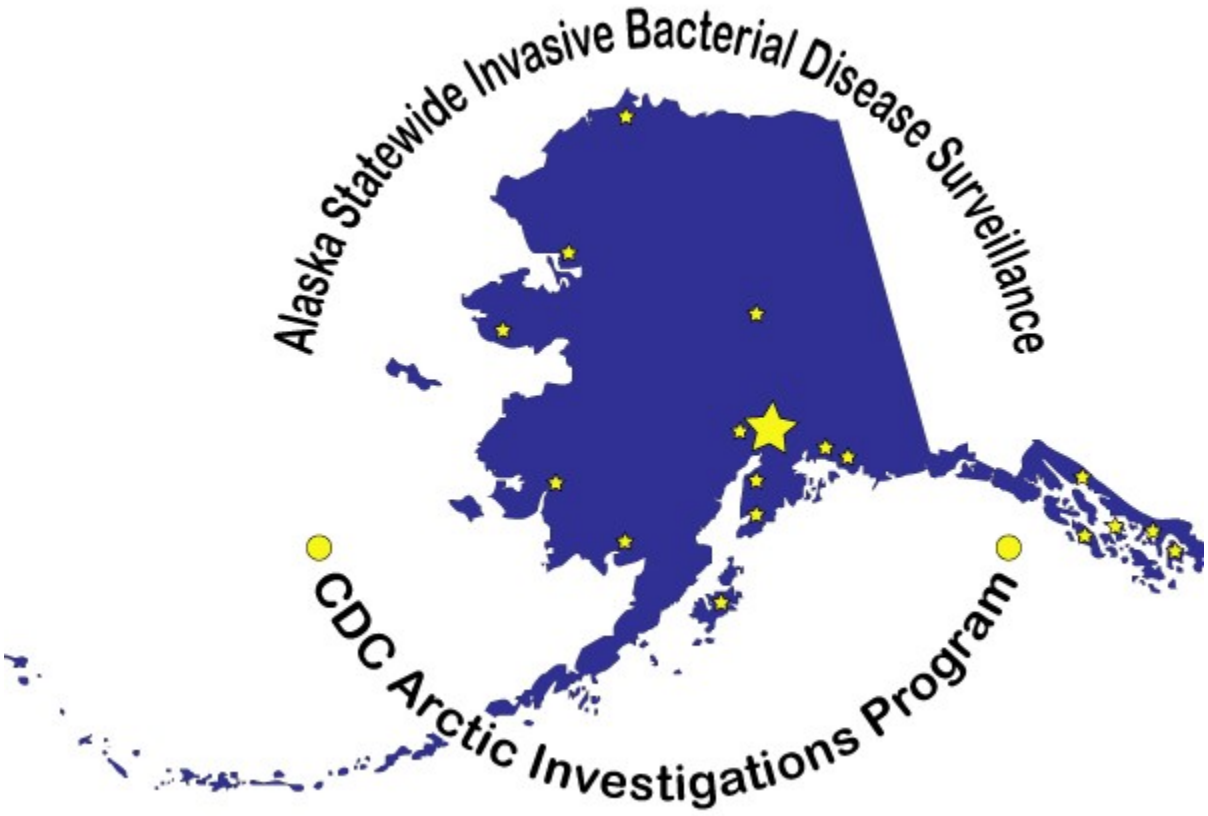

Surveillance of Invasive Bacterial Disease in Alaska, 2014

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Alaska Statewide Invasive Bacterial Disease

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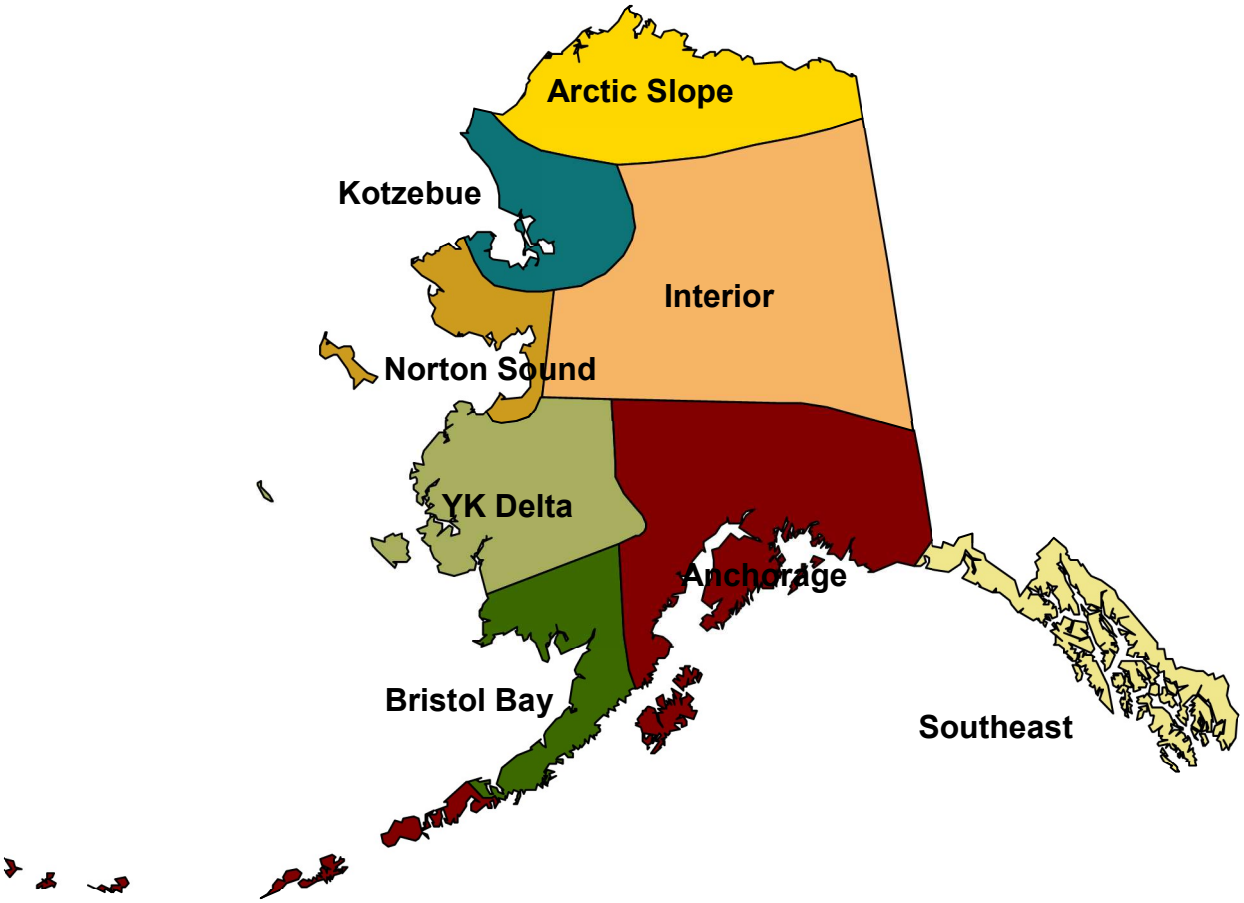
Summary

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

Figure 1: Invasive Bacterial Disease Surveillance Regions – Alaska, 2014



In 2014, the total numbers of cases of invasive disease caused by these organisms reported to AIP were 85 *S. pneumoniae*, 23 *H. influenzae*, 3 *N. meningitidis*, 57 group A *Streptococci* (GAS)

and 65 group B *Streptococci* (GBS). Alaska Native people had higher rates of disease overall than non-Native people for all surveillance organisms. Rates of invasive pneumococcal disease were highest in the YK Delta and Kotzebue regions. Rates for each organism by region are presented in the following table.

Table 1: Surveillance Organisms Reported by Region – Alaska, 2014

Region	*S. pneumoniae* n (rate*)	*H. influenzae* n (rate*)	*N. meningitidis* n (rate*)	GAS n (rate*)	GBS n (rate*)
Anchorage	53 (10.8)	11 (2.2)	1 (0.2)	37 (7.6)	45 (9.2)
Arctic Slope	2 (22.8)	1 (11.4)	0 (0)	0 (0)	0 (0)
Bristol Bay	2 (27.3)	0 (0)	0 (0)	2 (27.3)	0 (0)
Interior	12 (10.7)	4 (3.6)	0 (0)	4 (3.6)	6 (5.4)
Kotzebue	3 (35.5)	0 (0)	1 (11.8)	1 (11.8)	0 (0)
Norton Sound	0 (0)	0 (0)	1 (10)	2 (20)	0 (0)
Southeast	6 (8)	2 (2.7)	0 (0)	2 (2.7)	10 (13.4)
YK Delta	7 (26.6)	5 (19)	0 (0)	9 (34.2)	3 (11.4)
Total	85 (11.5)	23 (3.1)	3 (0.4)	57 (7.7)	64 (8.7)

*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 737,354 persons in 2014 [1]. Case detection occurs year-round as participating laboratories send isolates recovered from sterile sites to the AIP laboratory in Anchorage; materials and forms for isolate shipment and data collection are provided to each laboratory by AIP. Demographic and clinical information on the cases are collected from a review of medical records. At year-end, AIP asks that each laboratory review their records and provide information on any cases that may have been overlooked. In 2014, 23 laboratories in Alaska participated in the invasive disease surveillance system, either by sending isolates to the AIP laboratory throughout the year, conducting year-end record reviews, or both. Beginning in January, 2007, invasive *S. pneumoniae*, GAS and GBS became reportable conditions to the State of Alaska Division of Public Health (DPH). Reports of cases of disease caused by these organisms, along with cases of invasive *H. influenzae* and *N. meningitidis* which were previously reportable, are shared between AIP and DPH.

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

Invasive Pneumococcal Disease

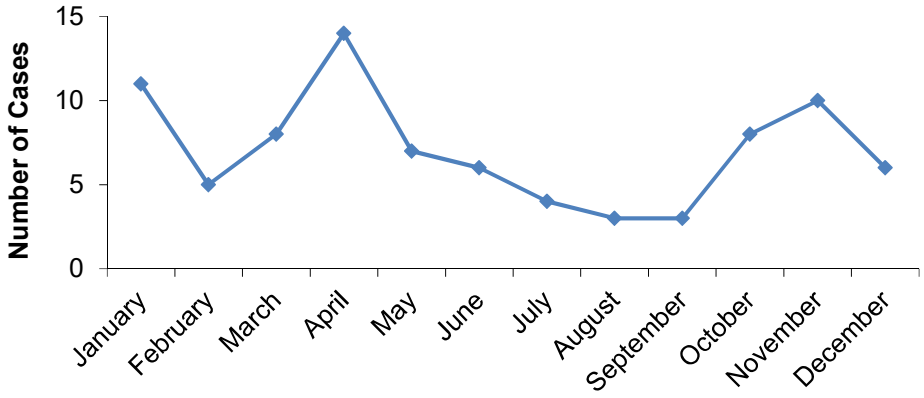
Overall Incidence

A total of 75 pneumococcal isolates were received at AIP in 2014. An additional 10 cases were detected through shared surveillance with the State DPH for a total of 85 cases of invasive pneumococcal disease. The overall rate for invasive pneumococcal disease in 2014 was 11.5 cases per 100,000 persons per year. Alaska rates for 2014 were higher than the Active Bacterial Core Surveillance (ABCs) 2014 national projected rate of 8.8/100,000 [2]. ABCs is a surveillance system operated in 10 states which covers a population of up to 42 million persons.

Seasonality

Invasive *Streptococcus pneumoniae* cases were identified in each month of 2014. The largest number of cases (n=14) was reported in April.

Figure 2: Invasive Pneumococcal Disease, by Month of Culture - Alaska, 2014



Race

In 2014, the state population was comprised of 19% Alaska Native people *(Alaska Natives 143,367 non-Natives 593,987)* [1]. Of all reported *S. pneumoniae* cases in 2014, 42% occurred among Alaska Native people for a total of 36 cases; the age-adjusted rate was 27.8/100,000 persons per year. Forty-nine cases occurred among the non-Native population for an age-adjusted rate of 7.4/100,000 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 2014 was 3.8.

Table 2: Invasive *Streptococcus pneumoniae* Cases by Race – Alaska, 2014

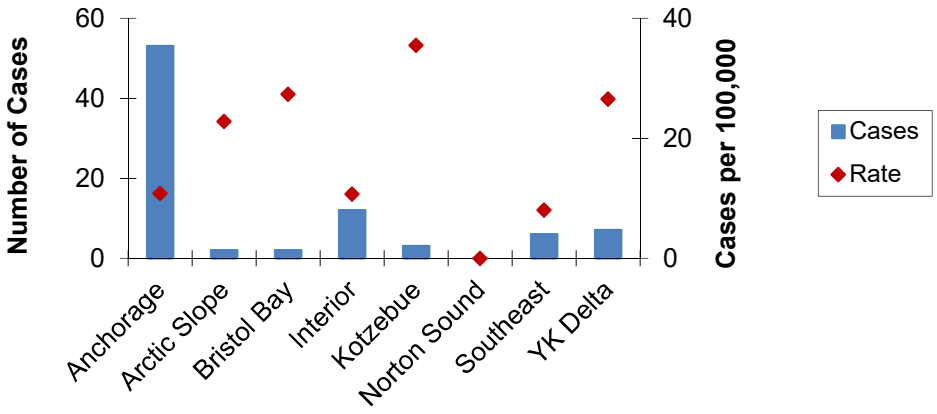
Race	Cases n (%)	Age Adjusted Rate*	% Male	Deaths n (%)
Alaska Native	36 (42)	27.8	67%	5 (14)
Non-Native†	49 (58)†	7.4	61%	6 (12)
Total	85		64%	11 (13)

*Cases per 100,000 per percent distribution of Alaska 2010 population
†Includes 3 cases for which race was unknown

Region

The highest percentage (62%) of invasive pneumococcal disease cases occurred in the Anchorage area in 2014. Rates of disease, however, were highest in the Kotzebue region (35.5/100,000 persons per year), Bristol Bay (27.3/100,000 persons per year) and the YK Delta (26.6/100,000 persons per year).

Figure 3: Invasive Pneumococcal Disease, Cases & Rates by Region - Alaska, 2014

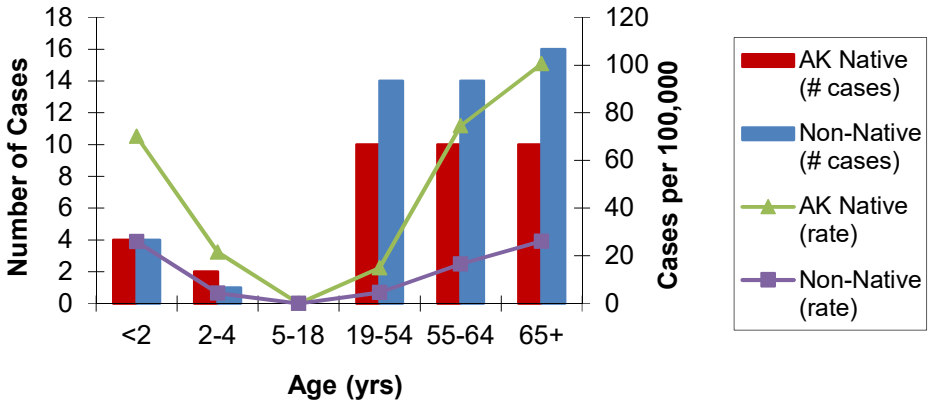


Age

Cases occurred in all age groups in 2014 ranging from 3 months to 91 years with a median age of 58 years. Overall, the highest rates of disease occurred in children less than two years old and adults 65 years and older.

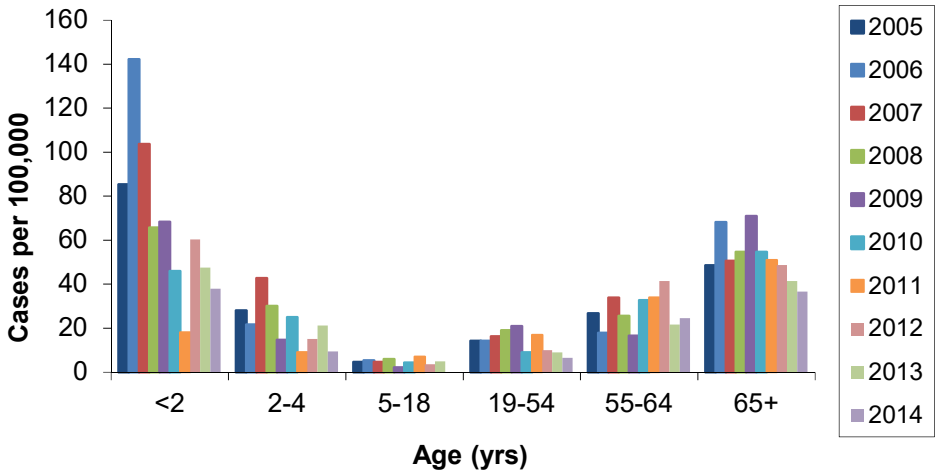
When stratified by age and race, the highest rates of disease in 2014 occurred in Alaska Native adults 65 years and older (100.6/100,000 persons per year).

Figure 4: Invasive Pneumococcal Disease, Cases & Rates by Age Group & Race - Alaska, 2014



Since the initiation of a pneumococcal 7-valent conjugate vaccine program in 2001, overall rates of invasive disease declined dramatically in children less than 2 years of age [3]. In 2008, the rate of invasive pneumococcal disease in children less than 2 years declined to 65.6/100,000 which was the lowest rate observed in this age group since introduction of the 7-valent vaccine. Following introduction of a 13-valent conjugate vaccine in 2010, rates of disease observed in children less than 2 years old declined to 18/100,000 in 2011. In 2012, however, disease rates in this age group increased to 60.3/100,000 due to disease caused by serotypes not included in the current vaccine. In 2014, rates have declined to 47.5/100,000.

Figure 5: Invasive Pneumococcal Disease by Age Group - Alaska, 2005-2014



Although pneumococcal disease rates dropped initially in AK Native and non-Native children less than 2 years of age after introduction of the 7-valent vaccine, the rates of disease in AK Native children less than 2 years trended upward from a low of 93.6/100,000 in 2001 to 335.9/100,000 in 2006. This increase in rates was due primarily to disease caused by serotypes not contained in the pneumococcal conjugate vaccine [4,5]. In 2009, rates of disease in AK Native children less than 2 years declined to 87.1/100,000 which was the lowest rate since the introduction of the seven-valent pneumococcal vaccine. After introduction of the 13-valent vaccine in 2010, rates declined to 30.7/100,000 in 2011, however, increased to 177.5/100,000 in 2012 and declined to 70.1/100,000 in 2014. All four of the cases in AK Native children less than 2 years old during 2014 were caused by serotypes not contained in the 13-valent vaccine. Rates of invasive disease in non-Native children less than 2 years declined during the same time period reaching 26.8/100,000 in 2005, and following an increase to 64.4/100,000 in 2007, declined in 2008 to 6.2/100,000. In 2009, the rate of disease in non-Native children less than 2 years increased to 60.3/100,000, but declined to 13/100,000 in 2012 with use of the 13-valent vaccine. Following an increase in 2013 (26.3/100,000), rates in non-Native children less than 2 years were similar in 2014 (25.9/100,000); three of four cases were caused by non-vaccine serotypes and the serotype for the fourth case was unknown.

Figure 6: Invasive Pneumococcal Disease in Alaska Natives, by Age Group - Alaska, 2005-2014

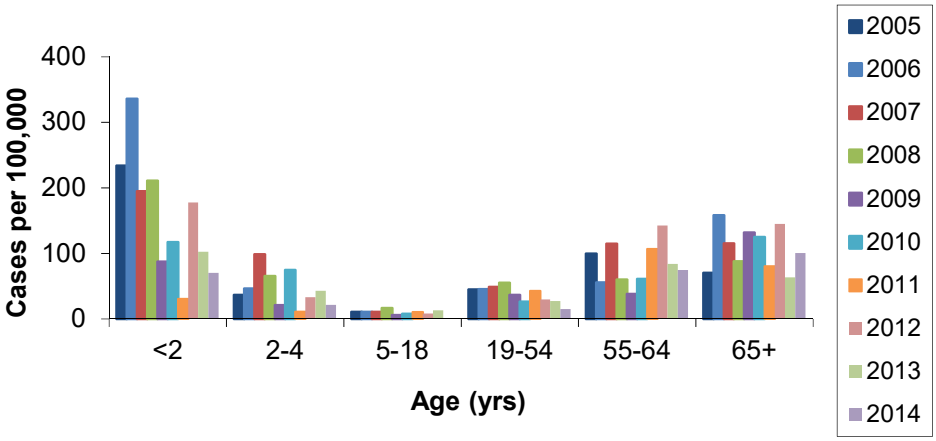
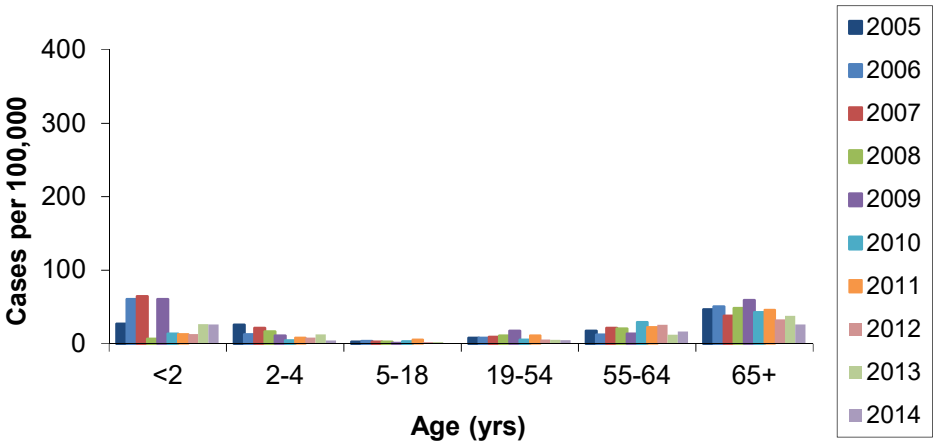


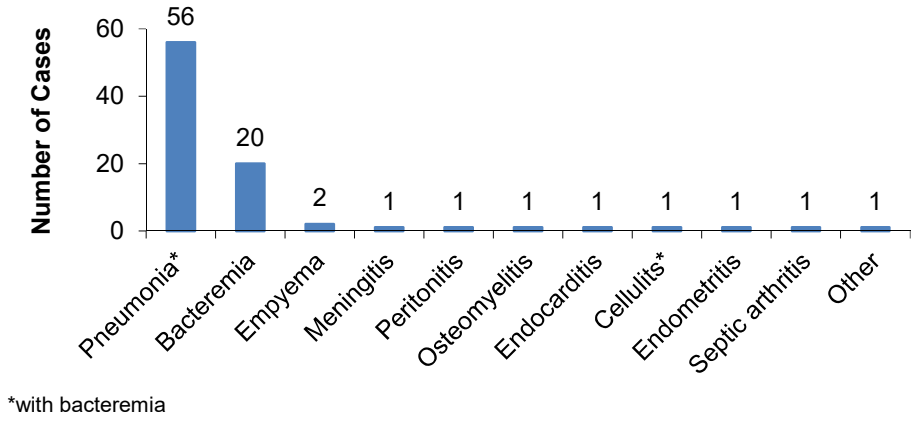
Figure 7: Invasive Pneumococcal Disease in Non-Natives, by Age Group - Alaska, 2005-2014



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 2014 (66%) followed by bacteremia (24%). Three cases had a secondary pneumococcal-related diagnosis in 2014; all were pneumonia with bacteremia.

Figure 8: Primary Clinical Presentations of Invasive Pneumococcal Disease - Alaska, 2014



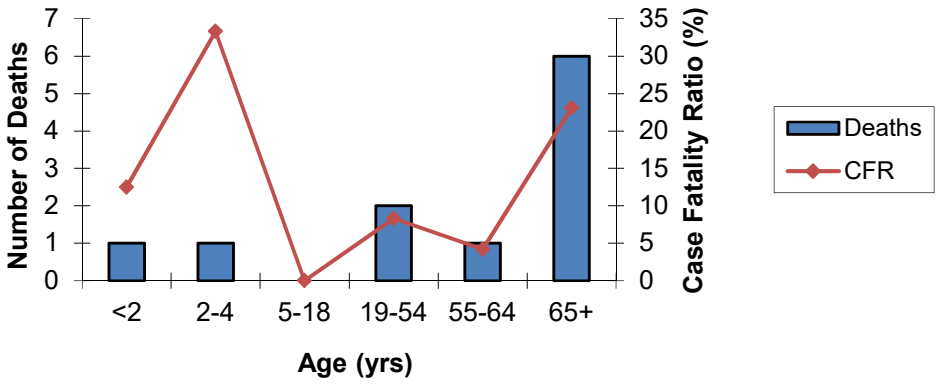
*with bacteremia

In 2014, blood was the most common source of a positive culture which was used to identify 82 (97%) of 85 cases. Three cases were identified from a surgical specimen.

Mortality

In 2014, the overall case fatality ratio for *S. pneumoniae* in Alaska was 13% (11 deaths out of 85 cases). The case fatality ratio for AK Natives was similar (14%, 5 deaths) to non-Natives (12%, 6 deaths). The largest number of deaths occurred in the 65 and older age category (6 deaths), however, the highest case fatality ratio occurred in the 2-4 age category (1 death) 33%.

Figure 9: Invasive Pneumococcal Deaths & Case Fatality Ratios by Age Group - Alaska, 2014



Serotype

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

by use of one of the available pneumococcal vaccines. Serotyping was performed on all of the *S. pneumoniae* cases for which an isolate was available.

Table 3: Invasive Pneumococcal Serotype Distribution by Race and Age Group – Alaska, 2014

		Alaska Native					Non-Native				
Serotype	Total n (%)	<2	2-4	5-18	19-64	65+	<2	2-4	5-18	19-64	65+
03	7 (10)	-	-	-	2	-	-	-	-	3	2
06C	3 (4)	-	-	-	-	2	-	-	-	-	1
07C	1 (1)	-	-	-	-	-	-	-	-	-	1
07F	2 (3)	-	1	-	-	-	-	-	-	1	-
08	3 (4)	-	-	-	-	-	-	-	-	3	-
09N	9 (12)	-	-	-	3	-	-	-	-	5	1
10A	2 (3)	1	-	-	-	-	-	-	-	-	1
12F	3 (4)	-	-	-	-	1	-	-	-	2	-
15A	2 (3)	-	-	-	2	-	-	-	-	-	-
15C	1 (1)	-	-	-	-	1	-	-	-	-	-
16F	7 (10)	-	-	-	4	1	-	-	-	2	-
19A	2 (3)	-	-	-	-	1	-	1	-	-	-
19F	1 (1)	-	-	-	-	-	-	-	-	-	1
20	2 (3)	-	-	-	1	-	-	-	-	1	-
22F	11 (15)	1	1	-	-	1	2	-	-	3	3
23A	2 (3)	-	-	-	1	-	-	-	-	-	1
23B	1 (1)	-	-	-	1	-	-	-	-	-	-
28A	2 (3)	-	-	-	1	-	-	-	-	-	1
29	1 (1)	1	-	-	-	-	-	-	-	-	-
31	2 (3)	-	-	-	1	-	-	-	-	1	-
33F	4 (5)	1	-	-	2	-	-	-	-	1	-
35B	3 (4)	-	-	-	-	-	-	-	-	2	1
35F	1 (1)	-	-	-	-	-	-	-	-	-	1
38	2 (3)	-	-	-	-	1	1	-	-	-	-
Total	74	4	2	0	18	8	3	1	0	24	14

In 2014, the most common pneumococcal serotypes were 22F, (11 isolates, 15%), 9N (9 isolates, 12%), 3 (7 isolates, 10%) and 16F (7 isolates, 10%). From 1986 through 2001, serotype 14 was the most common invasive pneumococcal serotype ranging from 7.4% to 23.5% of isolates. Following introduction in 2001 of the pneumococcal conjugate vaccine which includes serotype 14, the proportion of serotype 14 isolates dropped to 1.5% of serotyped isolates in 2006 and there were no serotype 14 cases in 2014. Disease caused by serotypes 7F and 19A, which are not included in the 7-valent conjugate vaccine, continually increased until the introduction of the 13-valent vaccine in 2010 which does include these two serotypes. Although cases caused by 7F and 19A continue to occur, they are no longer the most common serotypes and it is anticipated that the number of cases will continue to decline with the use of the vaccine. The majority (50%) of serotype 22F cases and serotype 9N cases (78%) occurred in the Anchorage area in 2014.

Table 4: Invasive Pneumococcal Serotype Distribution by Region – Alaska, 2014

Serotype	Anchorage	Arctic Slope	Bristol Bay	Interior	Kotzebue	Norton Sound	Southeast	YK Delta
03	4	-	-	3	-	-	-	-
06C	2	-	-	1	-	-	-	-
07C	1	-	-	-	-	-	-	-
07F	-	-	-	-	-	-	1	1
08	2	-	-	1	-	-	-	-
09N	7	-	-	-	1	-	1	-
10A	2	-	-	-	-	-	-	-
12F	2	-	-	-	-	-	-	1
15A	1	-	-	-	-	-	-	1
15C	1	-	-	-	-	-	-	-
16F	7	-	-	-	-	-	-	-
19A	-	-	-	1	-	-	-	1
19F	1	-	-	-	-	-	-	-
20	1	1	-	-	-	-	-	-
22F	6	-	-	3	1	-	-	1
23A	2	-	-	-	-	-	-	-
23B	1	-	-	-	-	-	-	-
28A	2	-	-	-	-	-	-	-
29	-	-	-	-	-	-	-	1
31	2	-	-	-	-	-	-	-
33F	1	1	-	1	1	-	-	-
35B	2	-	-	-	-	-	-	1
35F	1	-	-	-	-	-	-	-
38	1	-	-	-	-	-	1	-
Unknown	8	-	2	2	-	-	3	-
Total	53	2	2	12	3	0	6	7

Vaccine Serotypes

In 2001, the pneumococcal conjugate vaccine (PCV7) was included in the Alaska childhood vaccination schedule. This vaccine provided protection against the 7 most common pneumococcal serotypes causing invasive disease among children (types 4, 6B, 9V, 14, 18C, 19F, 23F). In early 2010, a new pneumococcal conjugate vaccine (PCV13) was introduced into the Alaska childhood vaccination schedule. This vaccine provided protection against the 7 pneumococcal serotypes contained in the PCV7 vaccine plus six additional serotypes (1, 3, 5, 6A, 7F, 19A) that have caused invasive disease since the introduction of the PCV7 vaccine. The table below shows the proportion of invasive infections from 2014 that were due to serotypes found in the PCV13 vaccine. There were two cases of pneumococcal disease caused by serotypes contained in the PCV13 vaccine in children less than 5 years of age, the age group for which the vaccine is recommended. It is anticipated that the number of cases caused by these serotypes will decrease over time.

Table 5: Proportion of Invasive Isolates Contained in the PCV13 Vaccine by Age Group and Race – Alaska, 2014

Age (yrs)	Alaska Native (%)	Non-Native (%)	Total (%)
<2	0 (0%) of 4	0 (0%) of 4	0 (0%) of 8
2-4	1 (50%) of 2	1 (100%) of 1	2 (67%) of 3
5+	3 (10%) of 30	7 (16%) of 44	10 (16%) of 74
Total	4 (12%) of 36	8 (16%) of 49	12 (14%) of 85

For the year covered by this report, the 23-valent polysaccharide vaccine (Ps23V) was recommended in Alaska for all persons 65 years and older, and for persons over age 2 who are at higher risk for pneumococcal disease [5]. In 2014, for persons 65 years and older, 11 (50%) of 22 cases serotyped were potentially vaccine preventable invasive pneumococcal illnesses.

Vaccine Failures

In 2014, pneumococcal vaccine status was known for 72 (85%) of the 85 cases; 53% (n=38) of cases with known vaccine status did receive a pneumococcal vaccine prior to illness and 34 cases (47%) had no record of a pneumococcal vaccine.

A PCV13 vaccine failure is defined as invasive pneumococcal disease caused by a serotype contained in the PCV13 vaccine in a child less than five years old who has had at least two doses of vaccine. There was one vaccine failure in 2014. The child had received 4 doses of PCV13 and had anemia and vitamin D deficiency; serotype of the case was 7F.

Potentially Preventable Deaths

Overall, 46% of all pneumococcal-related mortality in 2014 was potentially preventable with the use of the 23-valent polysaccharide vaccine in persons over 5 years old; 46% of deaths were due to disease caused by serotypes not contained in the 23-valent vaccine.

Table 6: Potentially Vaccine Preventable Invasive Pneumococcal Deaths – Alaska, 2014

Serotypes	< 2 years	2-4	5-18	19-54	55-64	65+	Total
PCV13	0	1 (100%)	0	0	0	0	1 (9%)
Ps23V	0	0	0	1 (50%)	0	3 (50%)	4 (36%)
Non-Vaccine	1 (100%)	0	0	1 (50%)	1 (100%)	2 (33%)	5 (46%)
Unknown	0	0	0	0	0	1 (17%)	1 (9%)
Total	1	1	0	2	1	6	11

Four of the 11 deaths in 2014 from invasive *S. pneumoniae* occurred from serotypes contained within the Ps23V vaccine; three of the deaths were in individuals eligible for the vaccine. One death occurred in a vaccinated individual; time since vaccination was 5 years.

Table 7: Invasive Pneumococcal Disease, Serotypes of Fatal Cases – Alaska, 2014

Serotype	Deaths n (%)	Serotype Frequency (n)
03†*	2 (29%)	7
06C	1 (33%)	3
09N*	1 (11%)	9
15A	1 (50%)	2
19A†*	2 (100%)	2
35B	1 (33%)	3
35F	1 (100%)	1
38	1 (50%)	2

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

Associated Risk Factors

The presence of one or more associated risk factors was reported in 78% of invasive pneumococcal cases in 2014. Cigarette smoking was the most prevalent risk factor observed in adults followed by chronic lung disease and alcohol abuse.

Table 8: Associated Risk Factors Identified in Invasive Pneumococcal Cases – Alaska, 2014*

Risk Factor	Adult Cases (≥ 18 years) n=74, Cases (%)
Cigarette smoking	29 (39%)
Chronic lung disease	27 (37%)
Alcohol abuse	19 (26%)
Diabetes	15 (20%)
Immunosuppressive treatment	3 (4%)
Injection drug use	0 (0%)
Asplenia	0 (0%)

*More than one risk factor was identified in several cases

Antibiotic Resistance

Susceptibility testing was performed on 74 isolates received in 2014. Results of the testing are presented in the following table.

Table 9: Antibiotic Resistance in Invasive *Streptococcus pneumoniae* Isolates – Alaska, 2014

Antibiotic	Susceptible	Intermediate	Resistant	I + R	Total Tested
Penicillin	65 (88%)	3 (4%)	6 (8%)	9 (12%)	74
TMP-sulfa	65 (88%)	7 (9%)	2 (3%)	9 (12%)	74
Erythromycin	56 (76%)	0 (0%)	18 (24%)	18 (24%)	74
Ceftriaxone	69 (93%)	3 (4%)	2 (3%)	5 (7%)	74
Tetracycline	68 (92%)	0 (0%)	6 (8%)	6 (8%)	74
Chloramphenicol	71 (96%)	0 (0%)	3 (4%)	3 (4%)	74
Vancomycin	74 (100%)	0 (0%)	0 (0%)	0 (0%)	74
Levofloxacin	74 (100%)	0 (0%)	0 (0%)	0 (0%)	74
Clindamycin	68 (92%)	0 (0%)	6 (8%)	6 (8%)	74

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

Serotypes found in the PCV7 and PCV13 vaccines are more likely to be non-susceptible to penicillin and erythromycin than non-vaccine serotypes. One potential benefit of the use of these vaccines was an anticipated decline in antibiotic resistance among circulating pneumococci. Following the initiation of the PCV7 vaccine in 2001, antibiotic resistance among invasive pneumococci dropped. During 2003, TMP-sulfa and penicillin resistance increased, however, following an increase in disease caused by serotype 19A. This serotype is included in the PCV13 vaccine; decreasing proportions of isolates resistant to most antibiotics tested may be due to the introduction of the vaccine. However, the proportion of isolates resistant to erythromycin has increased which is a trend that was also seen after the introduction of PCV7 [8].

Figure 10: Trends in Antibiotic Non-Susceptibility Among Invasive Pneumococcal Isolates - Alaska, 1994 - 2014

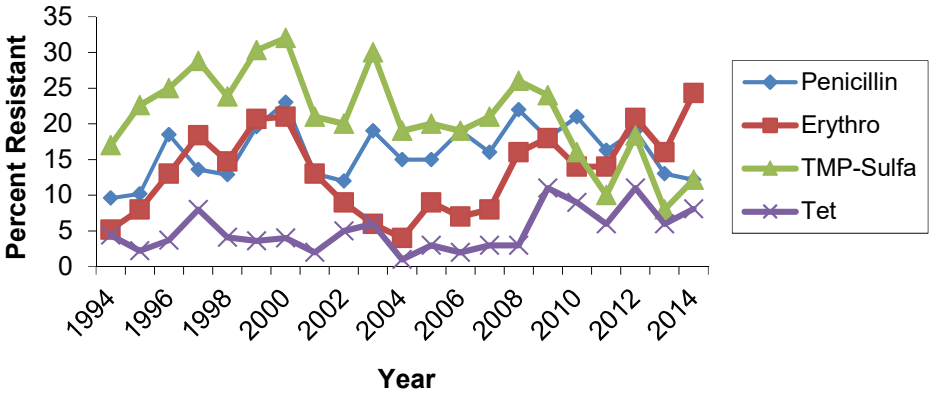


Table 10: Summary of Invasive *Streptococcus pneumoniae* Case Characteristics, Alaska, 2014

Sex	Age (Yrs)	Race	Residence	Site of Isolation	Clinical Presentation(s)	Serotype	Associated Risk Factors	Survived
M	0.3	Non-Native	Anchorage	Blood	Bacteremia	38	None	No
M	0.5	AK Native	Anchorage	Blood	Bacteremia	22F	Immune suppressive therapy, diabetes	Yes
M	0.6	AK Native	Other	Surgical specimen	Empyema	33F	None	Yes
M	0.9	AK Native	Other	Blood	Pneumonia	29	None	Yes
M	1.4	Non-Native	Anchorage	Blood	Bacteremia	22F	None	Yes
M	1.5	Non-Native	Anchorage	Blood	Bacteremia	22F	None	Yes
M	1.6	AK Native	Anchorage	Blood	Pneumonia	10A	None	Yes
F	1.9	Unknown	Other	Blood	Bacteremia	ND	None	Yes
F	2.1	AK Native	Other	Blood	Pneumonia	22F	None	Yes
M	2.9	Unknown	Other	Blood	Pneumonia	19A	None	No
F	3.5	AK Native	Other	Blood	Pneumonia	07F	None	Yes
M	26.1	Non-Native	Other	Surgical specimen	Bacteremia	ND	Smoking	Yes
F	32	Non-Native	Anchorage	Blood	Endometritis	12F	Chronic lung disease	Yes
M	33.4	AK Native	Anchorage	Blood	Pneumonia	09N	Alcohol abuse	Yes
M	35.4	AK Native	Other	Blood	Pneumonia	09N	Alcohol abuse	Yes
M	36.8	Non-Native	Anchorage	Blood	Pneumonia	16F	Smoking	Yes
M	40.3	Non-Native	Other	Blood	Pneumonia	ND	None	Yes
M	41.8	Non-Native	Anchorage	Blood	Bacteremia	09N	Smoking	Yes
M	44	AK Native	Other	Blood	Pneumonia	20	None	Yes
M	44.1	AK Native	Anchorage	Blood	Pneumonia	31	Alcohol abuse	Yes
M	44.7	AK Native	Anchorage	Blood	Bacteremia	15A	Chronic lung disease, alcohol abuse, diabetes	No
M	45.8	Non-Native	Anchorage	Blood	Bacteremia	09N	None	Yes
F	48.1	AK Native	Other	Blood	Pneumonia	03	Alcohol abuse	No
F	49.1	AK Native	Anchorage	Blood	Pneumonia	16F	Smoking, chronic lung disease, alcohol abuse	Yes
M	50.3	Non-Native	Anchorage	Blood	Pneumonia	16F	Smoking, alcohol abuse	Yes
M	50.6	AK Native	Other	Blood	Pneumonia	ND	Smoking, alcohol abuse	Yes
M	52	AK Native	Anchorage	Blood	Cellulitis	16F	Smoking, chronic lung disease	Yes
F	52.2	Unknown	Other	Blood	Bacteremia	ND	None	Yes
M	52.5	Non-Native	Other	Blood	Pneumonia	07F	Smoking, alcohol abuse	Yes
M	52.9	Non-Native	Other	Blood	Pneumonia	33F	Smoking	Yes
F	53.1	Non-Native	Anchorage	Blood	Pneumonia	09N	None	Yes
M	53.1	Non-Native	Anchorage	Blood	Pneumonia	12F	None	Yes
M	53.2	Non-Native	Other	Blood	Pneumonia	09N	None	Yes
M	53.4	Non-Native	Anchorage	Blood	Pneumonia	ND	Smoking, diabetes	Yes
M	53.8	AK Native	Anchorage	Blood	Pneumonia	28A	Smoking	Yes
M	55.1	AK Native	Anchorage	Blood	Pneumonia	ND	None	Yes
F	55.4	Non-Native	Anchorage	Blood	Pneumonia	31	Smoking, chronic lung disease	Yes
M	56.2	AK Native	Anchorage	Blood	Pneumonia	16F	Alcohol abuse	Yes
F	56.4	AK Native	Anchorage	Blood	Bacteremia	16F	Smoking, alcohol abuse	Yes
F	56.5	Non-Native	Other	Blood	Bacteremia	22F	Diabetes	Yes
M	56.9	Non-Native	Anchorage	Blood	Pneumonia	35B	Smoking, chronic lung disease, immune suppressive therapy	No

Sex	Age (Yrs)	Race	Residence	Site of Isolation	Clinical Presentation(s)	Serotype	Associated Risk Factors	Survived
M	57.1	Non-Native	Other	Blood	Pneumonia	03	Chronic lung disease, diabetes	Yes
M	57.6	Non-Native	Anchorage	Blood	Pneumonia	09N	Smoking, chronic lung disease	Yes
M	57.8	Non-Native	Other	Blood	Pneumonia	22F	Smoking, diabetes	Yes
M	58.4	Non-Native	Other	Blood	Pneumonia	03	None	Yes
F	58.9	AK Native	Anchorage	Blood	Empyema, pneumonia	23A	Smoking, immune suppressive therapy	Yes
F	59.2	Non-Native	Anchorage	Blood	Pneumonia	03	Chronic lung disease, alcohol abuse, diabetes	Yes
M	59.2	Non-Native	Anchorage	Blood	Pneumonia	08	None	Yes
F	59.8	Non-Native	Anchorage	Blood	Meningitis	08	None	Yes
M	60.2	Non-Native	Other	Blood	Pneumonia	08	Smoking, chronic lung disease, diabetes	Yes
M	60.8	AK Native	Anchorage	Blood	Pneumonia	03	Smoking, chronic lung disease	Yes
F	60.8	Non-Native	Anchorage	Blood	Pneumonia	20	Smoking, chronic lung disease	Yes
M	60.9	AK Native	Anchorage	Blood	Pneumonia	09N	Smoking, chronic lung disease	Yes
F	61.9	AK Native	Other	Blood	Pneumonia	33F	Smoking	Yes
M	62	AK Native	Other	Blood	Other	15A	Chronic lung disease, alcohol abuse	Yes
F	62.1	Non-Native	Anchorage	Blood	Pneumonia	22F	Chronic lung disease, immune suppressive therapy, diabetes	Yes
F	63.3	AK Native	Anchorage	Blood	Bacteremia	23B	Smoking, alcohol abuse	Yes
M	64.3	Non-Native	Other	Blood	Peritonitis, pneumonia	35B	None	Yes
M	64.7	AK Native	Anchorage	Blood	Pneumonia	33F	Smoking, chronic lung disease, alcohol abuse	Yes
M	65.5	AK Native	Other	Blood	Pneumonia	19A	Smoking, chronic lung disease	No
F	66.4	Non-Native	Anchorage	Blood	Pneumonia	07C	None	Yes
F	68.5	AK Native	Anchorage	Blood	Pneumonia	16F	None	Yes
M	69	Non-Native	Anchorage	Blood	Pneumonia	22F	Chronic lung disease	Yes
M	70.2	Non-Native	Anchorage	Blood	Bacteremia	35F	None	No
M	70.6	AK Native	Other	Blood	Osteomyelitis	22F	Smoking, chronic lung disease	Yes
F	71.3	Non-Native	Anchorage	Blood	Pneumonia	03	None	Yes
F	73	Non-Native	Anchorage	Blood	Bacteremia	19F	Chronic lung disease	Yes
M	73.3	Non-Native	Anchorage	Blood	Pneumonia	ND	Diabetes	Yes
F	74.4	Non-Native	Anchorage	Blood	Bacteremia	10A	None	Yes
M	75.2	Non-Native	Anchorage	Blood	Pneumonia	03	Alcohol abuse	No
M	75.9	AK Native	Anchorage	Blood	Pneumonia	15C	Chronic lung disease, alcohol abuse	Yes
F	77.6	Non-Native	Other	Blood	Pneumonia	22F	Chronic lung disease, diabetes	Yes
M	77.7	AK Native	Other	Blood	Pneumonia	ND	Smoking, diabetes	No
M	78.1	Non-Native	Anchorage	Blood	Pneumonia	06C	None	Yes
M	78.5	Non-Native	Anchorage	Blood	Pneumonia	23A	Smoking, chronic lung disease, diabetes	Yes
M	79	AK Native	Other	Surgical specimen	Bacteremia	ND	None	Yes

Sex	Age (Yrs)	Race	Residence	Site of Isolation	Clinical Presentation(s)	Serotype	Associated Risk Factors	Survived
F	80.1	AK Native	Other	Blood	Pneumonia	06C	Chronic lung disease	Yes
M	80.5	Non-Native	Anchorage	Blood	Pneumonia	28A	None	Yes
F	81.3	AK Native	Other	Blood	Pneumonia	12F	Diabetes	Yes
F	82	Non-Native	Anchorage	Blood	Bacteremia	35B	Chronic lung disease, diabetes	Yes
F	82	Non-Native	Anchorage	Blood	Septic arthritis	ND	Chronic lung disease	Yes
M	82.8	AK Native	Anchorage	Blood	Bacteremia	06C	Smoking	No
F	83.7	AK Native	Other	Blood	Pneumonia	38	Diabetes	Yes
F	84.9	Non-Native	Anchorage	Blood	Pneumonia	09N	Chronic lung disease	No
F	90.7	Non-Native	Anchorage	Blood	Pneumonia	22F	None	Yes

ND = typing not done

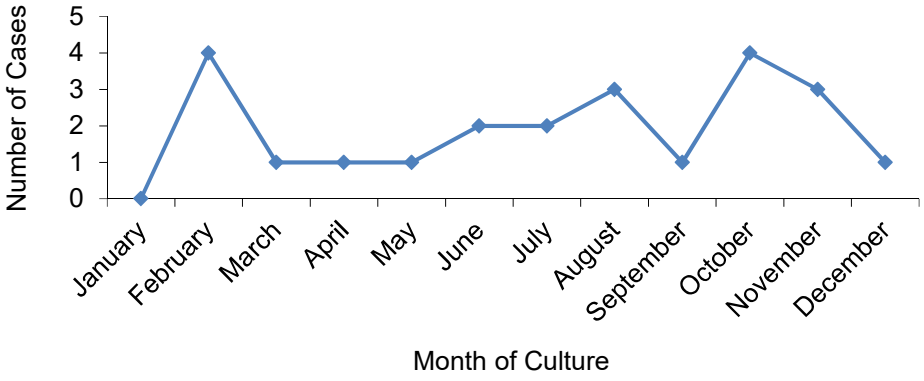
Invasive *Haemophilus influenzae*

Overall Incidence

In 2014, there were 23 cases of invasive *Haemophilus influenzae* in Alaska, for a statewide rate of 3.1/100,000 persons per year. This rate is higher than the national projected rate of 1.63/100,000 persons per year [9]. There were five deaths associated with *H. influenzae* in 2014 for a case fatality ratio of 22%.

Seasonality

Figure 11: *Haemophilus influenzae* Disease by Month of Culture - Alaska, 2014

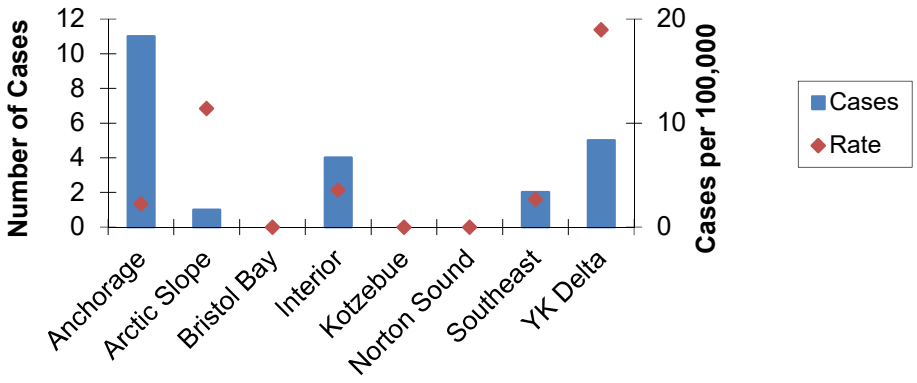


Cases of invasive *H. influenzae* occurred throughout 2014; however, due to the small number of cases, trends in seasonality cannot be determined. The largest number of cases (n=4) occurred in February and October.

Region

The highest rates of disease caused by invasive *H. influenzae* cases in 2014 were in the regions of the YK Delta, 19/100,000 (5 cases), and the Arctic Slope, 11.4/100,000 (1 case). Although a large number of cases occurred in the Anchorage area (11 cases), the rate was much lower (2.2/100,000).

Figure 12: Invasive *Haemophilus influenzae*, Cases & Rates by Region - Alaska, 2014



Race

Table 11: Invasive *Haemophilus influenzae* Cases by Race – Alaska, 2014

Race	Cases n (%)	Age Adjusted Rate*	% Male	Deaths n (%)
Alaska Native	12 (52%)	7.9	58%	3 (25%)
Non-Native	11 (48%)	1.7	64%	2 (18%)
Total	23		61%	5 (22%)

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

In 2014, 52% 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 2014 was 4.6.

Age

H. influenzae cases ranged in age from newborn to 95 years of age in 2014 (median 39.2 years). Overall, the highest rates of disease occurred in children less than 2 years old (33.1/100,000).

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, 87.7/100,000 persons per year and Alaska Native adults 65 years and older, 20.1/100,000 persons per year.

Figure 13: Invasive *Haemophilus influenzae* by Age Group - Alaska, 2014

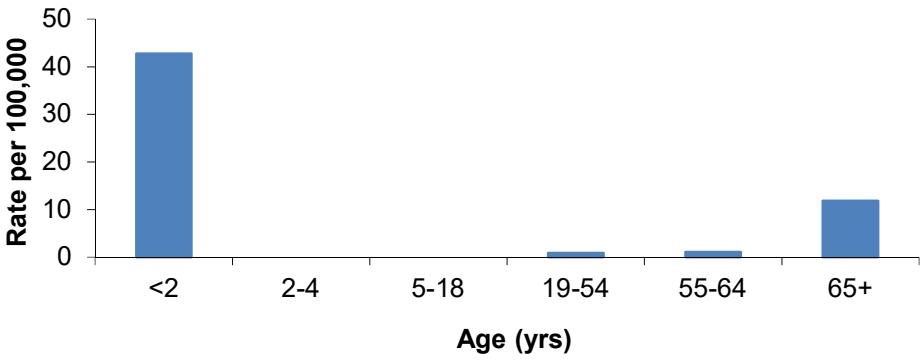
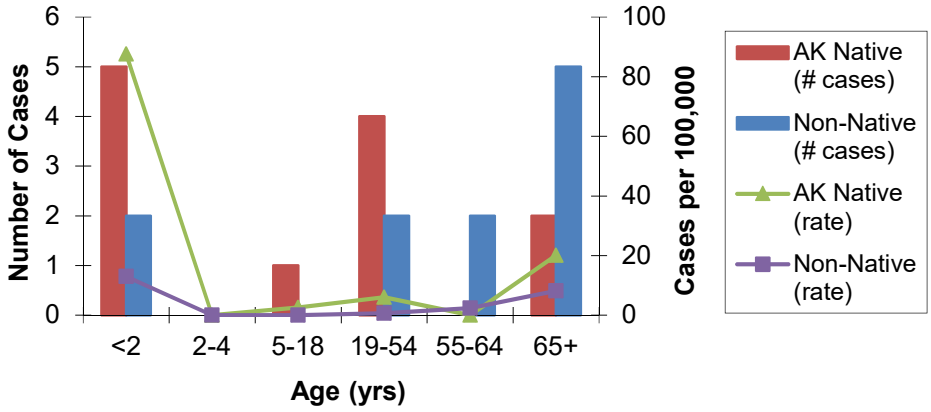


Figure 14: Invasive *Haemophilus influenzae*, Cases & Rates by Age Group & Race - Alaska, 2014



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 2014, pneumonia with bacteremia and bacteremia alone were the most common presentation (52% and 39% of cases, respectively).

Twenty-two (96%) *H. influenzae* isolates were from blood samples in 2014, and one was from cerebrospinal fluid.

Table 12: Primary Clinical Presentation of Invasive *Haemophilus influenzae* - Alaska, 2014

Primary Presentation	n (%)
Pneumonia*	12 (52%)
Bacteremia	9 (39%)
Meningitis	1 (4%)
Cellulitis*	1 (4%)
Total	23

*with bacteremia

Serotypes

All isolates received at AIP are serotyped; all 23 cases in 2014 had isolates and were serotyped. The bacterial capsule is the basis for serotyping and is the primary virulence factor. Serotype b was the most common serotype in the past, but its prevalence has decreased with use of the childhood Hib vaccine. Surveillance of serotypes is important for monitoring vaccine effectiveness and emergence of non-vaccine serotypes.

Table 13: Serotypes of Invasive *Haemophilus influenzae* Cases by Race – Alaska, 2014

		Alaska Native				Non-Native			
Serotype	Total n (%)	<2	2-18	19-64	65+	<2	2-18	19-64	65+
a	2 (9%)	2	-	-	-	-	-	-	-
b	1 (4%)	-	1	-	-	-	-	-	-
e	1 ((4%)	-	-	1	-	-	-	-	-
f	2 (9%)	-	-	-	-	1	-	-	1
NT*	17 (74%)	3	-	3	2	1	-	4	4
Total	23	5	1	4	2	2	0	4	5

*Non-typeable

Hib

In recent years, the prevalence of *H. influenzae* type b has declined due to increased use of a childhood vaccine against this serotype. There were no cases of Hib in children less than 5 years old in 2014.

Hia

Prior to 2002, *H. influenzae* type a (Hia) had not been detected in Alaska. Following an outbreak in 2003 [10], cases have occurred sporadically until 2010 when an outbreak began in the YK Delta and continued through 2011 [11]. Two cases of Hia were detected in 2014; all occurred in AK Native children less than 2 years old. The rate of invasive disease caused by Hia in AK Native children less than 2 years old for 2014 was 35.1/100,000.

Antibiotic Resistance

Twenty-three *H. influenzae* isolates received at AIP were tested for susceptibility to ampicillin, chloramphenicol, ceftriaxone and TMP/sulfa. All isolates tested were susceptible to ceftriaxone and chloramphenicol, 13 isolates were resistant to ampicillin (5 intermediate, 8 fully resistant) and 15 isolates were resistant to TMP/sulfa (8 intermediate and 8 fully resistant).

Table 14: Summary of Invasive *Haemophilus influenzae* Case Characteristics, Alaska, 2014

Sex	Age (Yrs)	Race	Residence	Site of Isolation	Clinical Presentation(s)	Serotype*	Associated Risk Factors	Survived
F	Newborn	AK Native	Anchorage	Blood	Bacteremia	NT	None	Yes
F	0.1	Non-Native	Other	Blood	Pneumonia	NT	None	Yes
M	0.3	Non-Native	Anchorage	Blood	Bacteremia	f	None	Yes
F	0.5	AK Native	Anchorage	CSF	Meningitis, empyema	NT	None	Yes
F	0.5	AK Native	Other	Blood	Cellulitis	a	None	Yes
M	1	AK Native	Other	Blood	Pneumonia	a	None	Yes
M	1.1	AK Native	Other	Blood	Pneumonia	NT	None	Yes
M	5.5	AK Native	Other	Blood	Pneumonia	b	None	Yes
F	23.3	Non-Native	Anchorage	Blood	Bacteremia	NT	None	Yes
F	30.5	AK Native	Other	Blood	Pneumonia	e	Alcohol abuse	No
M	33.9	Non-Native	Other	Blood	Bacteremia	NT	None	Yes
F	39.2	AK Native	Other	Blood	Pneumonia	NT	Smoking, alcohol abuse, injection drug use	No
M	48.8	AK Native	Other	Blood	Pneumonia	NT	Smoking, alcohol abuse, injection drug use	Yes
M	49.8	AK Native	Anchorage	Blood	Pneumonia	NT	Smoking, alcohol abuse	Yes
F	57.9	Non-Native	Anchorage	Blood	Bacteremia	NT	Chronic lung disease, diabetes	Yes
M	61.6	Non-Native	Other	Blood	Bacteremia	NT	Chronic lung disease, immune suppressive therapy, diabetes	No
M	67.7	Non-Native	Anchorage	Blood	Pneumonia	f	Chronic lung disease, diabetes	Yes
M	73.6	AK Native	Other	Blood	Bacteremia	NT	None	No
M	76.1	AK Native	Other	Blood	Bacteremia	NT	Chronic lung disease, immune suppressive therapy	Yes
M	80.7	Non-Native	Anchorage	Blood	Pneumonia	NT	Smoking, chronic lung disease, alcohol abuse	Yes
M	90.7	Non-Native	Anchorage	Blood	Pneumonia	NT	Chronic lung disease	Yes
F	94.4	Non-Native	Anchorage	Blood	Bacteremia	NT	None	Yes
M	95	Non-Native	Anchorage	Blood	Pneumonia	NT	Diabetes	No

*NT = non-typeable

Invasive *Neisseria meningitidis*

Overall Incidence

Three cases of invasive *Neisseria meningitidis* were reported to AIP in 2014 for an overall rate of 0.4/100,000. The Alaska rate is slightly higher than the ABCs 2014 national projected rate of 0.14/100,000 [12]. There were no invasive *N. meningitidis*-related deaths in Alaska in 2014.

Race

Table 15: Invasive *Neisseria meningitidis* Cases by Race – Alaska, 2014

Race	Cases n (%)	Age Adjusted Rate*	% Male	Deaths n (%)
Alaska Native	2 (67%)	1.3	100%	0 (0%)
Non-Native	1 (33%)	0.3	0%	0 (0%)
Total	3		67%	0 (0%)

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

In 2014, 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 2014 was 4.3.

Table 16: Summary of Invasive *Neisseria meningitidis* Case Characteristics, Alaska, 2014

Sex	Age (Yrs)	Race	Residence	Site of Isolation	Clinical Presentation(s)	Serogroup	Associated Risk Factors	Survived
M	7.1	AK Native	Other	Blood	Meningitis	C	None	Yes
M	25.4	AK Native	Other	Blood	Bacteremia	C	Smoking, alcohol abuse	Yes
F	73.1	Non-Native	Anchorage	Blood	Meningitis, cellulitis	C	Smoking, chronic lung disease, diabetes	Yes

Invasive group A *Streptococcus*

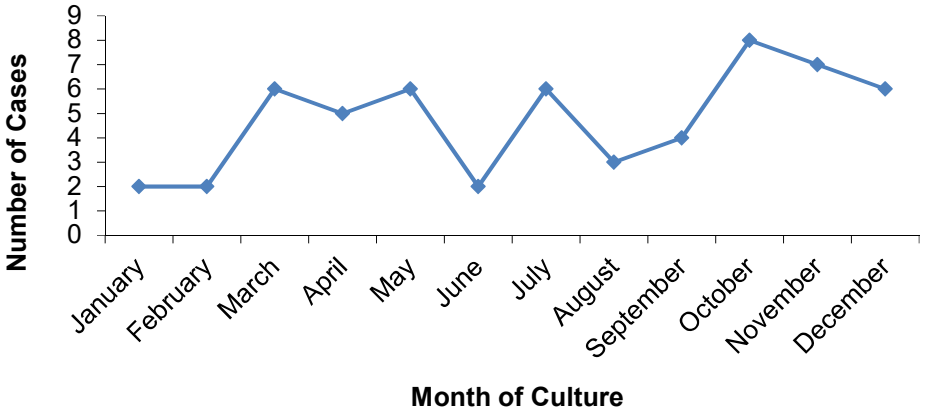
Overall Incidence

A total of 57 cases of invasive group A *Streptococcus* (GAS) were reported to AIP in 2014. The overall rate of invasive GAS disease in the state of Alaska was 7.7/100,000 persons per year. The Alaska rate is higher than the ABCs 2014 national projected rate of 4.4/100,000 [13]. In 2014, there were 4 GAS-related deaths for a case fatality ratio of 7%.

Seasonality

Cases of group A *Streptococcus* occurred throughout the year in 2014 with no apparent trends in seasonality. The largest number of cases (n=8) occurred in October.

Figure 15: Invasive group A *Streptococcus*, by Month of Culture - Alaska, 2014



Race

In 2014, 47% of invasive GAS cases in Alaska occurred in the Alaska Native population. The age-adjusted rate ratio of invasive GAS disease for the Alaska Native population compared with the non-Native population in 2014 was 4.3.

Table 17: Invasive group A *Streptococcus* Cases by Race – Alaska, 2014

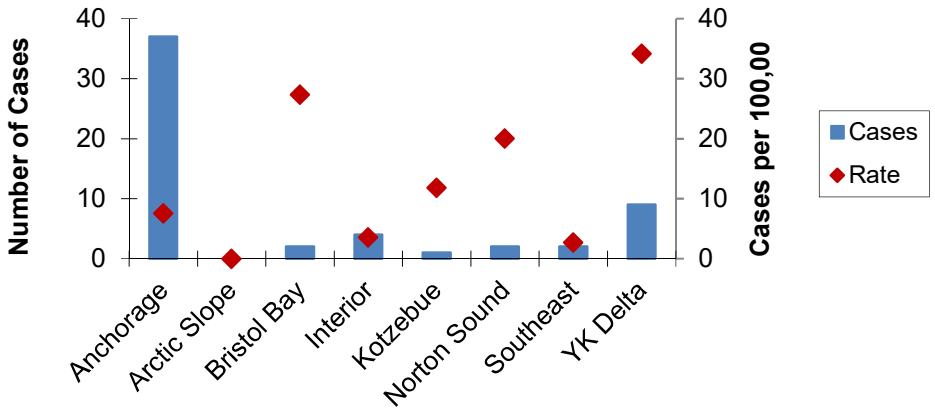
Race	Cases n (%)	Age Adjusted Rate*	% Male	Deaths n (%)
Alaska Native	27 (47%)	21.9	67%	1 (4%)
Non-Native	30† (53%)	5.1	63%	3 (10%)
Total	57		65%	4 (7%)

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

Region

Thirty-seven (65%) of the 57 invasive group A *Streptococcus* cases in 2014 were reported in the Anchorage area, 9 cases in the YK Delta, 4 cases in the Interior, 2 cases each in Bristol Bay, Norton Sound and Southeast, and 1 case in Kotzebue. The highest rates of disease occurred in the YK Delta (34.2/100,000) and Bristol Bay (27.4/100,000).

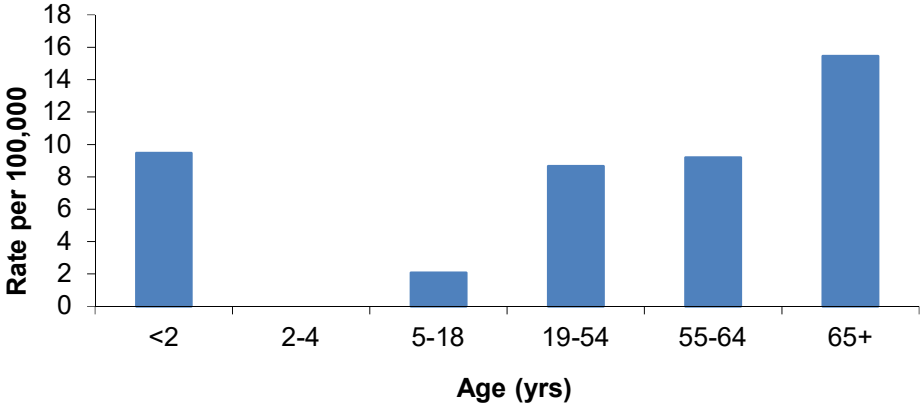
Figure 16: Invasive GAS Disease, Cases & Rates by Region - Alaska, 2014



Age

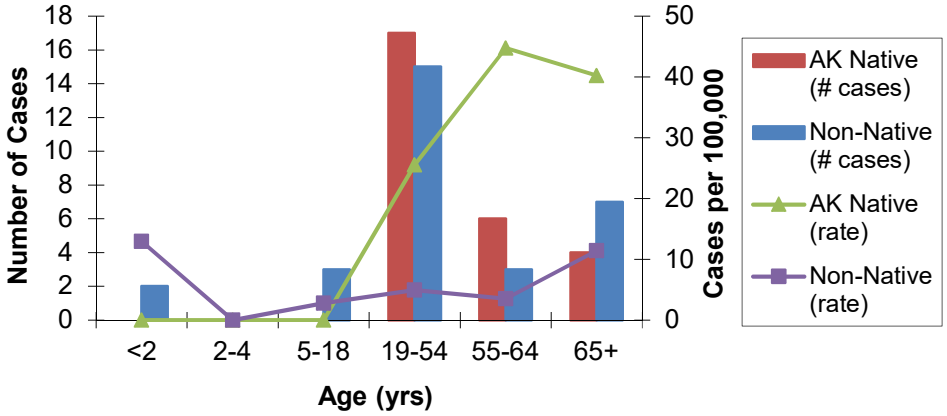
Invasive group A *Streptococcus* cases reported in 2014 ranged in age from 3 months to 93.5 years old; the median age was 44.6 years. Highest rates of disease occurred in adults 65 years and older (15.4/100,000).

Figure 17: Invasive group A *Streptococcus* by Age Group - Alaska, 2014



When stratified by race, the highest rates of invasive group A streptococcal disease occurred in Alaska Native adults 55-64 years old (44.74/100,000 persons per year). The highest GAS disease rate in the non-Native population occurred in children less than two years old (13/100,000 persons per year).

Figure 18: Invasive group A *Streptococcus*, Cases & Rates by Age Group & Race - Alaska, 2014



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 15 shows the primary clinical presentations of invasive group A *Streptococcus* in Alaska for 2014. Nine cases also presented with secondary diagnoses including pneumonia, septic abortion and cellulitis.

Group A *Streptococcus* was isolated from blood samples in 34 (60%) of 57 cases, 12 from surgical specimens, 8 from joint fluid, one from synovial fluid and two from other sterile sites.

Table 18: Primary Clinical Presentations of Invasive group A *Streptococcus* – Alaska, 2014

Primary Presentation	n (%)
Cellulitis*	26 (46%)
Septic arthritis	9 (16%)
Bacteremia	8 (14%)
Necrotizing fasciitis	4 (7%)
Pneumonia*	2 (3%)
Osteomyelitis	2 (3%)
Endometritis	2 (3%)
Epiglottitis	1 (2%)
Empyema	1 (2%)
Bursitis	1 (2%)
Other	1 (2%)
Total	57

*with bacteremia

Associated Risk Factors

The presence of one or more associated risk factors was reported in 86% of invasive GAS cases in 2014. Cigarette smoking was the most prevalent risk factor observed in adults followed by diabetes and alcohol abuse.

Table 19: Associated Risk Factors Identified in Invasive GAS Cases – Alaska, 2014*

Medical Condition/Risk Factor	Adult Cases (≥ 18 years) n=54, Cases (%)
Cigarette smoking	19 (35%)
Alcohol abuse	17 (31%)
Diabetes	9 (17%)
Injection drug use	9 (17%)
Chronic lung disease	6 (11%)
Immunosuppressive treatment	4 (7%)
Asplenia	0 (0%)

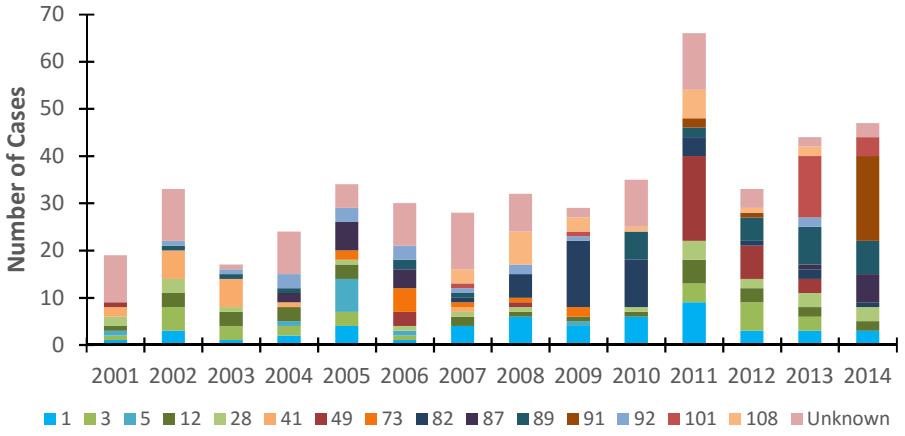
*More than one risk factor was identified in several cases

Molecular Typing

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

In 2014, 54 invasive GAS isolates were *emm* typed at AIP. The most common *emm* types were *emm* 91 (33%) and *emm* 89 (13%). The following graph shows *emm* typing trends over time. Strains that totaled ≤ 10 over the time period were not included.

Figure 19: Invasive group A *Streptococcus emm* Typing Trends - Alaska, 2001-2014



Antibiotic Resistance

Fifty-three GAS isolates received at AIP were tested for susceptibility to penicillin, ceftriaxone, erythromycin, vancomycin, levofloxacin and clindamycin. All isolates tested were susceptible to penicillin, ceftriaxone, vancomycin and levofloxacin. Two isolates were resistant to both erythromycin and clindamycin; one isolate was *emm* type 91 and one was *emm* type 11. A third isolate was resistant to erythromycin only; the isolate was *emm* type 91.

Table 20: Summary of Invasive group A *Streptococcus* Case Characteristics, Alaska, 2014

Sex	Age (yrs)	Race	Residence	Site of Isolation	Clinical Presentation(s)	*emm* Type	Associated Risk Factors	Survived
M	0.3	Non-Native	Anchorage	Blood	Bacteremia	1	None	No
M	0.4	Non-Native	Anchorage	Blood	Bacteremia	28	Immune suppressive therapy	Yes
M	6.6	Non-Native	Anchorage	Blood	Osteomyelitis	11	None	Yes
F	18.9	Non-Native	Anchorage	Other	Cellulitis	4	None	Yes
M	19	Unknown	Anchorage	Blood	Bacteremia	87	Alcohol abuse	Yes
F	21.4	Non-Native	Other	Blood	Endometritis, septic abortion	89	None	Yes
M	23.4	AK Native	Anchorage	Surgical specimen	Cellulitis	28	None	Yes
F	23.6	AK Native	Other	Blood	Cellulitis	12	Injection drug use	Yes
M	24.4	Non-Native	Anchorage	Surgical specimen	Cellulitis	89	Smoking, injection drug use	Yes
M	26.1	Non-Native	Anchorage	Blood	Cellulitis	53	Diabetes	Yes
M	26.6	Non-Native	Anchorage	Blood	Cellulitis	101	Chronic lung disease, immune suppressive therapy, diabetes	Yes
M	27.6	Non-Native	Anchorage	Surgical specimen	Septic arthritis, cellulitis	4	Smoking, injection drug use	Yes
F	28.5	AK Native	Other	Joint fluid	Septic arthritis, cellulitis	91	None	Yes
M	28.5	AK Native	Other	Blood	Cellulitis	87	Injection drug use	Yes
M	29.1	AK Native	Anchorage	Joint fluid	Septic arthritis, cellulitis	91	Alcohol abuse	Yes
M	29.5	AK Native	Other	Surgical specimen	Septic arthritis	91	Smoking, alcohol abuse	Yes
F	30.5	AK Native	Other	Surgical specimen	Cellulitis	238	Smoking	Yes
M	31.5	Non-Native	Anchorage	Blood	Cellulitis	89	Smoking, alcohol abuse	Yes
F	32	Non-Native	Anchorage	Blood	Bacteremia	91	Injection drug use	Yes
F	32.9	Non-Native	Anchorage	Blood	Pneumonia	91	Smoking, injection drug use	Yes
M	36.9	AK Native	Other	Surgical specimen	Septic arthritis, cellulitis	87	Smoking	Yes
F	38.3	Non-Native	Anchorage	Blood	Endometritis	4	None	Yes
M	38.7	AK Native	Other	Surgical specimen	Necrotizing fasciitis	89	Alcohol abuse	Yes
M	39.4	AK Native	Anchorage	Blood	Necrotizing fasciitis	91	Smoking, alcohol abuse	Yes
F	41.1	Non-Native	Anchorage	Blood	Cellulitis	11	Smoking, injection drug use	Yes
M	43.2	Non-Native	Other	Joint fluid	Bursitis	ND	None	Yes
F	43.6	AK Native	Other	Blood	Cellulitis	87	Smoking, chronic lung disease, alcohol abuse, diabetes	Yes
F	44.2	Non-Native	Other	Blood	Cellulitis	77	Injection drug use	Yes
M	44.6	Non-Native	Anchorage	Blood	Cellulitis	91	Alcohol abuse, injection drug use	Yes
M	45.3	AK Native	Anchorage	Blood	Septic arthritis	101	Immune suppressive therapy	Yes
M	45.3	AK Native	Other	Surgical specimen	Cellulitis	91	None	Yes
M	46.4	Non-Native	Anchorage	Joint fluid	Septic arthritis	91	Smoking	Yes
M	50.5	AK Native	Anchorage	Blood	Bacteremia	89	Alcohol abuse	No
F	53.4	AK Native	Other	Surgical specimen	Necrotizing fasciitis	28	Smoking, chronic lung disease, alcohol abuse	Yes
M	53.7	AK Native	Anchorage	Blood	Cellulitis	91	Smoking, immune suppressive therapy	Yes
M	54	Non-Native	Anchorage	Blood	Pneumonia	1	None	Yes
M	54.9	AK Native	Other	Joint fluid	Bacteremia	101	Smoking, alcohol abuse	Yes
F	56.5	AK Native	Other	Other	Cellulitis	91	Diabetes	Yes
M	56.8	Non-Native	Anchorage	Surgical specimen	Cellulitis	91	Smoking, chronic lung disease, alcohol abuse	Yes
F	57.2	Non-Native	Anchorage	Blood	Bacteremia	82	None	Yes

Sex	Age (yrs)	Race	Residence	Site of Isolation	Clinical Presentation(s)	*emm* Type	Associated Risk Factors	Survived
M	57.8	AK Native	Other	Synovial fluid	Septic arthritis, cellulitis	87	Smoking, chronic lung disease, alcohol abuse	Yes
M	57.9	AK Native	Anchorage	Blood	Cellulitis	91	Alcohol abuse, diabetes	Yes
M	57.9	AK Native	Other	Joint fluid	Empyema, pneumonia, cellulitis	101	None	Yes
M	59.2	AK Native	Anchorage	Blood	Cellulitis	91	Smoking, alcohol abuse	Yes
M	62/2	AK Native	Other	Blood	Septic arthritis, cellulitis	91	Smoking, alcohol abuse, immune suppressive therapy	Yes
F	64.8	Non-Native	Anchorage	Joint fluid	Necrotizing fasciitis	ND	Smoking	Yes
F	71.6	Non-Native	Anchorage	Blood	Cellulitis	89	Diabetes	Yes
F	77.1	Non-Native	Other	Blood	Cellulitis	11	None	Yes
M	79.4	Non-Native	Anchorage	Blood	Cellulitis	1	Alcohol abuse	Yes
M	79.8	Non-Native	Anchorage	Blood	Celluliits	4	Diabetes	Yes
M	79.9	AK Native	Anchorage	Surgical specimen	Other	91	Diabetes	Yes
F	80.1	AK Native	Anchorage	Joint fluid	Osteomyelitis	89	None	Yes
M	80.2	Non-Native	Anchorage	Blood	Epiglottitis	12	Chronic lung disease	No
F	81.4	AK Native	Other	Surgical specimen	Cellulitis	ND	None	Yes
M	81.5	Non-Native	Anchorage	Blood	Cellulitis	91	Diabetes	Yes
F	91.1	AK Native	Anchorage	Blood	Bacteremia	91	None	Yes
M	93.5	Non-Native	Anchorage	Blood	Cellulitis	87	None	No

ND = typing not done

Invasive group B *Streptococcus*

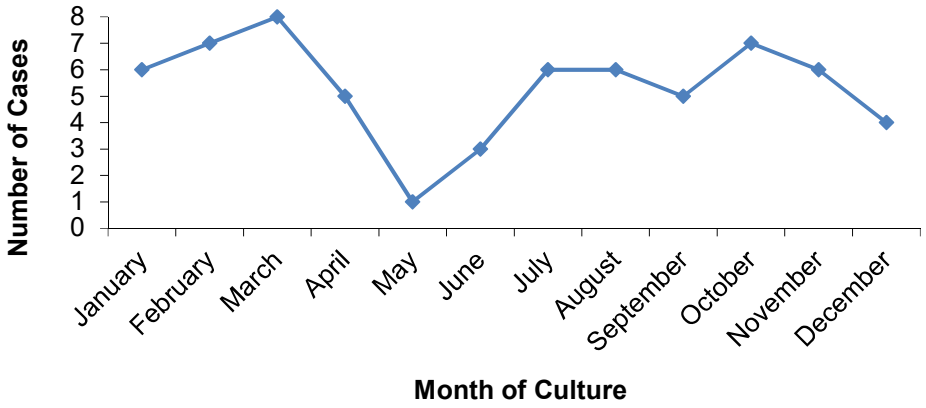
Overall Incidence

A total of 64 cases of invasive group B *Streptococcus* (GBS) were reported to AIP in 2014. The overall rate of invasive GBS disease in the state of Alaska was 8.7/100,000 persons per year. The Alaska rate is similar to the ABCs 2014 national projected rate of 8.3/100,000 [14]. In 2014, there were four GBS-related deaths for a case fatality ratio of 6.3%.

Seasonality

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

Figure 20: Invasive group B *Streptococcus*, by Month of Culture - Alaska, 2014



Race

In 2014, 23% of invasive group B *Streptococcus* cases in Alaska occurred in the Alaska Native population; the age-adjusted rate was 11.6/100,000 persons per year which is higher than the non-Native rate of 7.3/100,000 persons per year.

Table 21: Invasive group B *Streptococcus* Cases by Race – Alaska, 2014

Race	Cases n (%)	Age Adjusted Rate*	% Male	Deaths n (%)
Alaska Native	15 (23)	11.6	53	0 (0)
Non-Native	49 (77)‡	7.3	49	4 (8.2)
Total	64		50	4 (6.3)

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

Region

In 2014, 45 (70%) of the 64 reported GBS cases occurred in Anchorage; 10 cases were reported in Southeast Alaska, six cases in the Interior, and three cases in the YK Delta. The highest rates of disease occurred in Southeast Alaska (13.4/100,000) and the YK Delta (11.4/100,000).

Age

Invasive group B *Streptococcus* cases reported in 2014 ranged in age from newborn to 102.6 years old; the median age was 57.5 years. Highest rates of disease overall occurred in adults 65 years and older (30.9/100,000 persons per year).

Figure 21: Invasive group B *Streptococcus* by Age Group - Alaska, 2014

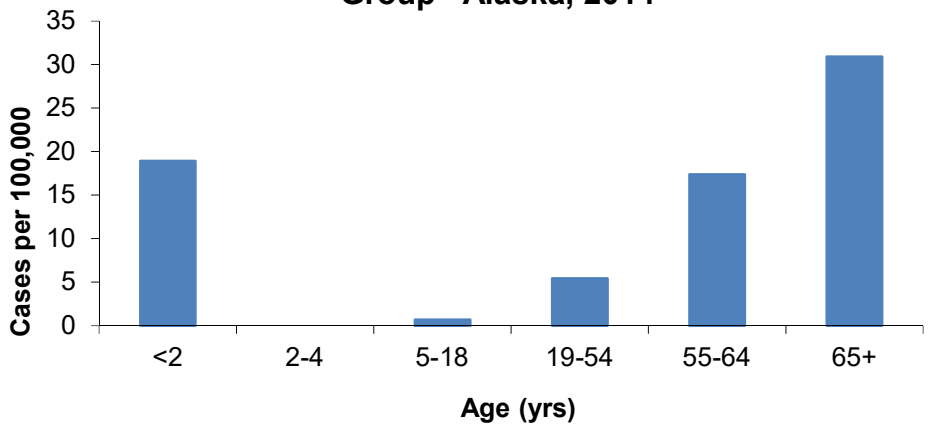
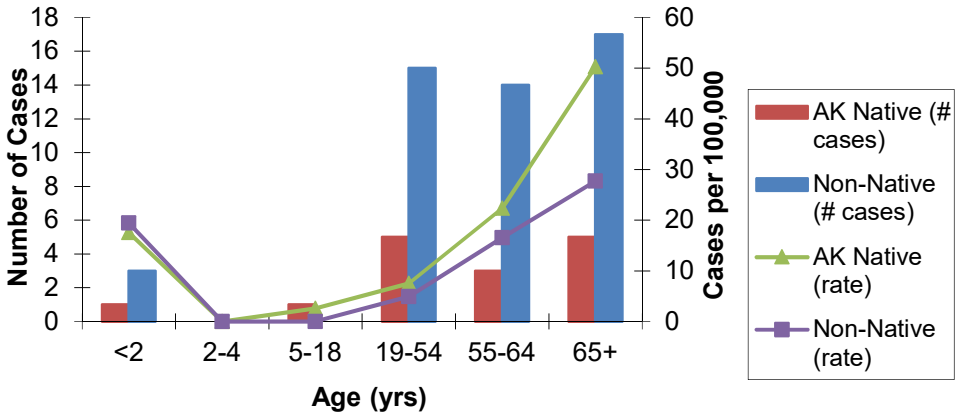


Figure 22: Invasive group B *Streptococcus*, Cases & Rates by Age Group & Race - Alaska, 2014



When stratified by race, the highest rates of disease occurred in AK Native adults 65 years and older (50.3/100,000 persons per year). There were two cases of early-onset disease (less than 7 days old) for a rate of 0.2 cases per 1,000 live births.

Clinical Presentation

The primary clinical presentation was determined by a review of the discharge diagnoses in each patient's individual medical record associated with the invasive bacterial illness. In cases with multiple discharge diagnoses, the most serious diagnosis related to the GBS infection was recorded as the primary clinical presentation. In 2014, the most common clinical presentation was bacteremia which occurred in 21 cases (33%).

Group B *Streptococcus* was isolated from blood in 50 (78%) of 64 cases in 2014; six cases were isolated from surgical specimens, three cases from bone, two cases from cerebrospinal fluid, one case from amniotic fluid, one from a wound and one case from another sterile site.

Table 22: Primary Clinical Presentations of Invasive group B *Streptococcus* – Alaska, 2014

Primary Presentation	n (%)
Bacteremia	21 (33)
Cellulitis*	17 (27)
Pneumonia*	9 (14)
Osteomyelitis	4 (6)
Septic arthritis	4 (6)
Amnionitis	3 (5)
Endocarditis	2 (3)
Meningitis	1 (1.5)
Necrotizing fasciitis	1 (1.5)
Peritonitis	1 (1.5)
Other	1 (1.5)
Total	64

*with bacteremia

Antibiotic Resistance

Susceptibility testing was performed on 57 GBS isolates received in 2014. Results of the testing are presented in the following table.

Table 23: Antibiotic Resistance in Invasive group B *Streptococcus* Isolates – Alaska, 2014

Antibiotic	Susceptible	Intermediate	Resistant	I + R	Total Tested
Penicillin	57 (100%)	0 (0%)	0 (0%)	0 (0%)	57
Ceftriaxone	57 (100%)	0 (0%)	0 (0%)	0 (0%)	57
Erythromycin	26 (45%)	1 (2%)	30 (53%)	31 (55%)	57
Tetracycline	11 (19%)	0 (0%)	46 (81%)	46 (81%)	57
Levofloxacin	57 (100%)	0 (0%)	0 (0%)	0 (0%)	57
Clindamycin	40 (70%)	1 (2%)	16 (28%)	17 (30%)	57
Vancomycin	57 (100%)	0 (0%)	0 (0%)	0 (0%)	57

All isolates tested were susceptible to penicillin, ceftriaxone, levofloxacin and vancomycin. Resistance to tetracycline, erythromycin, and clindamycin was seen in 81%, 55%, and 30%, respectively, of isolates tested. Of the two early onset cases, all isolates were available for susceptibility testing; both were resistant to tetracycline.

Table 24: Summary of Invasive group B *Streptococcus* Case Characteristics, Alaska, 2014

Sex	Age (yrs)	Race	Residence	Site of Isolation	Clinical Presentation(s)	Associated Risk Factors	Survived
M	Newborn	Non-Native	Anchorage	Blood	Amnionitis	None	Yes
F	Newborn	Non-Native	Other	Blood	Bacteremia	None	Yes
M	18 days	Non-Native	Anchorage	Blood	Bacteremia	None	Yes
F	1 month	AK Native	Anchorage	CSF	Bacteremia	Diabetes	Yes
F	17.6	AK Native	Other	Amniotic fluid	Septic abortion	None	Yes
F	21.7	Non-Native	Other	CSF	Bacteremia	None	Yes
F	30.2	Non-Native	Anchorage	Blood	Bacteremia	None	Yes
M	33.2	Unknown	Other	Blood	Bacteremia	Alcohol abuse	Yes
F	33.7	Non-Native	Anchorage	Other	Amnionitis	None	Yes
F	34.2	Non-Native	Other	Surgical specimen	Cellulitis	Diabetes	Yes
M	34.7	AK Native	Anchorage	Bone	Osteomyelitis	Smoking	Yes
F	34.9	AK Native	Other	Blood	Bacteremia	Diabetes	Yes
M	35.5	Non-Native	Anchorage	Blood	Endocarditis, empyema	Smoking, injection drug use	Yes
M	38.9	AK Native	Anchorage	Bone	Osteomyelitis	None	Yes
F	39.3	Non-Native	Anchorage	Blood	Osteomyelitis	Diabetes	Yes
F	39.9	Non-Native	Anchorage	Blood	Septic arthritis	None	Yes
M	43	Non-Native	Anchorage	Blood	Cellulitis	Diabetes	Yes
F	43.8	Non-Native	Anchorage	Blood	Bacteremia	None	Yes
M	45.1	Non-Native	Anchorage	Blood	Bacteremia	Smoking, alcohol abuse	No
M	47.9	AK Native	Anchorage	Blood	Cellulitis	Alcohol abuse	Yes
F	47.9	Non-Native	Other	Blood	Cellulitis	None	Yes
F	48.3	Non-Native	Anchorage	Blood	Pneumonia	Diabetes	Yes
F	51.1	Non-Native	Anchorage	Blood	Pneumonia	Chronic lung disease	No
F	52.1	Non-Native	Other	Blood	Bacteremia	None	Yes
M	52.6	AK Native	Other	Blood	Cellulitis	Diabetes	Yes
M	55.2	Non-Native	Anchorage	Blood	Bacteremia	Diabetes	Yes
M	55.2	Non-Native	Anchorage	Blood	Bacteremia	None	Yes
F	55.8	Non-Native	Anchorage	Surgical specimen	Other	None	Yes
M	56.7	Non-Native	Anchorage	Blood	Cellulitis, osteomyelitis	Chronic lung disease, alcohol abuse, diabetes	Yes
M	57.1	Non-Native	Anchorage	Blood	Cellulitis, osteomyelitis	Diabetes	Yes
M	57.1	AK Native	Anchorage	Surgical specimen	Cellulitis	Diabetes	Yes
F	57.1	Non-Native	Anchorage	Blood	Cellulitis	None	Yes
M	57.9	Non-Native	Anchorage	Blood	Pneumonia	None	Yes
F	58.1	Non-Native	Other	Wound	Necrotizing fasciitis	Smoking, diabetes	Yes
M	58.4	AK Native	Anchorage	Surgical specimen	Cellulitis, osteomyelitis	Smoking, diabetes	Yes
M	59	Non-Native	Anchorage	Blood	Pneumonia	None	Yes
M	59.3	Non-Native	Anchorage	Blood	Pneumonia	Smoking, chronic lung disease, diabetes	Yes
M	59.3	Non-Native	Other	Blood	Bacteremia	Chronic lung disease, diabetes	Yes
M	59.4	AK Native	Other	Blood	Septic arthritis, osteomyelitis	Smoking, alcohol abuse, injection drug use	Yes
M	62	Non-Native	Anchorage	Blood	Bacteremia	Diabetes	Yes
F	63.1	Non-Native	Anchorage	Blood	Bacteremia	None	Yes
F	63.2	Non-Native	Anchorage	Blood	Peritonitis	None	Yes
M	67.9	AK Native	Anchorage	Bone	Osteomyelitis	Alcohol abuse, diabetes	Yes
M	68	Non-Native	Anchorage	Blood	Pneumonia	None	Yes
M	70.6	Non-Native	Anchorage	Blood	Bacteremia	Immune suppressive therapy	Yes
M	71.2	Non-Native	Anchorage	Blood	Cellulitis	Chronic lung disease, diabetes	Yes
F	71.6	Non-Native	Anchorage	Surgical specimen	Septic arthritis	Diabetes	Yes

Sex	Age (yrs)	Race	Residence	Site of Isolation	Clinical Presentation(s)	Associated Risk Factors	Survived
F	71.7	AK Native	Other	Surgical specimen	Septic arthritis	None	Yes
F	71.8	AK Native	Anchorage	Blood	Cellulitis	None	Yes
F	72	Non-Native	Other	Blood	Pneumonia	Chronic lung disease	Yes
F	73.4	Non-Native	Anchorage	Blood	Bacteremia	None	Yes
F	74.1	Non-Native	Other	Blood	Cellulitis	Smoking	Yes
M	74.1	Non-Native	Anchorage	Blood	Bacteremia	None	Yes
M	74.1	Non-Native	Anchorage	Blood	Bacteremia	Immune suppressive therapy, diabetes	No
M	78.1	Non-Native	Other	Blood	Cellulitis	Chronic lung disease, diabetes	Yes
F	78.2	AK Native	Anchorage	Blood	Pneumonia, cellulitis	Chronic lung disease	Yes
F	81.2	AK Native	Other	Blood	Bacteremia	Diabetes	Yes
F	82.2	Non-Native	Anchorage	Blood	Cellulitis	None	Yes
F	82.6	Non-Native	Anchorage	Blood	Cellulitis	Chronic lung disease, diabetes	Yes
F	82.8	Non-Native	Other	Blood	Endocarditis	Diabetes	Yes
F	85.9	Non-Native	Anchorage	Blood	Bacteremia	Diabetes	Yes
M	87.6	Non-Native	Anchorage	Blood	Cellulitis	Chronic lung disease, diabetes	Yes
M	89.6	Non-Native	Anchorage	Blood	Pneumonia	Chronic lung disease, diabetes	Yes
M	102.6	Non-Native	Other	Blood	Meningitis	Chronic lung disease	No

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Appendix

MIC Interpretive Standards Definitions:

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

1. Susceptible (S):

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

2. Intermediate (I):

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

3. Resistant (R):

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