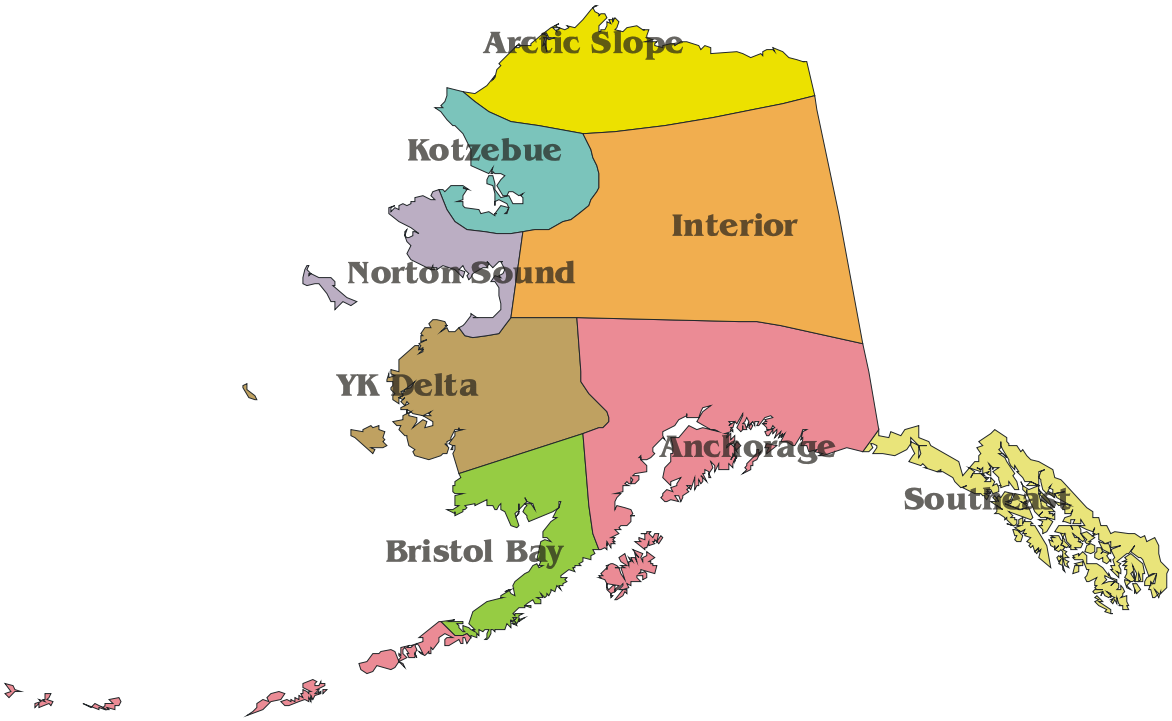
Alaska Statewide Invasive Bacterial Disease

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. 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 7-valent pneumococcal conjugate vaccine and *Haemophilus influenzae* type b vaccines.

Figure 1: Invasive Bacterial Disease Surveillance Regions – Alaska, 2005



In 2005, the total numbers of cases of invasive disease caused by these organisms reported to AIP were 122 *S. pneumoniae*, 9 *H. influenzae*, 3 *N. meningitidis*, 36 group A *Strep* and 24 group B *Strep*. Alaska Native people had higher rates of disease than non-Native people for all surveillance organisms. Rates of invasive pneumococcal disease, *H. influenzae* and group A *Strep* 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, 2005

Region	*S. pneumoniae* n (rate*)	*H. influenzae* n (rate*)	*N. meningitidis* n (rate*)	Group A *Strep* n (rate*)	Group B *Strep* n (rate*)
Anchorage	70 (16)	5 (1.1)	0 (0)	17 (3.9)	17 (3.9)
Arctic Slope	1 (17)	0 (0)	0 (0)	0 (0)	0 (0)
Bristol Bay	2 (28.1)	0 (0)	0 (0)	0 (0)	0 (0)
Interior	14 (13.9)	0 (0)	1 (1)	7 (6.9)	3 (3)
Kotzebue	3 (37.4)	0 (0)	1 (12.5)	0 (0)	1 (12.5)
Norton Sound	3 (31.7)	1 (10.6)	0 (0)	1 (10.6)	0 (0)
Southeast	8 (11.3)	0 (0)	0 (0)	6 (8.5)	2 (2.8)
YK Delta	21 (84.2)	3 (12)	1 (4)	5 (20.1)	1 (4)
Total	122 (18.4)	9 (1.4)	3 (0.5)	36 (5.4)	24 (3.6)

*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 663,661 persons in 2005 [1]. Case detection occurs year-round as participating laboratories send isolates recovered from sterile sites to the AIP lab 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 lab 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 2005, 23 labs in Alaska participated in the invasive disease surveillance system, either by sending isolates to the AIP lab throughout the year, conducting year-end record reviews, or both.

AIP defines a case of invasive *Streptococcus pneumoniae, Haemophilus influenzae*, *Neisseria meningitidis*, or groups A and B *Streptococcus* 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 group A streptococcus, isolates are requested from deep tissue infections such as might be collected from surgical debridement of cases of necrotizing fasciitis.

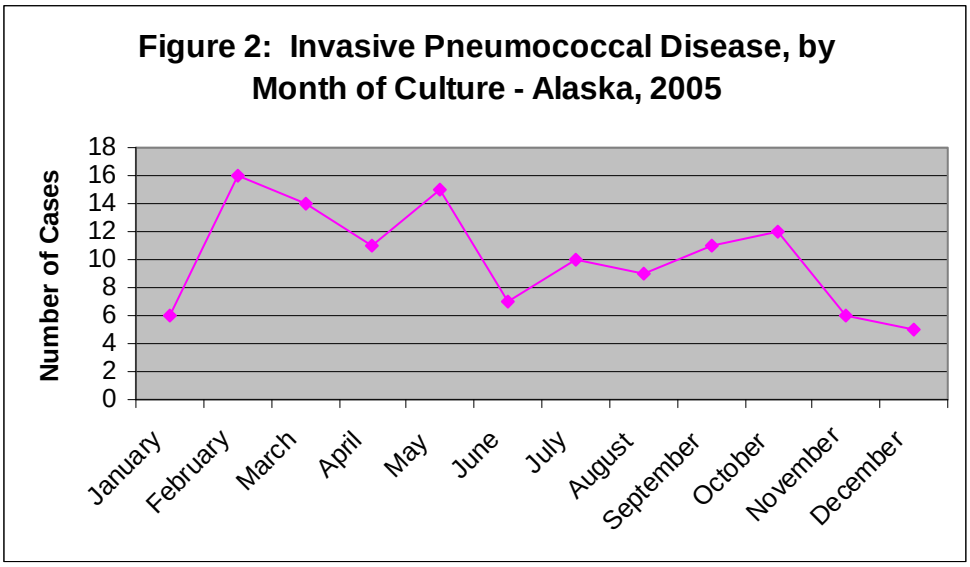
Invasive Pneumococcal Disease

Overall Incidence

A total of 114 pneumococcal isolates were received at AIP in 2005. An additional 8 cases were detected through year-end follow up with participating labs throughout the state for a total of 122 cases of invasive pneumococcal disease. The overall rate for invasive pneumococcal disease in 2005 was 18.4 per 100,000 persons per year. Alaska rates for 2005 were higher than the Active Bacterial Core Surveillance (ABCs) 2005 national projected rate of 14/100,000 [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 2005. The largest number of cases was reported in February.



Race

In 2005, the state population was comprised of 19% Alaska Native people *(Alaska Natives 129,594, non-Natives 534,067)* [1]. The percentage of all reported *S. pneumoniae* cases that occurred in 2005 among Alaska Native people was 50%; for a total of 61 cases resulting in an age-adjusted rate of 47.2/100,000 persons per year. Sixty-one cases occurred among the non-Native population for an age-adjusted rate of 10.9/100,000 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 2005 is 4.3.

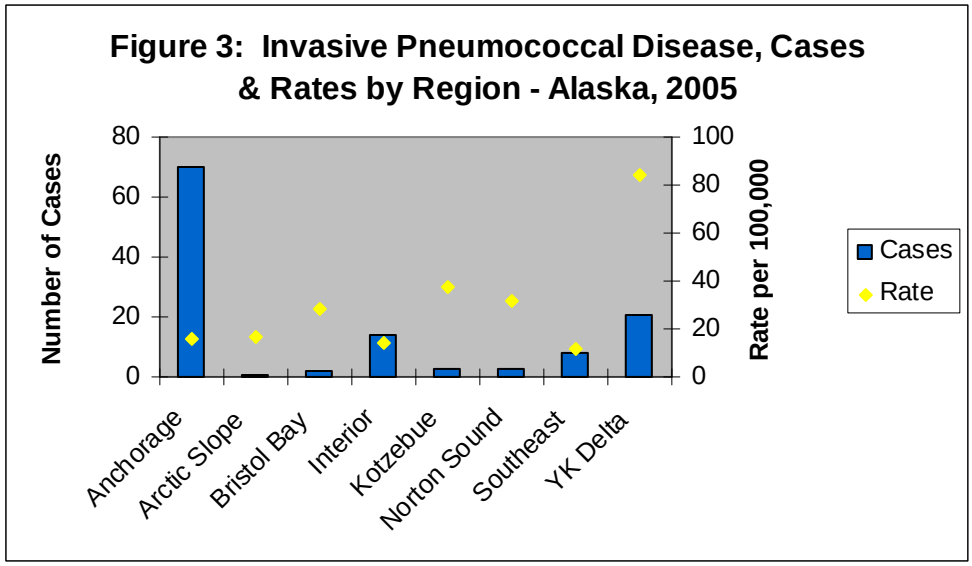
Table 2: Invasive *Streptococcus pneumoniae* Cases by Race – Alaska, 2005

Race	Cases n (%)	Age Adjusted Rate*	% Male	Deaths n (%)
Alaska Native	61 (50)	47.2	57.4	6 (10.7)‡
Non-Native†	61 (50)	10.9	55.7	6 (10.2)‡
Total	122		56.6	12 (10.4)

*Cases per 100,000 per percent distribution of Alaska 2000 population
†Includes 1 case for which race was unknown
‡Outcome unknown for 5 AK Native cases, 2 non-Native cases

Region

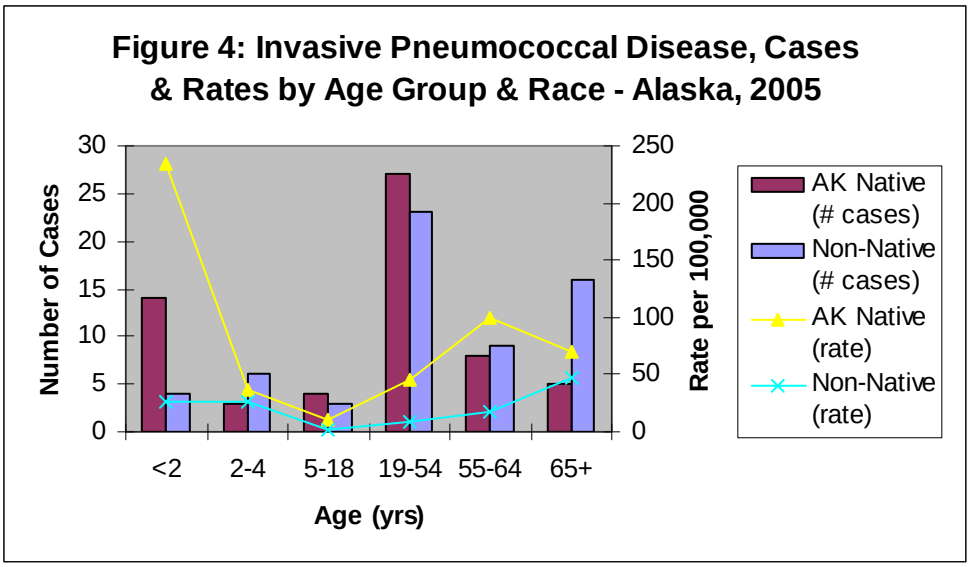
The highest percentage (57%) of invasive pneumococcal disease cases occurred in the Anchorage area in 2005. Rates of disease, however, were highest in the YK Delta, 84.2/100,000 persons per year.



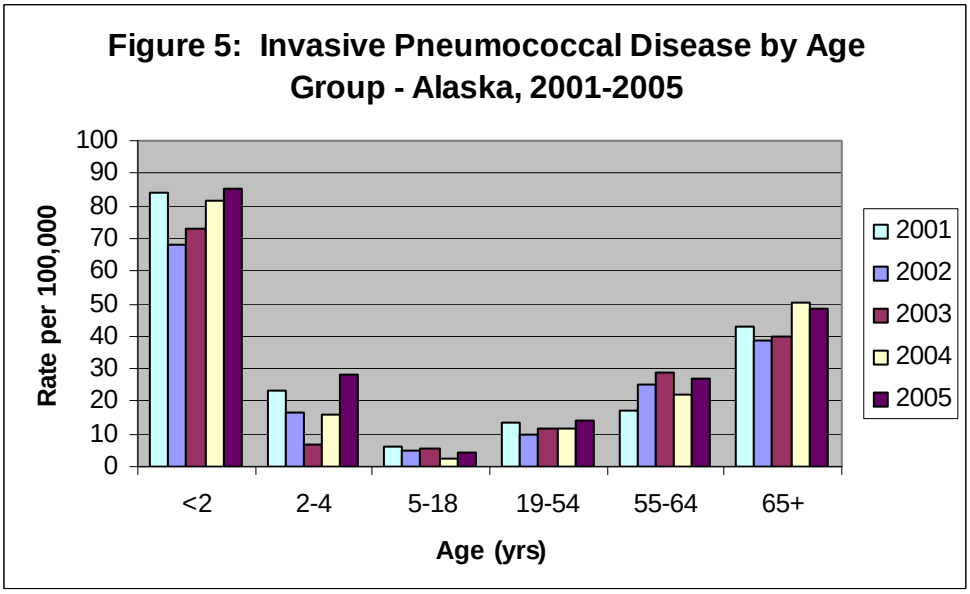
Age

Cases occurred in all age groups in 2005 ranging from 0.2 years to 89.9 years with a median age of 41.7 years. Overall, the highest rates of disease occurred in children less than 2 years old.

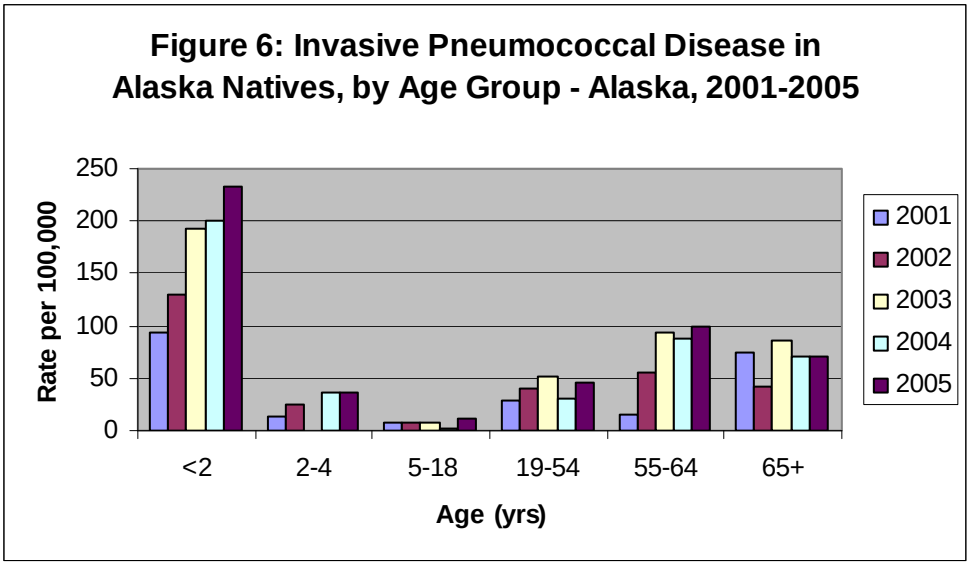
When stratified by age and race, the highest rates of disease in 2005 occurred in Alaska Native children less than 2 years old (233.6/100,000 persons per year).

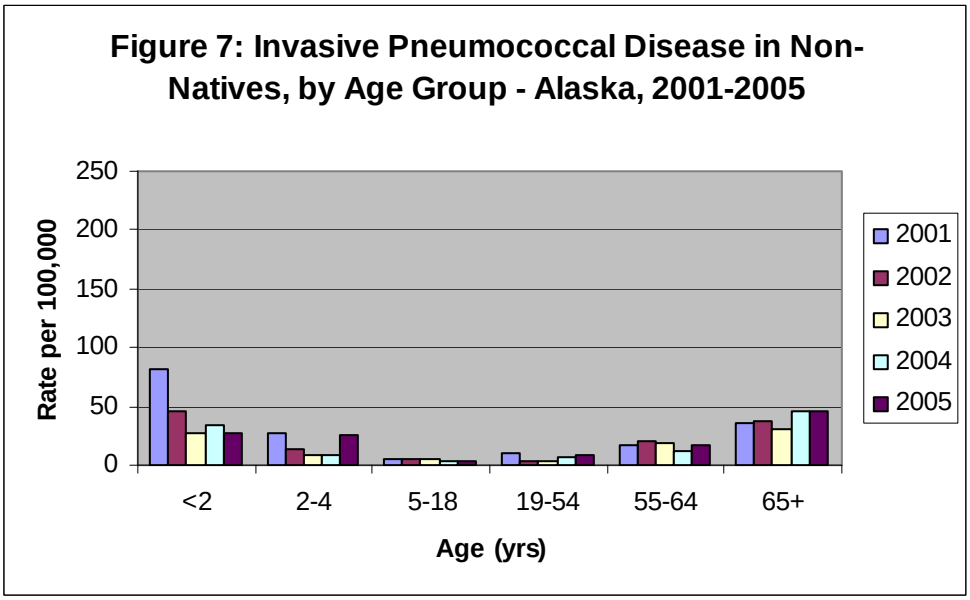


Since the initiation of a pneumococcal conjugate vaccine program in 2001, overall rates of invasive disease have declined dramatically in children less than 2 years of age [3]. In 2000, overall yearly rates of pneumococcal disease in children less than 2 years were 191.2/100,000, dropping to a low of 67.9/100,000 in 2002 and then increasing to 84.2/100,000 in 2005.



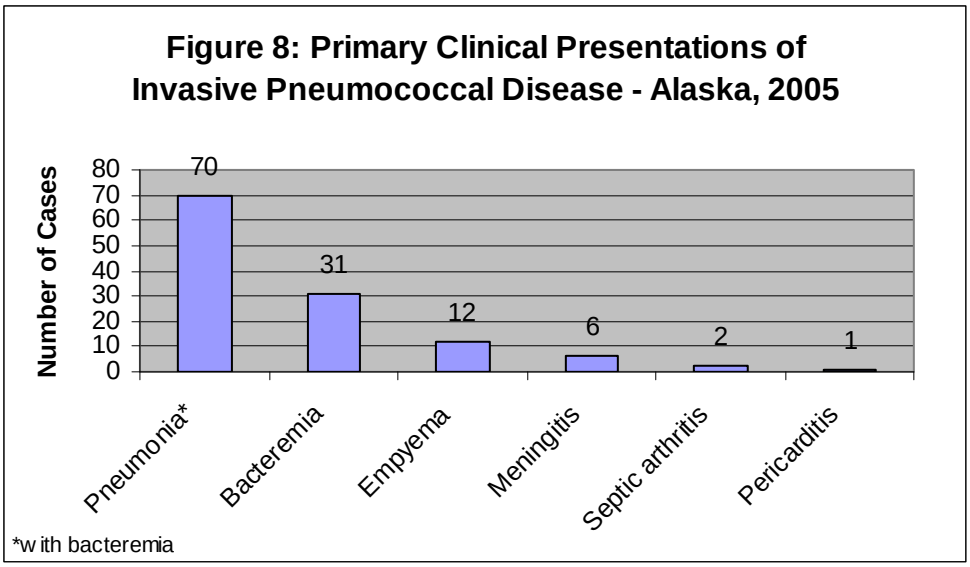
Although pneumococcal disease rates dropped initially in AK Native and non-Native children less than 2 years after 2000, the rates of disease in AK Native children less than 2 years have been trending upward from a low of 93.6/100,000 in 2001 to 233.6/100,000 in 2005. Rates of invasive disease in non-Native children less than 2 years have continued to decline during the same time period reaching a low of 26.8 in 2005.





Clinical Presentation

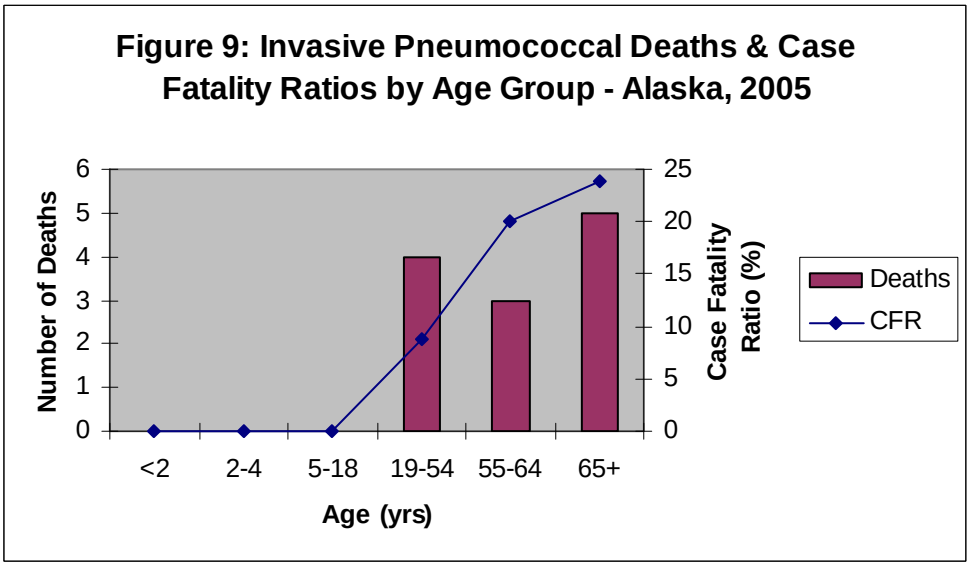
The primary clinical presentation was determined by a review of the discharge diagnoses in each patient's individual medical record associated with the invasive bacterial illness. In cases with multiple discharge diagnoses, the most serious diagnosis related to the pneumococcal infection was recorded as the primary clinical presentation. Pneumonia with bacteremia was the most common primary clinical presentation in 2005 (57%) followed by bacteremia (25%). Fifteen cases had a secondary pneumococcal-related diagnosis in 2005; 14 pneumonia and 1 cellulitis with bacteremia.



In 2005, blood was the most common source of a positive culture which was used to identify 116 (95%) of 122 cases. Cerebrospinal fluid was the positive site for 3% of cases and 1 case each was identified through joint fluid and an unspecified other sterile site.

Mortality

In 2005, the overall case fatality ratio for *S. pneumoniae* in Alaska was 10.4% (12 deaths out of 115 cases for which outcome was known). The case fatality ratio for non-Natives was similar to Natives; 10.2% (6 deaths) and 10.7% (6 deaths), respectively. The majority of deaths and the highest case fatality ratio occurred in the 65+ age category; 23.8% (5 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, 2005

		Alaska Native				Non-Native				Unknown
Serotype	Total n (%)	<2	2-18	19-64	65+	<2	2-18	19-64	65+	All Ages
01	3 (2.7)	-	-	-	-	-	1	2	-	-
03	10 (8.9)	3	-	2	2	-	-	2	1	-
04	3 (2.7)	-	-	1	-	-	-	2	-	-
06A	2 (1.8)	-	-	-	-	-	-	1	1	-
06B	1 (0.9)	-	-	-	-	-	-	-	1	-
07C	1 (0.9)	-	-	-	-	-	-	1	-	-
07F	16 (14.2)	2	4	4	-	-	1	4	1	-
08	11 (9.7)	-	-	6	-	-	-	5	-	-
09N	1 (0.9)	1	-	-	-	-	-	-	-	-
09V	2 (1.8)	1	-	-	-	-	-	-	1	-
10A	5 (4.4)	2	1	2	-	-	-	-	-	-
11A	3 (2.7)	-	-	1	-	-	1	1	-	-
12F	10 (8.9)	-	-	6	2	-	-	2	-	-
14	2 (1.8)	-	-	-	-	-	-	-	2	-
15A	2 (1.8)	-	1	-	-	-	-	-	1	-
15B	2 (1.8)	-	-	-	-	-	1	-	1	-
15C	2 (1.8)	-	1	-	-	-	1	-	-	-
16F	1 (0.9)	-	-	1	-	-	-	-	-	-
17F	2 (1.8)	-	-	2	-	-	-	-	-	-
18C	2 (1.8)	-	-	-	-	-	-	-	1	1
19A	17 (15)	1	-	3	-	3	2	5	3	-
19F	1 (0.9)	-	-	1	-	-	-	-	-	-
22F	6 (5.3)	1	-	4	-	-	-	1	-	-
23A	1 (0.9)	-	-	1	-	-	-	-	-	-
23F	1 (0.9)	1	-	-	-	-	-	-	-	-
33F	2 (1.8)	1	-	-	1	-	-	-	-	-
34	2 (1.8)	-	-	1	-	-	1	-	-	-
35B	1 (0.9)	-	-	-	-	1	-	-	-	-
38	1 (0.9)	-	-	-	-	-	-	-	1	-
Total	113	13	7	35	5	4	8	26	14	1

In 2005, the most common pneumococcal serotype was 19A (17 isolates, 15%). 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 1.8% of serotyped isolates in 2005. However, disease caused by serotype 19A, which is not included in the conjugate vaccine, increased. Prior to 2003, yearly numbers of cases of serotype 19A disease and the proportion of total isolates have ranged from 2 to 7 and 1.6% to 6.1%, respectively. Although the majority of serotype 19A disease occurred in AK Natives during 2003 and were equally distributed between AK Natives and non-Natives in 2004, the majority (76%) of serotype 19A cases occurred in

non-Natives in 2005. In 2004, the majority (80%) of serotype 19A cases occurred in the Anchorage area; forty-seven percent of cases in 2005 occurred in the Anchorage area and 35% occurred in the Interior. Serotype 7F increased to 14.2% (16 cases) of serotyped isolates in 2005; this is the highest proportion of isolates attributed to serotype 7F since the initiation of invasive pneumococcal disease surveillance in 1986. The highest proportion of isolates previously serotyped as 7F was 9.3% (10 cases) in 2000.

Table 4: Invasive Pneumococcal Serotype Distribution by Region – Alaska, 2005

Serotype	Anchorage	Arctic Slope	Bristol Bay	Interior	Kotzebue	Norton Sound	Southeast	YK Delta
01	3	-	-	-	-	-	-	-
03	3	1	-	2	1	-	-	3
04	3	-	-	-	-	-	-	-
06A	2	-	-	-	-	-	-	-
06B	1	-	-	-	-	-	-	-
07C	1	-	-	-	-	-	-	-
07F	6	-	-	-	-	-	-	10
08	8	-	-	1	1	-	-	-
09N	1	-	-	-	-	-	-	-
09V	1	-	1	-	-	-	-	-
10A	2	-	-	-	-	-	-	-
11A	2	-	-	1	-	-	-	-
12F	3	-	-	1	-	3	3	-
14	1	-	-	1	-	-	-	-
15A	1	-	-	-	-	-	-	1
15B	2	-	-	-	-	-	-	-
15C	-	-	-	1	-	-	1	-
16F	-	-	-	-	-	-	1	-
17F	1	-	-	-	-	-	-	1
18C	2	-	-	-	-	-	-	-
19A	8	-	1	6	-	-	1	1
19F	1	-	-	-	-	-	-	-
22F	5	-	-	-	1	-	-	-
23A	1	-	-	-	-	-	-	-
23F	1	-	-	-	-	-	-	-
33F	-	-	-	1	-	-	-	1
34	2	-	-	-	-	-	-	-
35B	1	-	-	-	-	-	-	-
38	1	-	-	-	-	-	-	-
Total	64	1	2	14	3	3	6	20

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 2005 that were due to serotypes found in the PCV7 vaccine.

Table 5: Proportion of Invasive Isolates Contained in the PCV7 Vaccine by Age Group and Race – Alaska, 2005

Age (yrs)	Alaska Native (%)	Non-Native (%)	Total (%)
<2	2 (15%) of 13	0 (0%) of 4	2 (12%) of 17
2-4	0 (0%) of 3	0 (0%) of 6	0 (0%) of 9
5+	2 (5%) of 44	7 (17%) of 42	9 (11%) of 86
Total	4 (7%) of 60	7 (16%) of 52	11 (10%) of 112

The 23-valent polysaccharide vaccine (Ps23V) is 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 is recommended after 6 years [4]. In 2005, for persons 55 years and older, 12 (92%) of 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 two vaccine failures in 2005; one was in a 14-month old and one in a 19-month old child. The 14-month old had received three doses of vaccine and the 19-month old had received four doses. The 14-month old had a history of upper respiratory infections and presented with empyema; the isolate from the case was serotype 9V. The 19-month old also had a history of upper respiratory infections and presented with pneumonia; the isolate from the case was serotype 23F.

Potentially Preventable Deaths

In 2005, pneumococcal vaccine status was known for 77 (63%) of the 122 cases; 53 cases (43%) did receive a pneumococcal vaccine prior to illness and 24 cases (20%) had no record of a pneumococcal vaccine.

Table 6: Potentially Vaccine Preventable Invasive Pneumococcal Deaths – Alaska, 2005

Serotypes	< 2 years	2-4	5-18	19-54	55-64	65+	Total
PCV7	0	0	0	0	1 (33%)	0	1 (8%)
Ps23V	0	0	0	3 (75%)	1 (33%)	3 (60%)	7 (58%)
Non-Vaccine	0	0	0	1 (25%)	0	2 (40%)	3 (25%)
Unknown	0	0	0	0	1 (33%)	0	1 (8%)
Total	0	0	0	4	3	5	12

Overall, 58% of all pneumococcal-related mortality in 2005 was potentially preventable with the use of the 23-valent polysaccharide vaccine in persons over 2 years old; 25% of deaths were due to disease caused by serotypes not contained in either the 7 or 23-valent vaccines.

Eight of the 12 deaths in 2005 from invasive *S. pneumoniae* occurred from serotypes contained within the Ps23V vaccine. Of the eight deaths, two occurred in vaccinated individuals; time since vaccination for each was 3 years and 9 years.

Table 7: Invasive Pneumococcal Disease, Serotypes of Fatal Cases – Alaska, 2005

Serotype	Deaths n (%)	Serotype Frequency (n)
03†	2 (20)	10
10A†	1 (20)	5
11A†	1 (33)	3
12F†	1 (10)	10
15A	1 (50)	2
19A†	2 (12)	17
19F*†	1 (100)	1
23A	1 (100)	1
38	1 (100)	1

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

Associated Medical Conditions

The presence of one or more associated medical conditions was reported in 84% of invasive pneumococcal cases in 2005. 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, 2005*

Medical Condition	Adult Cases (≥ 18 years) n=88, Cases (%)
Cigarette smoking	41 (47)
Alcohol abuse	36 (41)
Chronic lung disease	18 (20)
Diabetes	13 (15)
Immunosuppressive treatment	5 (6)
Injection drug use	3 (3)
Asplenia	0 (0)

*More than one risk factor was identified in several cases

Antibiotic Resistance

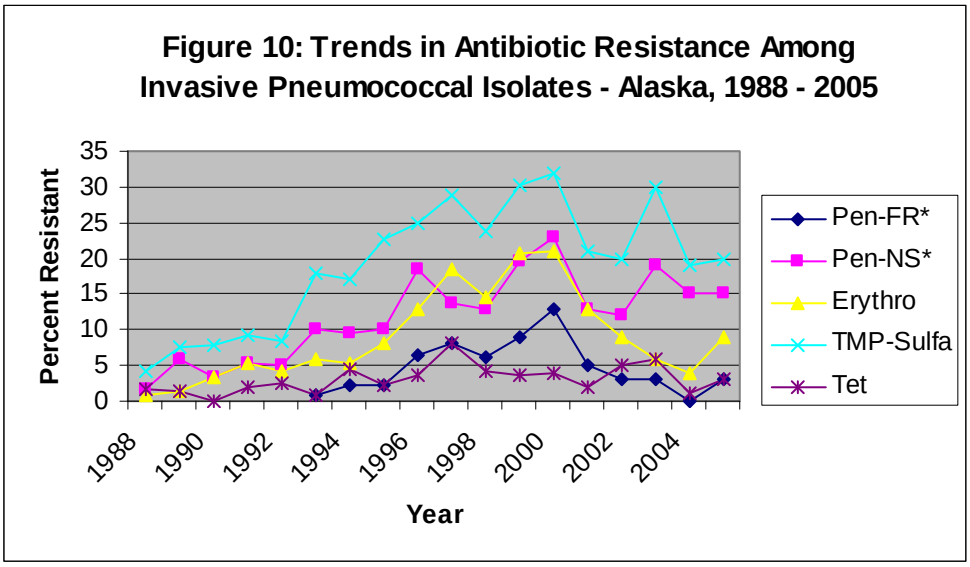
Susceptibility testing was performed on all isolates received in 2005. Results of the testing are presented in the following table.

Table 9: Antibiotic Resistance in Invasive *Streptococcus pneumoniae* Isolates – Alaska, 2005

Antibiotic	Susceptible	Intermediate	Resistant	I + R	Total Tested
Penicillin	96 (85%)	14 (12%)	3 (3%)	17 (15%)	113
TMP-sulfa	91 (81%)	11 (10%)	11 (10%)	22 (20%)	113
Erythromycin	103 (91%)	0 (0%)	10 (9%)	10 (9%)	113
Ceftriaxone	113 (100%)	0 (0%)	0 (0%)	0 (0%)	113
Tetracycline	109 (97%)	1 (1%)	2 (2%)	3 (3%)	112
Chloramphenicol	111 (99%)	0 (0%)	1 (1%)	1 (1%)	112
Rifampin	111 (99%)	0 (0%)	1 (1%)	1 (1%)	112
Vancomycin	113 (100%)	0 (0%)	0 (0%)	0 (0%)	113
Levofloxacin	113 (100%)	0 (0%)	0 (0%)	0 (0%)	113
Clindamycin	107 (100%)	0 (0%)	0 (0%)	0 (0%)	107

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 2005. After steadily declining since 2000 to a low of 4% in 2004, erythromycin resistance has increased to 9% of tested isolates in 2005.



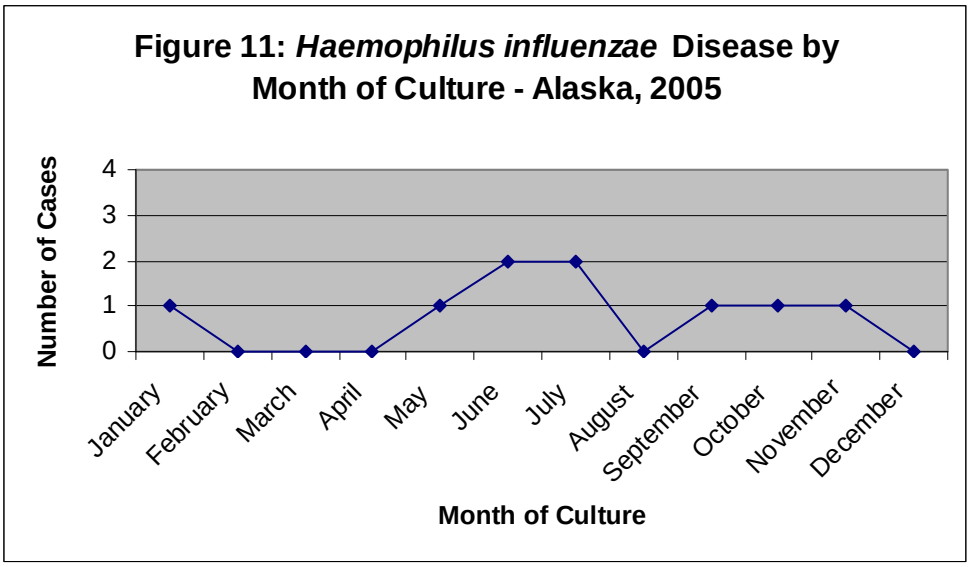
*Pen-FR = fully resistant, Pen-NS = non-susceptible

Invasive *Haemophilus influenzae*

Overall Incidence

In 2005, there were 9 cases of invasive *Haemophilus influenzae* in Alaska, for a statewide rate of 1.4/100,000 persons per year. This rate is the same as the national projected rate of 1.4/100,000 persons per year [6]. There was one death caused by *Haemophilus influenzae* in 2005 for a case fatality ratio of 12.5% (outcome was unknown in one case).

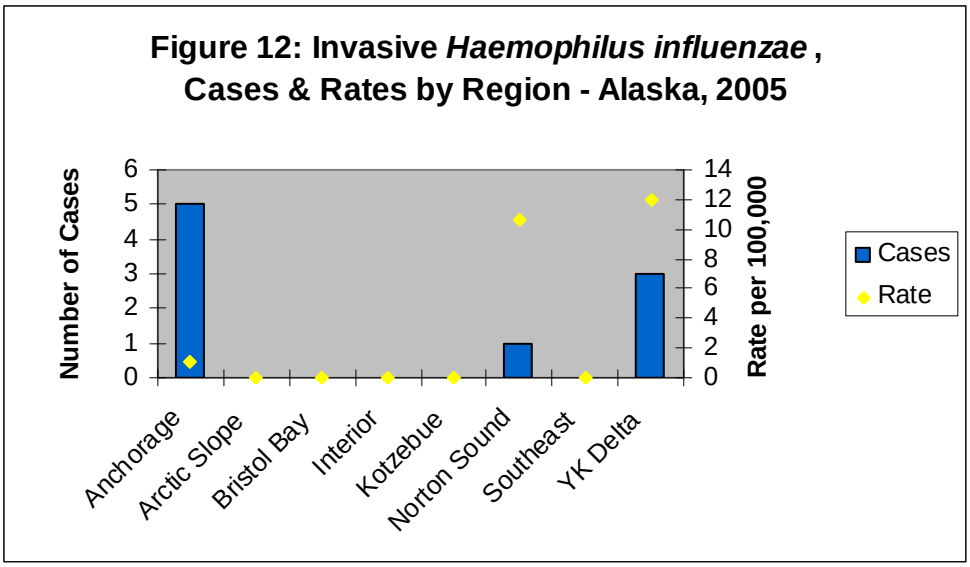
Seasonality



Due to the small number of cases, trends in seasonality cannot be determined, however, five (56%) of the nine cases occurred during the summer (May-July).

Region

The Anchorage area had the highest proportion of invasive *Haemophilus influenzae* cases in 2005 (5 cases, 56%). The Yukon-Kuskokwim Delta area, however, had the highest disease rate of 12/100,000 persons per year. One case was reported in Norton Sound for a regional rate of 10.6/100,000 persons per year.



Race

Table 10: Invasive *Haemophilus influenzae* Cases by Race – Alaska, 2005

Race	Cases n (%)	Age Adjusted Rate*	% Male	Deaths n (%)
Alaska Native	3 (33)	1.5	67	0 (0)†
Non-Native	6 (67)	1	83	1 (17)
Total	9		78	1 (12.5)

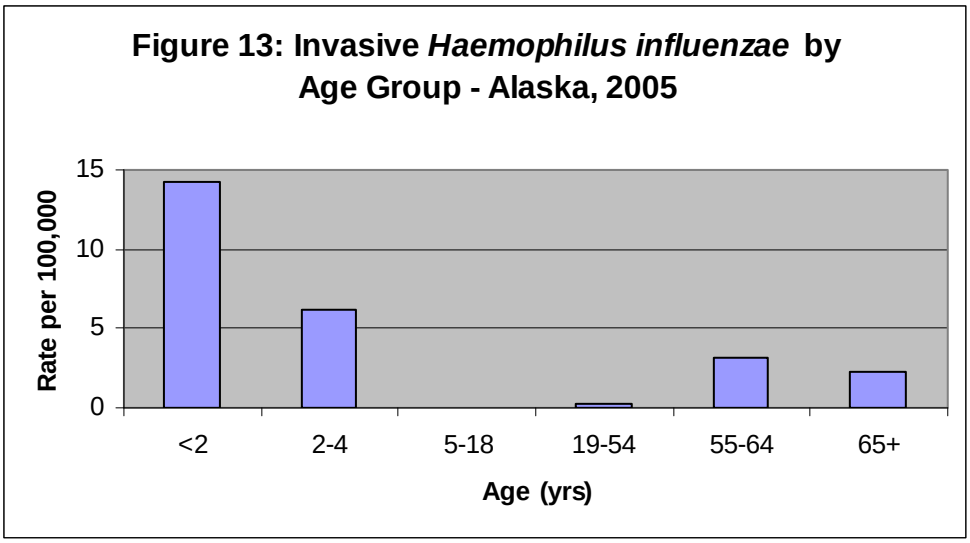
*Cases per 100,000 per percent distribution of Alaska 2000 population
†Outcome unknown in one AK Native case.

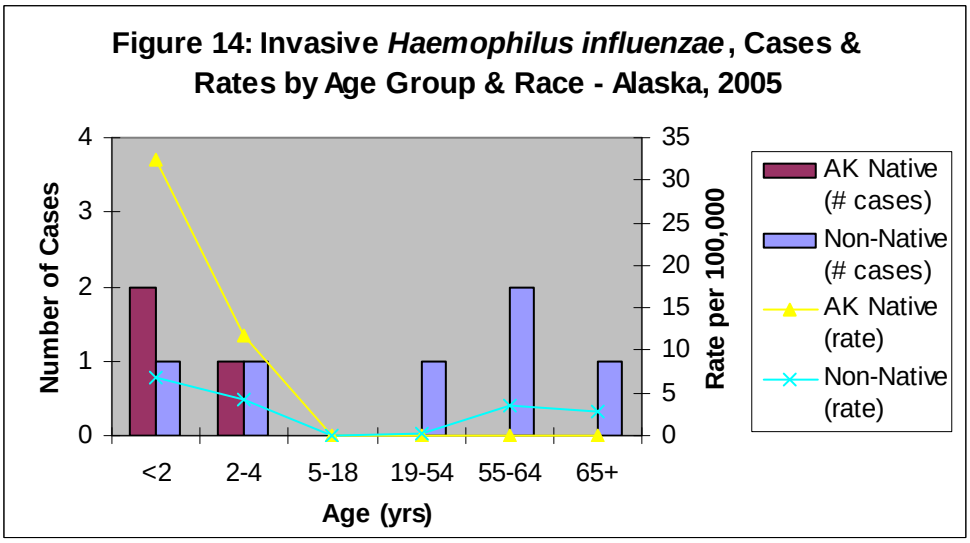
In 2005, 67% of the cases occurred in non-Natives. Age-adjusted rates were calculated for Alaska Natives and non-Natives. The age-adjusted rate ratio of *H. influenzae* disease for the Alaska Native population compared with the non-Native population in 2005 was 1.5.

Age

Haemophilus influenzae cases ranged in age from less than 6 months to 73 years of age in 2005 (median 3.6 years). Overall, the highest rates of disease occurred in children less than 2 years old and 2-4 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 (32.5/100,000 persons per year) and 2-4 years old (11.7/100,000 persons per year). There were no cases of *Haemophilus influenzae* in AK Native people 5 years old and older. In non-Natives, cases occurred in all age categories except 5-18 years; 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 *Haemophilus influenzae*-related diagnosis was recorded as the primary clinical presentation. In 2005, pneumonia was the most common presentation (67% of cases).

Haemophilus influenzae was isolated from 7 (78%) blood samples and 2 (22%) cerebrospinal fluid samples.

Table 11: Primary Clinical Presentation of Invasive *Haemophilus influenzae* - Alaska, 2005

Primary Presentation	n (%)
Pneumonia*	6 (67)
Meningitis	3 (33)
Total	9

*with bacteremia

Serotypes

All isolates received at AIP are 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, 2005

		Alaska Native				**Non-Native**			
Serotype	Total n (%)	<2	2-18	19-64	65+	<2	2-18	19-64	65+
a	1 (11)	1	0	0	0	0	0	0	0
b	4 (44)	1	1	0	0	0	1	0	1
f	2 (22)	0	0	0	0	1	0	1	0
NT*	2 (22)	0	0	0	0	0	0	2	0
Total	9	2	1	0	0	1	1	3	1

*Non-typable

Hib

In recent years, the prevalence of *Haemophilus influenzae* type b has declined due to increased use of a childhood vaccine against this serotype. Four cases of Hib occurred in 2005; two in AK Native children, 6 months old and 3.5 years old, one in a non-Native child 2.4 years old and one in a non-Native adult 73 years old. Vaccine status was known for the three children; the 6 month old was not vaccinated; the 2.4 and 3.5 year old were fully vaccinated (3 doses). The 6 month old presented with meningitis and the remaining cases presented with pneumonia. The overall Hib rate for 2005 was 0.6/100,000 persons per year; for children less than 2 years, the rate was 4.7/100,000.

Antibiotic Resistance

The 8 *Haemophilus influenzae* isolates received at AIP were tested for susceptibility to ampicillin, chloramphenicol, and ceftriaxone; six isolates were tested for susceptibility to TMP/sulfa. All 8 isolates were susceptible to chloramphenicol and ceftriaxone; 2 isolates were fully resistant to ampicillin and the remaining 6 were susceptible. One isolate was fully resistance to TMP/sulfa, 3 had intermediate resistance and 2 were susceptible.

Table 13: Summary of Invasive *Haemophilus influenzae* Case Characteristics, Alaska, 2005

Sex	Age (Yrs)	Race	Residence	Site of Isolation	Clinical Presentation(s)	Serotype*	Associated Medical Conditions	Survived
F	0.5	AK Native	Other	CSF	Meningitis	B	None	Yes
M	0.6	AK Native	Other	Blood	Pneumonia	A	Chronic lung disease	Yes
M	0.6	Non-Native	Anchorage	Blood	Pneumonia	F	Chronic lung disease	No
M	2.4	Non-Native	Anchorage	Blood	Pneumonia	B	None	Yes
M	3.6	AK Native	Other	Blood	Pneumonia	B	Chronic lung disease	Unknown
F	35.6	Non-Native	Anchorage	Blood	Pneumonia	NT	Chronic lung disease	Yes
M	62.2	Non-Native	Anchorage	CSF	Meningitis	F	None	Yes
M	64	Non-Native	Anchorage	Blood	Meningitis	NT	Cigarette smoking, alcohol abuse	Yes
M	73	Non-Native	Other	Blood	Pneumonia	B	Cigarette smoking, chronic lung disease, immune suppressive treatment, diabetes	Yes

*NT = non-typeable

Invasive *Neisseria meningitidis*

Overall Incidence

A total of 3 cases of invasive *Neisseria meningitidis* were reported to AIP in 2005 for an overall rate of 0.5/100,000. The Alaska rates are similar to the ABCs 2005 national projected rate of 0.35/100,000 [7]. There was one invasive *N. meningitidis*-related death in Alaska in 2005 which resulted in a case fatality ratio of 50%; outcome was unknown in one case.

Seasonality

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

Race

In 2005, all cases of invasive *N. meningitidis* cases in Alaska occurred in the AK Native population for an age-adjusted rate of 2.1/100,000 persons per year.

Table 14: Invasive *Neisseria meningitidis* Cases by Race – Alaska, 2005

Race	Cases n (%)	Age Adjusted Rate*	% Male	Deaths n (%)
Alaska Native	3 (100)	2.1	33	1 (50)†
Non-Native	0	0	0	0 (0)
Total	3		33	1 (50)

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

Region

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

Age

Invasive *N. meningitidis* cases reported in 2005 ranged in age from 3.1 to 39.8 years old; the median age was 5.2 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 septic arthritis; one case had a secondary diagnosis of pneumonia.

N. meningitidis was isolated from blood samples in two of three (67%) cases in 2005. The remaining case was isolated from cerebrospinal fluid.

Mortality

There was one *N. meningitidis*-related death reported in Alaska in 2005. The death occurred in a 39.8 year old AK Native female who presented with meningitis and had no risk factors.

Serogroup

All three invasive *N. meningitidis* cases in 2005 were serogrouped; all three were serogroup B.

Table 15: Summary of Invasive *Neisseria Meningitidis* Cases Characteristics, Alaska, 2005

Sex	Age (yrs)	Race	Residence	Site of Isolation	Clinical Presentation(s)	Serogroup	Associated Medical Conditions	Survived
F	3.1	AK Native	Other	Blood	Meningitis, pneumonia	B	None	Unknown
M	5.2	AK Native	Other	Blood	Septic arthritis	B	None	Yes
F	39.8	AK Native	Other	CSF	Meningitis	B	None	No

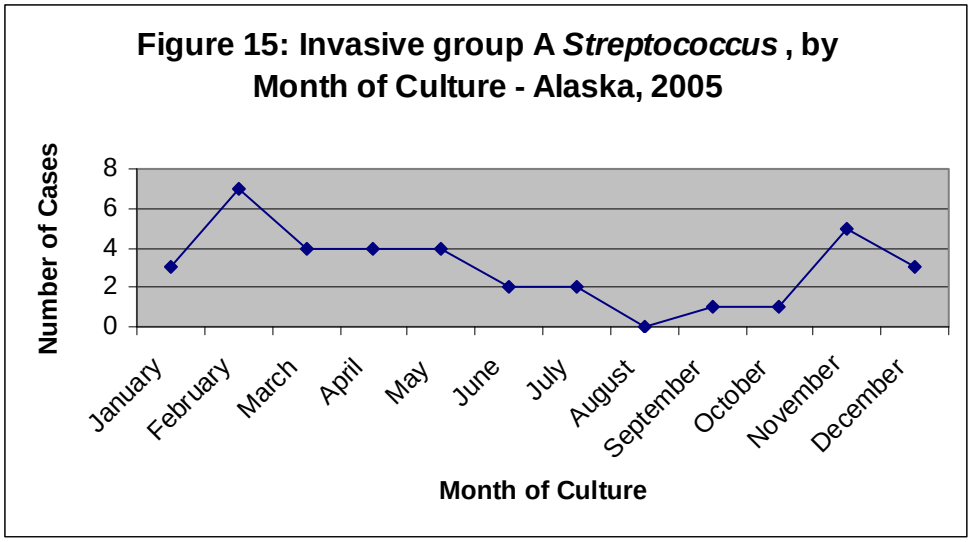
Invasive group A *Streptococcus*

Overall Incidence

A total of 36 cases of invasive group A *Streptococcus* (GAS) were reported to AIP in 2005. The overall rate of invasive GAS disease in the state of Alaska was 5.4/100,000 persons per year. The Alaska rate is higher than the ABCs 2005 national projected rate of 3.6/100,000 [8]. In 2005, there were 2 GAS-related deaths (*emm* types 3 and 12) for a case fatality ratio of 5.6%; outcome was unknown in two cases.

Seasonality

Cases of group A *Streptococcus* occurred throughout the year in 2005 with no apparent trends in seasonality.



Race

In 2005, 51% of invasive GAS cases in Alaska occurred in the Alaska Native population for an age-adjusted rate of 15.5/100,000 persons per year which was over four and a half times higher the non-Native age-adjusted rate of 3.2/100,000 persons per year and over three times the 2003 age-adjusted rate for Alaska Natives (5/100,000 persons).

Table 16: Invasive group A *Streptococcus* Cases by Race – Alaska, 2005

Race	Cases n (%)	Age Adjusted Rate*	% Male	Deaths n (%)
Alaska Native	19 (53)	15.5	26	2 (11)†
Non-Native	17 (47)	3.2	53	0 (0)†
Total	36		39	2 (5.6)

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

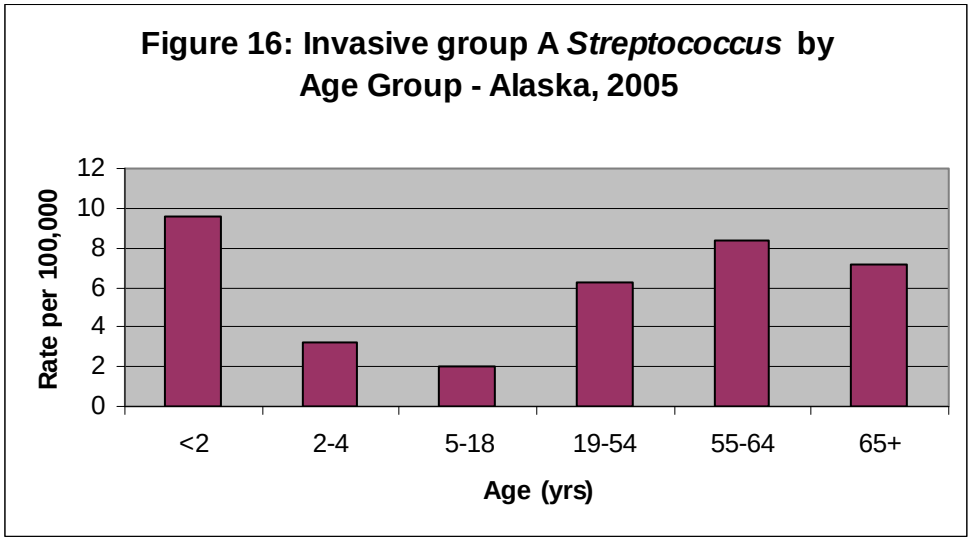
Region

Seventeen (47.2%) of the 36 invasive group A *Streptococcus* cases in 2005 were reported in the Anchorage area, 7 cases in the Interior, 6 cases in Southeast, 5 cases in the YK Delta and one case in Norton Sound.

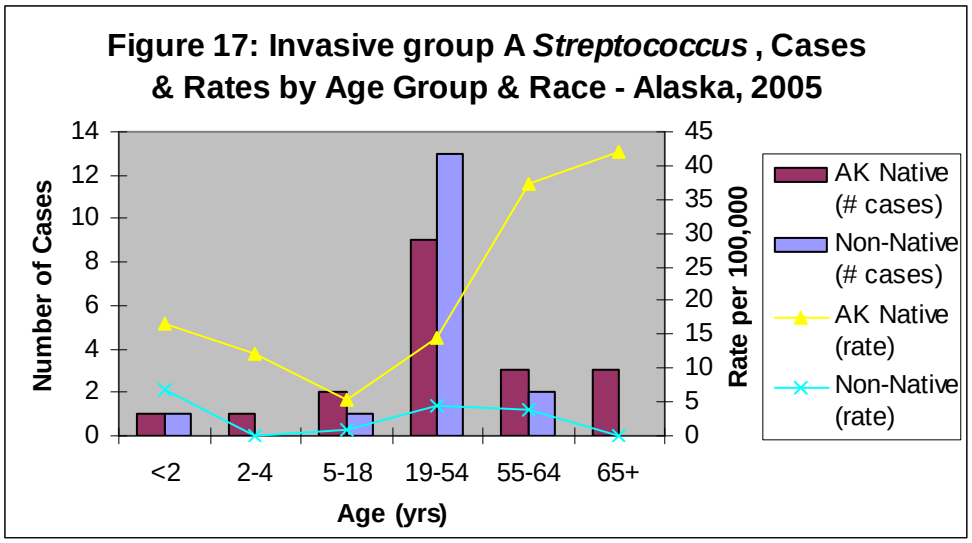
A temporal cluster of GAS infections occurred in the Interior during 2005. Six cases of invasive GAS were reported in this area between the dates of 11/8/2005 – 12/12/2005. Since surveillance for GAS began in 1999, the number of cases reported from the Interior each year has ranged from 1 to 7; in 2001, 7 cases were reported but they occurred throughout the year. During 2003-2004, one case of GAS had been reported from the Interior each year. The cases in 2005 were not a cluster of necrotizing fasciitis cases. There were no known epidemiologic links between the patients and none died. PFGE analysis of the isolates from the cases revealed three different patterns; *emm* typing resulted in three different types: 58 (1 case), 2 (1 case) and 87 (4 cases).

Age

Invasive group A *Streptococcus* cases reported in 2005 ranged in age from 1.2 to 76.8 years old; the median age was 42.6 years. Highest rates of disease occurred in children less than 2 years old (9.6/100,000).



When stratified by race, the highest rates of invasive group A streptococcal disease occurred in Alaska Native persons 55-64 years old (37.3/100,000 persons per year) and Alaska Native children less than 2 years of age (16.7/100,000 persons per year). The highest GAS disease rate in the non-Native population occurred in children less than 2 years old (6.7/100,000 persons per year). No cases were reported in the non-Native population in the 2-4 or 65 and older age categories.



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 2005. Fourteen cases also presented with secondary diagnoses including five cellulitis, three pneumonia and one each osteomyelitis, necrotizing fasciitis, endometritis and streptococcal toxic shock syndrome.

Group A *Streptococcus* was isolated from blood samples in 31 (86%) of 36 cases, two from joint fluid, two from synovial fluid and one from tissue.

Table 17: Primary Clinical Presentations of Invasive group A *Streptococcus* – Alaska, 2005

Primary Presentation	n (%)
Bacteremia	9 (25)
Pneumonia*	7 (20)
Cellulitis*	5 (14)
Septic arthritis	4 (11)
Empyema	3 (9)
Necrotizing fasciitis	2 (6)
Endometritis	1 (3)
Peritonitis	1 (3)
Amnionitis	1 (3)
Other	3 (9)
Total	36

*with bacteremia

Table 18: Summary of Invasive group A *Streptococcus* Case Characteristics, Alaska, 2005

Sex	Age (yrs)	Race	Residence	Site of Isolation	Clinical Presentation(s)	*emm* Type	Associated Medical Conditions	Survived
M	1.2	Non-Native	Anchorage	Blood	Septicemia	3	None	Yes
F	1.2	AK Native	Other	Blood	Pneumonia	87	None	Yes
F	4.4	AK Native	Other	Blood	Pneumonia	92	None	Yes
M	8	AK Native	Other	Joint fluid	Septic arthritis, osteomyelitis	1	None	Yes
F	10.5	AK Native	Other	Blood	Septicemia	5	None	Yes
M	11.4	Non-Native	Anchorage	Blood	Other	5	None	Yes
F	20.9	Non-Native	Anchorage	Blood	Amnionitis, endometritis	73	Cigarette smoking, chronic lung disease	Yes
F	21.2	Non-Native	Other	Blood	Endometritis	73	Cigarette smoking, chronic lung disease	Yes
F	27.8	Non-Native	Other	Tissue	Necrotizing fasciitis, strep toxic shock	58	None	Yes
F	29.3	Non-Native	Anchorage	Blood	Pneumonia	5	None	Unknown
F	32.7	AK Native	Other	Blood	Bacteremia	87	Unknown	Yes
M	34.1	Non-Native	Anchorage	Blood	Pneumonia		Chronic lung disease, alcohol abuse	Yes
F	34.9	AK Native	Anchorage	Blood	Cellulitis, necrotizing fasciitis		Cigarette smoking, alcohol abuse	Yes
M	35.7	AK Native	Anchorage	Blood	Septicemia	87	Cigarette smoking, diabetes	Yes
M	38.4	Non-Native	Anchorage	Blood	Empyema, pneumonia, strep toxic shock	3	None	Yes
M	40	Non-Native	Other	Blood	Other	1	Cigarette smoking	Yes
M	41	AK Native	Anchorage	Blood	Septicemia	3	Diabetes	Yes
M	42.1	Non-Native	Anchorage	Blood	Empyema, pneumonia	5	Cigarette smoking, alcohol abuse, injection drugs	Yes
M	43.1	Non-Native	Anchorage	Blood	Cellulitis	12	None	Yes
F	46	AK Native	Other	Blood	Cellulitis	2	None	Yes
M	46.6	AK Native	Other	Blood	Peritonitis	1	Alcohol abuse	Yes
F	47.1	AK Native	Other	Blood	Cellulitis	87	Alcohol abuse	Yes
F	48.6	AK Native	Anchorage	Blood	Pneumonia	92	Cigarette smoking, chronic lung disease, alcohol abuse	Unknown
M	49.8	Non-Native	Other	Joint fluid	Septic arthritis, cellulitis	1	Diabetes	Yes
M	50.4	Non-Native	Anchorage	Blood	Empyema, pneumonia	5	Cigarette smoking, alcohol abuse	Yes
F	51.2	Non-Native	Other	Blood	Septicemia	28	None	Yes
F	53.5	Non-Native	Anchorage	Blood	Bacteremia	102	None	Yes
M	54.3	AK Native	Anchorage	Synovial fluid	Septic arthritis, cellulitis		Cigarette smoking, alcohol abuse	Yes
F	56.2	Non-Native	Other	Blood	Cellulitis	12	None	Yes
F	59.5	AK Native	Other	Blood	Other	5	Cigarette smoking	Yes
F	61.2	AK Native	Anchorage	Blood	Septicemia	3	Diabetes	No
F	63.1	Non-Native	Other	Blood	Pneumonia, cellulitis	87	Diabetes	Yes
F	63.2	AK Native	Other	Blood	Septicemia	12	Immune suppressive treatment	No
F	75.6	AK Native	Anchorage	Blood	Necrotizing fasciitis		None	Yes
F	76.4	AK Native	Other	Synovial fluid	Septic arthritis, cellulitis, osteomyelitis	92	Cigarette smoking, chronic lung disease	Yes
F	76.8	AK Native	Other	Blood	Pneumonia, cellulitis	87	Alcohol abuse	Yes

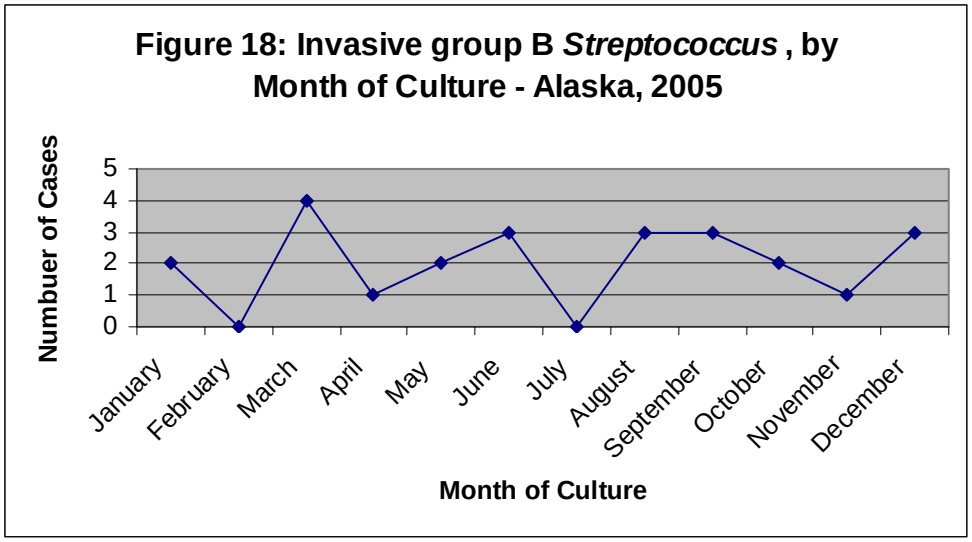
Invasive group B *Streptococcus*

Overall Incidence

A total of 24 cases of invasive group B *Streptococcus* (GBS) were reported to AIP in 2005. Overall rates of invasive GBS disease in the state of Alaska were 3.6/100,000 persons per year. The Alaska rate is lower than the ABCs 2005 national projected rate of 7.3/100,000 [9]. In 2004, there were four GBS-related deaths for a case fatality ratio of 19% (outcome was unknown in 3 cases).

Seasonality

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



Race

In 2004, 32% of invasive group B *Streptococcus* cases in Alaska occurred in the Alaska Native population for an age-adjusted rate of 7.4/100,000 persons per year which is three times the non-Native rate of 2.4/100,000 persons per year.

Table 19: Invasive group B *Streptococcus* Cases by Race – Alaska, 2005

Race	Cases n (%)	Age Adjusted Rate*	% Male	Deaths n (%)
Alaska Native	10 (42)	7.4	50	1 (11)†
Non-Native	14 (58)‡	2.4	43	3 (25)†
Total	24		46	4 (19)

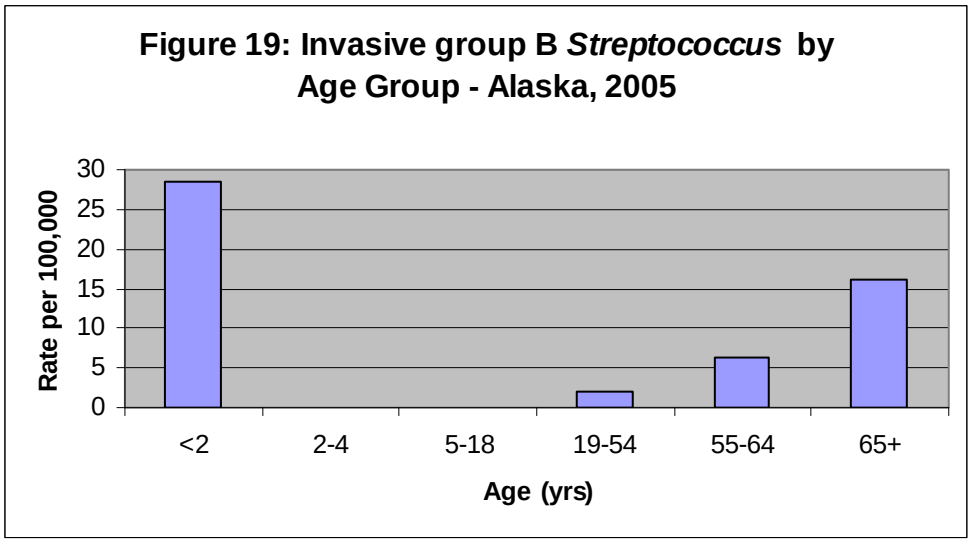
*Cases per 100,000 per percent distribution of Alaska 2000 population
†Outcome unknown in 1AK Native, 2 non-Native cases
‡Includes one case for which race was unknown

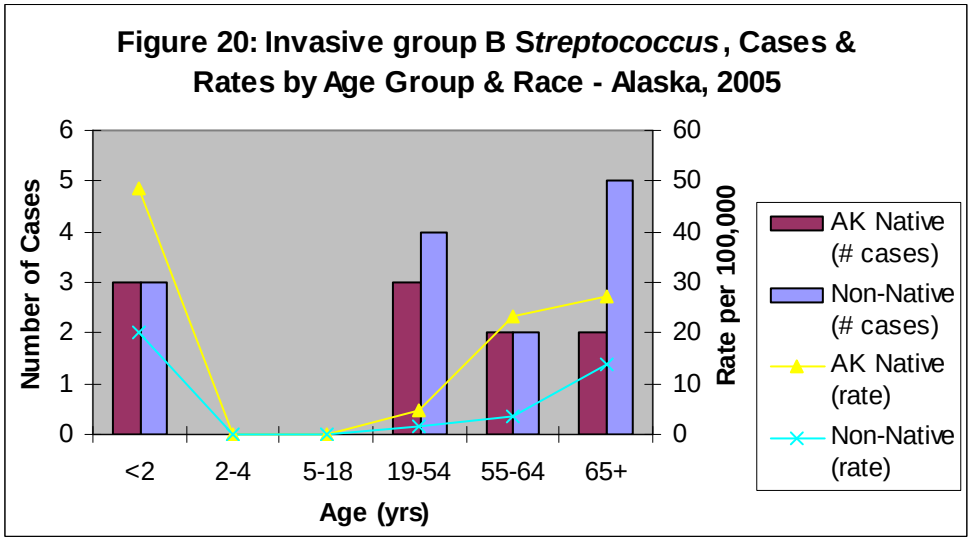
Region

In 2005, 17 of the 24 reported GBS cases occurred in Anchorage; three cases were reported in the Interior, two cases in Southeast Alaska, and one each in Kotzebue and the YK Delta.

Age

Invasive group B *Streptococcus* cases reported in 2005 ranged in age from newborn to 89.7 years old; the median age was 53.3 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 (48.7/100,000 persons per year). Two of three cases that occurred in this age category were early-onset disease (cases less than 7 days old); and comprised a rate of 0.6/1,000 births. Of the

three cases that occurred in children less than 2 years old in non-Natives, two were early-onset disease for a rate of 0.3/1,000 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 2005, the most common clinical presentation was bacteremia which occurred in 12 cases (50%).

Group B *Streptococcus* was isolated from blood in 23 (96%) of 24 cases in 2005; one case was isolated from cerebrospinal fluid.

Table 20: Primary Clinical Presentations of Invasive group B *Streptococcus* – Alaska, 2005

Primary Presentation	n (%)
Bacteremia	12 (50)
Osteomyelitis	4 (17)
Cellulitis*	3 (12.5)
Pneumonia*	3 (12.5)
Meningitis	1 (4)
Amnionitis	1 (4)
Total	24

*with bacteremia

Antibiotic Resistance

Susceptibility testing was performed on 19 GBS isolates received in 2005. Results of the testing are presented in the following table.

Table 21: Antibiotic Resistance in Invasive group B *Streptococcus* Isolates – Alaska, 2005

Antibiotic	Susceptible	Intermediate	Resistant	I + R	Total Tested
Penicillin	19 (100%)	0 (0%)	0 (0%)	0 (0%)	19
Cefotaxime	19 (100%)	0 (0%)	0 (0%)	0 (0%)	19
Erythromycin	10 (53%)	0 (0%)	9 (47%)	9 (47%)	19
Tetracycline	1 (5%)	0 (0%)	18 (85%)	18 (95%)	19
Levoflox	18 (95%)	1 (5%)	0 (0%)	1 (5%)	19
Clindamycin	14 (74%)	0 (0%)	5 (26%)	5 (26%)	19

All isolates tested were susceptible to penicillin and cefotaxime. Resistance to erythromycin and clindamycin, either intermediate or full, was seen in 65% and 43%, respectively, of isolates tested. Isolates from three of the four early onset cases were tested; all were resistant to tetracycline and one isolate was additionally resistant to erythromycin and clindamycin.

Table 21: Summary of Invasive group B *Streptococcus* Case Characteristics, Alaska, 2005

Sex	Age (yrs)	Race	Residence	Site of Isolation	Clinical Presentation(s)	Associated Medical Conditions	Survived
M	< 1 day	AK Native	Anchorage	Blood	Septicemia	None	Yes
M	< 1 day	AK Native	Other	Bood	Septicemia	None	Yes
F	< 1 day	Non-Native	Anchorage	Blood	Pneumonia	None	Yes
F	< 1 week	Non-Native	Anchorage	Blood	Septicemia	None	Yes
M	0.1	AK Native	Other	CSF	Meningitis	None	Unknown
M	0.2	Non-Native	Anchorage	Blood	Septicemia	Chronic lung disease	No
F	35.4	AK Native	Anchorage	Blood	Amnionitis	Cigarette smoking, chronic lung disease, diabetes	Yes
F	39.4	AK Native	Other	Blood	Septicemia	Immune suppressive treatment	No
F	48.3	AK Native	Other	Blood	Osteomyelitis	None	Yes
M	51.1	Non-Native	Anchorage	Blood	Osteomyelitis	Diabetes	Yes
F	51.9	Non-Native	Anchorage	Blood	Cellulitis	Cigarette smoking, immune suppressive treatment	Unknown
M	52.6	Non-Native	Other	Blood	Osteomyelitis	Diabetes	Yes
F	54	Non-Native	Anchorage	Blood	Cellulitis	None	Yes
F	63.4	AK Native	Other	Blood	Septicemia	None	Yes
M	63.5	AK Native	Other	Blood	Cellulitis	Chronic lung disease, alcohol abuse	Yes
F	64.4	Non-Native	Anchorage	Blood	Septicemia	Cigarette smoking, alcohol abuse	No
F	64.6	Non-Native	Anchorage	Blood	Septicemia	None	Yes
M	66.9	Non-Native	Anchorage	Blood	Septicemia	None	Yes
M	68.3	AK Native	Anchorage	Blood	Osteomyelitis	None	Yes
M	69.3	Non-Native	Anchorage	Blood	Septicemia	None	Yes
M	71.3	Non-Native	Anchorage	Blood	Pneumonia	Chronic lung disease	No
F	72	Non-Native	Anchorage	Blood	Pneumonia	Chronic lung disease, immune suppressive treatment, diabetes	Yes
Unk	88.6	Unknown	Anchorage	Blood	Bacteremia	Unknown	Unknown
F	89.7	AK Native	Anchorage	Blood	Bacteremia	None	Yes

References

[1] State of Alaska, Department of Labor & Workforce Development. Retrieved 7/27/2006 from http://almis.labor.state.ak.us

[2] Centers for Disease Control and Prevention. 2006. Active Bacterial Core Surveillance Report, Emerging Infections Program Network, *Streptococcus pneumoniae*, 2005.

[3] HennessyTW, 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] National Committee for Clinical Laboratory Standards (NCCLS). *Performance Standards for Antimicrobial Susceptibility Testing; Fourteenth Informational Supplement.* 2004; 24(1): M100-S14.

[6] Centers for Disease Control and Prevention. 2006. Active Bacterial Core Surveillance Report, Emerging Infections Program Network, *Haemophilus influenzae*, 2005.

[7] Centers for Disease Control and Prevention. 2006. Active Bacterial Core Surveillance Report, Emerging Infections Program Network, *Neisseria meningitidis*, 2005.

[8] Centers for Disease Control and Prevention. 2006. Active Bacterial Core Surveillance Report, Emerging Infections Program Network, Group A *Streptococcus*, 2005.

[9] Centers for Disease Control and Prevention. 2006. Active Bacterial Core Surveillance Report, Emerging Infections Program Network, Group B *Streptococcus*, 2005.

Appendix

MIC Interpretive Standards Definitions:

NCCLS [5] provides recommended interpretive categories for various Minimum Inhibitory Concentration values (cut points) for each organism which are defined as follows:

1. Susceptible (S):

The "susceptible" category implies that an infection due to the strain may be appropriately treated with the dosage of antimicrobial agent recommended for that type of infection and infecting species, unless otherwise contraindicated.

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 applicability in body sites where the drugs are physiologically concentrated (e.g., quinolones and β-lactams in urine) or when a high 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 a narrow pharmacotoxicity margins.

3. Resistant (R):

Resistant strains are not inhibited by the usually achievable systemic concentrations of the agent with normal dosage schedules and/or fall in the range where specific microbial resistance mechanisms are likely (e.g., β-lactamases) and clinical efficacy has not been reliable in treatment studies.