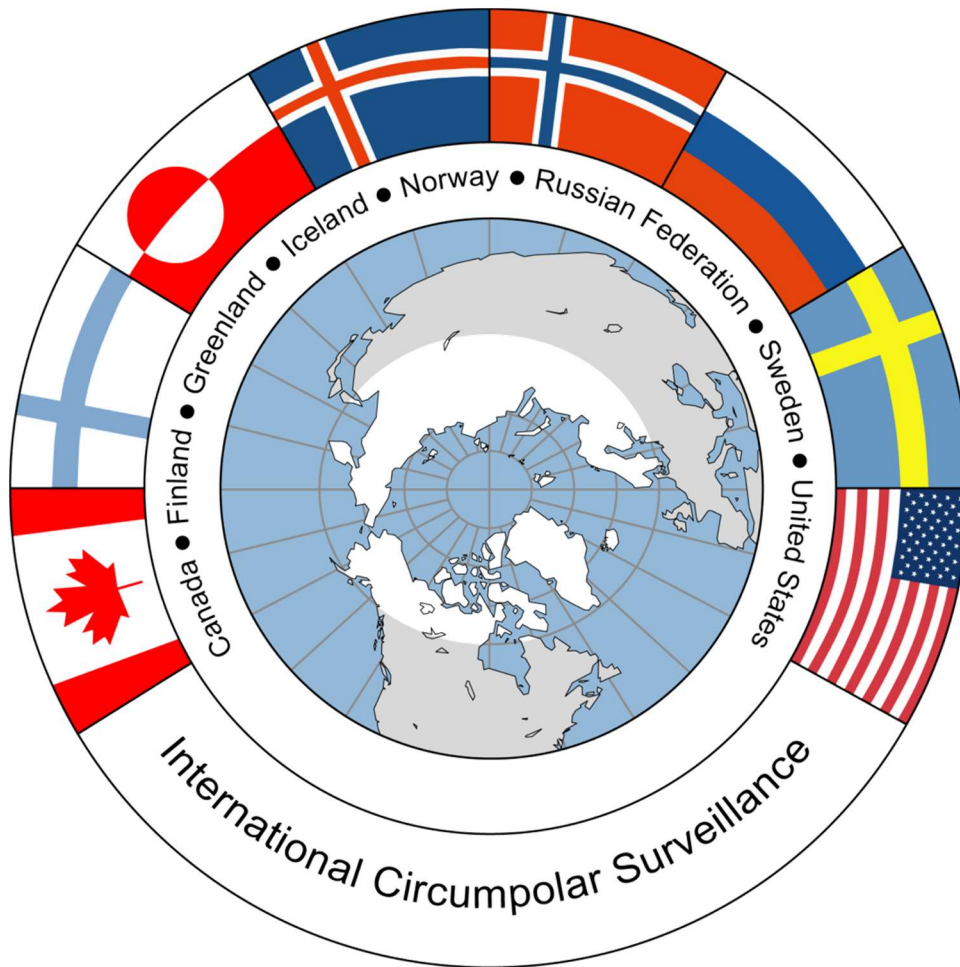


# INTERNATIONAL CIRCUMPOLAR SURVEILLANCE (ICS) SUMMARY REPORT



**YEAR 2007 DATA**



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## SUMMARY

International Circumpolar Surveillance (ICS) is a population-based surveillance system for invasive bacterial diseases established in the U.S. Arctic, Northern Canada, Greenland, Iceland, Norway, Finland, and Northern Sweden. Data collection began in 1999 and includes information on disease caused by *Streptococcus pneumoniae*, *Haemophilus influenzae*, *Neisseria meningitidis*, and groups A and B *Streptococcus* (GAS, GBS). This report reviews the data collected for the year 2007.

Data on invasive disease with the organism *S. pneumoniae* are collected from all participating countries. A total of 2,033 cases of invasive pneumococcal disease were identified in 2007. Overall, rates of invasive *S. pneumoniae* were highest in individuals less than 2 years of age except in Greenland and N. Sweden where rates were highest in persons 2-19 years and 65 years and older, respectively. Case fatality ratios ranged from 5-20%. Race and ethnicity data are collected only in N. Canada and the U.S. Arctic; rates of invasive pneumococcal disease in Northern Canadian Aboriginal and U.S. Arctic Native populations were 39 and 58 cases per 100,000 population, respectively, which represents an increase in disease from 2006 in both populations. Pneumonia, meningitis and bacteremia were the most common clinical presentations; cigarette smoking and alcohol abuse were the most common risk factors. The most common *S. pneumoniae* serotype in Iceland is 4; in Greenland the most common serotype is 18C, in the U.S. Arctic the most common serotype is 19A, in N. Sweden the most common serotype is 7 and in N. Canada the most common serotypes are 8 and 12F.

Data on invasive disease due to *H. influenzae*, *N. meningitidis*, and groups A and B *Streptococcus* are currently collected in Greenland, Northern Canada, Northern Sweden and the U.S. Arctic; Norway also contributes data on cases of *N. meningitidis* and *H. influenzae*. A total of 106 *H. influenzae* cases, 34 *N. meningitidis* cases, 57 GAS cases, and 54 GBS cases were reported in 2007. In general, the highest rates of disease as a result of all organisms occurred in N. Canada Aboriginal or Alaska Native persons less than two years of age or 65 years and older.

### Surveillance Organisms Reported by Country, ICS 2007 Data

Country	<i>S. pneumoniae</i> n (rate*)	<i>H. influenzae</i> n (rate*)	<i>N. meningitidis</i> n (rate*)	GAS n (rate*)	GBS n (rate*)
Finland	768 (14.5)	N/A	N/A	N/A	N/A
Greenland	5 (8.8)	0 (0)	1 (1.8)	0 (0)	0 (0)
Iceland	43 (14)	N/A	N/A	N/A	N/A
N. Canada	45 (31.2)	11 (7.6)	0 (0)	14 (9.7)	1 (0.7)
N. Sweden	71 (14)†	2 (0.8)‡	0 (0)‡	11 (4.4)‡	15 (6)‡
Norway	951 (20.3)	78 (1.7)	28 (0.6)	N/A	N/A
U.S. Arctic	150 (22.2)	15 (2.2)	5 (0.7)	32 (4.7)	38 (5.6)
<b>Total</b>	<b>2,033 (18.2)</b>	<b>106 (1.8)</b>	<b>34 (0.6)</b>	<b>57 (5.1)</b>	<b>54 (4.8)</b>

\*Cases per 100,000

†Norbotten & Vasterbotten

‡Norbotten

## INTRODUCTION

In January, 1999, the United States and Canada began international cooperative population-based surveillance for invasive *S. pneumoniae* by all laboratories serving residents of the North American Arctic. In January, 2000, this surveillance system expanded to include invasive diseases with the following organisms: *H. influenzae* (all types), *N. meningitidis*, GAS, and GBS. These pathogens were selected for ICS because rates of these diseases are elevated in indigenous peoples of the north, strains demonstrate resistance to commonly used antibiotics, they are routinely cultured in clinical laboratories, and clinically important serotypes of *S. pneumoniae*, *H. influenzae*, and *N. meningitidis* are vaccine preventable in infants and adults.

Denmark's autonomous region of Greenland joined ICS in 2000; Iceland, Norway (including Svalbard), and Finland joined in 2001; the Northern Sweden regions of Norbotten and Vasterbotten joined in 2003 and 2006, respectively.

## GOALS

The goal of ICS is to establish an integrated network of hospital and public health facilities throughout the Arctic countries to monitor infectious diseases of concern. Linking public health facilities within Arctic nations will allow for the collection and sharing of uniform laboratory and epidemiological data that will describe the prevalence of infectious diseases in Arctic populations and assist in the formulation of prevention and control strategies.

The project, initiated in 1998, focused on establishing an ICS system for diseases caused by *S. pneumoniae*. This bacterium causes pneumonia, meningitis, and bacteremia in both the very young and the elderly. Once easily treated with antibiotics, this bacterium has become resistant to commonly used antibiotics. This is of great concern to the public health community and is increasingly a target for surveillance by many countries worldwide. A polysaccharide vaccine is available for use in persons two years of age and older. A conjugate vaccine for infants has been developed and is licensed for use in the U.S., Canada, and the European Union. The fact that diseases caused by *S. pneumoniae* were already being monitored by many public health authorities within the Arctic states made establishing a circumpolar surveillance system for this infection feasible. In addition, due to the availability of polysaccharide and conjugate vaccines, much of the morbidity and mortality caused by *S. pneumoniae* is currently preventable.

ICS objectives include:

- Identify key public health contacts within Arctic countries. These persons should be familiar with infectious disease surveillance systems in place (particularly surveillance systems for diseases caused by *S. pneumoniae*) in the member country. Through correspondence and working group meetings, the scope and gaps of the surveillance systems are determined.
- Determine the comparability of laboratory and data collection methods, and negotiate standard protocols and quality control programs.
- Share and report data in agreed upon formats.
- Form a working group of key laboratory and public health contacts to coordinate pneumococcal surveillance within their respective jurisdictions. This group meets on a regular basis to review problems, progress, compliance, report generation, and future plans.

- Form a steering committee of national Arctic health experts to coordinate new objectives and initiatives within ICS.

This program forms a framework through which surveillance of other infectious diseases as well as prevention and control programs can be added. Other infectious diseases of circumpolar community concern include: other invasive bacterial diseases (caused by *H. influenzae*, *N. meningitidis*, GAS, and GBS), tuberculosis, HIV, hepatitis, foodborne diseases (botulism, brucellosis), waterborne diseases, respiratory diseases of children such as those caused by respiratory syncytial virus, and chronic conditions related to infectious agents (hepatitis B virus and liver cancer, human papilloma virus and cervical cancer). In addition, the surveillance model developed by this program for infectious disease may be adapted to monitor other non-infectious human health priorities of community concern.

## METHODS

ICS is coordinated by personnel at the Arctic Investigations Program, Centers for Disease Control and Prevention, in Anchorage, Alaska.

A case of invasive *S. pneumoniae*, *H. influenzae*, *N. meningitidis*, GAS or GBS is defined by the isolation 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 the surveillance area.

In the U.S. Arctic and Northern Canada, laboratory, demographic and clinical data are collected continually by ICS, while in Greenland, Iceland, Northern Sweden, Norway, and Finland, summary data are submitted to ICS in aggregate at the end of the year.

### Surveillance System Description by Country/Region

The following table outlines the organisms reported and data provided by each country or region.

#### **Data Provided by Country/Region, ICS 2007**

<b>Country</b>	<b><i>S. pneumoniae</i></b>	<b><i>H. influenzae</i></b>	<b><i>N. meningitidis</i></b>	<b>GAS</b>	<b>GBS</b>	<b>Serotype</b>	<b>Demographics</b>	<b>Race/Ethnicity</b>	<b>Risk Factors</b>	<b>Outcome</b>
<b>Finland</b>	X						X			
<b>Greenland</b>	X	X	X	X	X	X	X			X
<b>Iceland</b>	X					X	X			X
<b>N. Canada</b>	X	X	X	X	X	X	X	X	X	X
<b>N. Sweden</b>	X	X	X	X	X		X			
<b>Norway</b>	X	X	X				X			X
<b>U.S. Arctic</b>	X	X	X	X	X	X	X	X	X	X

## Finland

- 23 district hospital laboratories participate in ICS.
  - Provide diagnostic microbiology services for all residents of Finland.
  - All invasive isolates of *S. pneumoniae* submitted to the National Public Health Institute (KTL) laboratory in Oulu.
- Antimicrobial susceptibility testing of *S. pneumoniae* isolates was performed by agar dilution method at district hospital laboratories as well as the KTL laboratory.
- Population estimates for 2007 were obtained from the website <http://www.stat.fi>

## Greenland

- 15 district hospital laboratories participate in ICS.
  - Provide diagnostic microbiology services for all residents of Greenland.
  - All invasive isolates of *S. pneumoniae*, *H. influenzae*, *N. meningitidis*, GAS, and GBS submitted to reference laboratories in Nuuk and Copenhagen.
- Antimicrobial susceptibility testing of *S. pneumoniae* isolates was performed by agar dilution at the central laboratory at Queen Ingrid's Hospital in Nuuk.
- Serotyping was performed at the Statens Serum Institute in Copenhagen, Denmark, by the Quellung method.
- Clinical and demographic data for every case of invasive *S. pneumoniae*, *H. influenzae*, *N. meningitidis*, GAS, and GBS was collected by public health authorities at the end of the year and entered onto a standardized collection tool, the Bacterial Diseases Surveillance Form (BDSF), which is also used in Iceland, Northern Canada, and the U.S. Arctic.
- Population estimates for 2007 were obtained from the website <http://www.stat.gl>

## Iceland

- 10 district hospital laboratories and one regional laboratory participate in ICS.
  - Provide diagnostic microbiology services for all residents of Iceland.
  - All invasive isolates of *S. pneumoniae* submitted to the reference hospital in Reykjavik.
- Antimicrobial susceptibility testing of *S. pneumoniae* isolates is performed by disc diffusion method at the Landspítali University Hospital (LUH) in Reykjavik and the laboratory at the regional hospital in Akureyri. All oxacillin resistant isolates are then analyzed by E test.
- Serotyping is performed at the LUH by coagglutination using antisera from Statens Serum Institute.
- Clinical and demographic data for every case of invasive *S. pneumoniae* was collected by public health authorities at the end of the year and entered onto the same collection form (BDSF) used in Greenland, Northern Canada, and the U.S. Arctic.
- Population estimates for 2007 were obtained from the website <http://www.statice.is>

## Northern Canada

- 14 Canadian laboratories participate in ICS.
  - Provide diagnostic microbiology services for all residents of the Yukon Territory, Northwest Territories, Nunavut, Northern Quebec, and Northern Labrador.
  - Submit all invasive isolates of *S. pneumoniae*, *H. influenzae*, *N. meningitidis*, GAS, and GBS to one of two reference laboratories in Canada.
  - *S. pneumoniae*, *H. influenzae*, GAS, and GBS isolates are serotyped by the Quellung method using Statens Serum Institute antisera.
- Antimicrobial susceptibility of *S. pneumoniae*, GAS, and GBS isolates was tested by micro-broth dilution (according to NCCLS recommendations).
- Communicable disease consultants located within one of the five regions of Northern Canada provided clinical and demographic information on the same collection form (BDSF) used in Greenland, Iceland, and the U.S. Arctic.
- Laboratory and clinical data are forwarded to the ICS coordinator at AIP in Anchorage.
- Population estimates for 2007 were obtained from the website <http://www.statcan.ca>

## Northern Sweden

- 1 district laboratory participates in ICS.
  - Provides diagnostic microbiology services for all residents of Norrbotten and Vasterbotten counties.
  - The main reference laboratory is at the Swedish Institute for Infectious Disease Control in Stockholm.
  - Isolates are serotyped by the Quellung method.
- Antimicrobial susceptibility testing was by disc diffusion at the University Hospital in Umea and Sunderby Hospital in Lulea.
- Population estimates for 2007 were obtained from the website [http://www.scb.se/default\\_2154.asp](http://www.scb.se/default_2154.asp)

## Norway

- 33 district hospital laboratories participate in ICS.
  - Provide diagnostic microbiology services for all residents of Norway.
  - All invasive isolates of *S. pneumoniae* submitted to one of two reference laboratories in Oslo or Tromso.
- Antimicrobial susceptibility testing of *S. pneumoniae* isolates is performed using the disc diffusion method at district hospital laboratories, the reference laboratory in Tromso or the main national laboratory in Oslo.
- Serotyping is performed at the Statens Serum Institute in Denmark by the Quellung method.
- Population estimates for 2007 were obtained from the website <http://www.ssb.no>



## U.S. Arctic

- 23 laboratories providing diagnostic services to residents of Alaska submitted to AIP isolates of *S. pneumoniae*, *H. influenzae*, *N. meningitidis*, GAS, and GBS cultured in blood, cerebrospinal fluid, or from other sterile sites.
  - *S. pneumoniae* and *H. influenzae* isolates are serotyped by the Quellung method using Statens Serum Institute antisera.
  - Serogroup testing of *N. meningitidis* was done using real-time PCR to detect the *ctaA* gene (capsule transport), as well as the genes required for serogroup-specific capsule biosynthesis.
- Antimicrobial susceptibility testing of *S. pneumoniae* isolates is performed at AIP by micro-broth dilution (according to NCCLS recommendations).
- Clinical and demographic information on each case-patient is recorded by AIP research nurses onto the same collection form (BDSF) used in Greenland, Iceland, and Northern Canada.
- Population estimates for 2007 were obtained from the website <http://www.labor.state.ak.us>

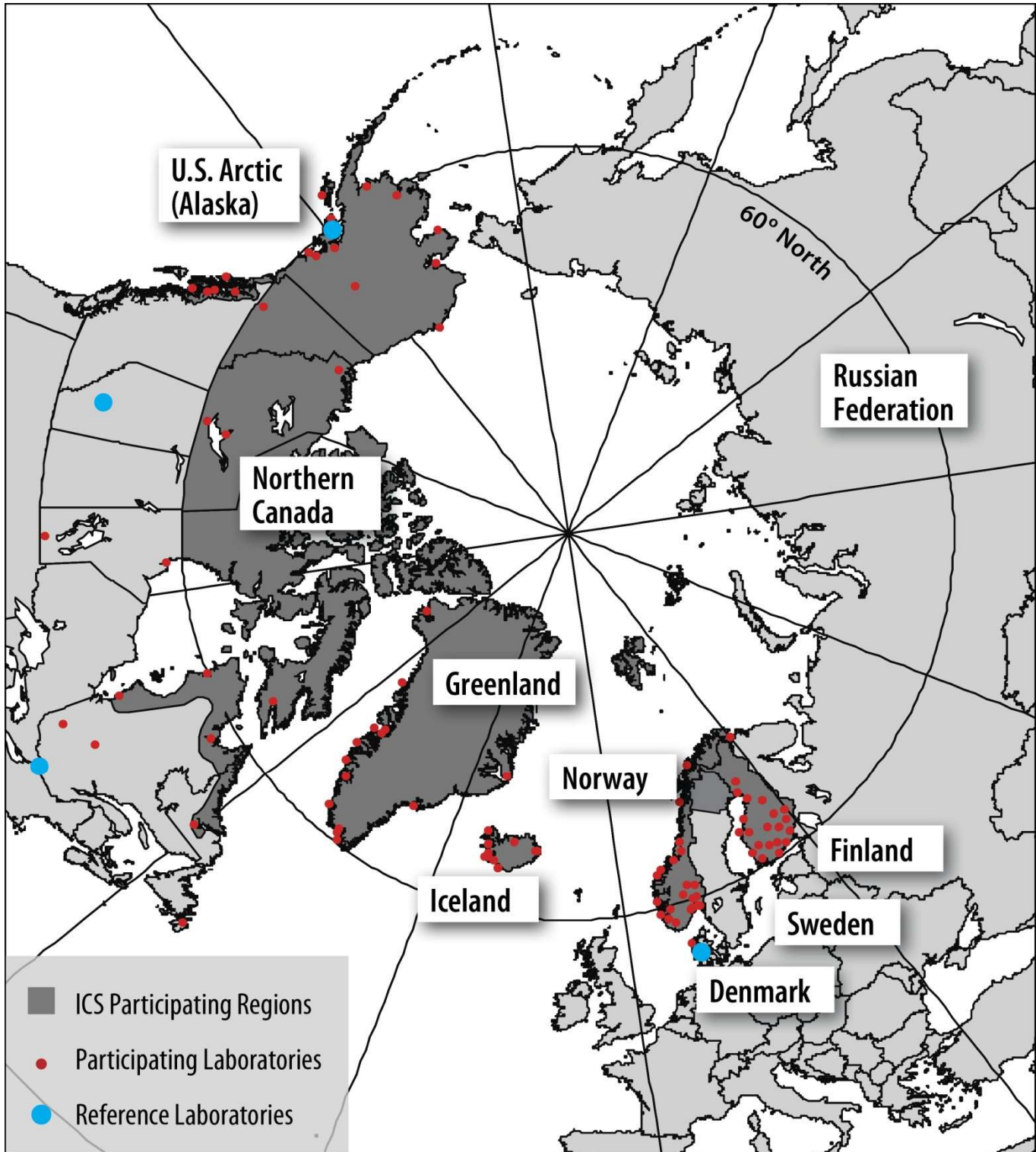
## Quality Control

*Streptococcus pneumoniae*: Currently 37 clinical laboratories in the U.S. Arctic and N. Canada forward isolates from patients with invasive pneumococcal disease to reference laboratories in Alaska and Canada respectively. To ensure inter-laboratory comparability of *S. pneumoniae* serotyping and antimicrobial susceptibility testing between two reference laboratories in Canada (Alberta and Quebec) and one in the U.S. (Alaska), the ICS *S. pneumoniae* inter-laboratory quality control (QC) program was established in 1999. Statens Serum Institute, Copenhagen, Denmark, joined the program in 2004.

Each reference laboratory is responsible for exporting one QC panel of seven *S. pneumoniae* isolates every other year to each of the other laboratories using a transportation medium of their choice for a total of 14 *Strep pneumoniae* isolates in 2007. Serotyping was performed by Quellung reaction. Minimum inhibitory concentration (MIC) is determined for each QC isolate and for ATCC strain 49619 for those antibiotics which are routinely tested in each laboratory. MIC results for each laboratory are expected to be within one log<sub>2</sub> dilution of each other regardless of testing method. Discrepancies of results are documented and examined to determine causes and solutions [1].

*Neisseria meningitidis*/*Haemophilus influenzae*: An interlaboratory quality control program for *Neisseria meningitidis* and *Haemophilus influenzae* was established in 2005. Participating laboratories include the National Microbiology Laboratory, Winnipeg, Manitoba, Canada; Arctic Investigations Program, Anchorage, Alaska, USA; Laboratoire Santé Publique du Québec, Sainte-Anne-de-Bellevue, Québec, Canada; National Centre for Streptococcus, Edmonton, Alberta, Canada; and Statens Serum Institut, Copenhagen, Denmark. Strain panels are distributed twice a year from the National Microbiology Laboratory or Arctic Investigations Program [2].

# Participating Countries, ICS 2007



## RESULTS

### *Streptococcus pneumoniae*

#### Case Demographics

A total of 2,033 cases of invasive disease caused by *S. pneumoniae* were reported to ICS during 2007 by Finland, Greenland, Iceland, N. Canada, N. Sweden, Norway, and the U.S. Arctic. The highest rates of disease (31 per 100,000) occurred in N. Canada and the lowest in Greenland (9 per 100,000) with an overall rate for the ICS circumpolar region of 18.2 per 100,000; 54% of all cases occurred in males. The median age of cases overall was 60.1 years with the lowest median age in Greenland (23.5 years) and the highest in Norway (63.8 years). Case fatality ratios ranged from 5% in N. Canada to 20% in Greenland; the overall case fatality ratio was 14.7%.

#### *Streptococcus pneumoniae* Case Demographics, ICS 2007 Data

Country	Population	# Cases	Rate*	Sex M (%)	Median Age (min-max) yrs	Deaths n (CFR†)
Finland	5,300,484	768	14.5	442 (58)	58 (0.1-103)	‡
Greenland	56,648	5	8.8	4 (80)	23.5 (3.1-62.8)	1 (20%)
Iceland	307,672	43	14	29 (67)	59.3 (0.2-88.8)	4 (9.3%)
N. Canada	144,421	45	31.2	28 (62)	39.8 (0.1-87.6)	2 (4.8%) <sup>b</sup>
N. Sweden	508,195 <sup>a</sup>	71	14	40 (56)	63 (2-91)	‡
Norway	4,681,134	951	20.3	463 (49)	63.8 (0.2-98.6)	74 (16.9%) <sup>b</sup>
U.S. Arctic	676,987	150	22.2	91 (61)	46.1 (0.2-94.1)	13 (8.7%)
<b>Total</b>	<b>11,167,346</b>	<b>2,033</b>	<b>18.2</b>	<b>1,097 (54)</b>	<b>60.1 (0.1-103)</b>	<b>94 (14.7%)</b>

\*Number of cases per 100,000 per year

†Case fatality ratio

‡Case outcomes not reported from Finland, N. Sweden

<sup>a</sup> Population for Norbotten and Vasterbotten

<sup>b</sup> Case outcomes unknown in 3 cases from N. Canada, 514 cases from Norway

#### *Streptococcus pneumoniae* by Age Category, ICS 2007 Data

Age	Finland	Greenland	Iceland	N. Canada	N. Sweden	Norway	U.S. Arctic
<2 yrs	Pop	118,029	1,684	8,783	5,135	10,434	116,435
	N (%)	75 (10)	0 (0)	6 (14)	9 (20)	0 (0)	37 (4)
	Rate*	63.5	0	68.3	175.3	0	31.8
2-19 yrs	Pop	1,108,481	16,764	79,701	44,480	106,292	1,097,766
	N (%)	64 (8)	2 (40)	2 (5)	6 (13)	8 (11)	45 (5)
	Rate*	5.8	11.9	2.5	13.4	7.5	4.1
20-64 yrs	Pop	3,198,743	34,821	183,555	89,863	295,655	2,781,336
	N (%)	345 (45)	3 (60)	20 (46)	26 (58)	29 (41)	413 (43)
	Rate*	10.8	8.6	10.9	28.9	9.8	14.9
65+ yrs	Pop	875,231	3,379	35,633	7,116	95,814	685,597
	N (%)	284 (37)	0 (0)	15 (34)	4	34 (48)	456 (48)
	Rate*	32.5	0	42.1	56.2	35.5	66.5
All ages	Pop	5,300,484	56,648	307,672	144,421	508,195	4,681,134
	N	768	5	43	45	71	951
	Rate*	14.5	8.8	14	31.2	14	20.3

\*Number of cases per 100,000 per year

When stratified by age, the highest rates of disease in Greenland occurred in persons 2-19 years of age, in persons 65+ years of age in N. Sweden and Norway, and in those cases less than two years of age in the remaining regions.

### Seasonality

*S. pneumoniae* was diagnosed throughout the year in 2007 in each country. No distinct seasonality was observed in any country except Greenland where the lowest proportion of cases occurred in the second quarter and the highest in the third, however, this represents a small number of cases (n=5).

### Race

Race and ethnicity data were collected in N. Canada and the U.S. Arctic. Rates of invasive pneumococcal disease were higher in Aboriginal and Native populations in all age categories than in non-Aboriginal and non-Native populations. The highest rates of disease occurred in children less than 2 years of age and adults 65+ in both countries.

### ***Streptococcus pneumoniae* by Race and Age Categories, ICS 2007 Data**

Age (yrs)	N. Canada*		U.S. Arctic		
	Aboriginal	Non-Aboriginal	Native	Non-Native	
<2	Population	3,680	1,455	6,670	15,528
	Cases (rate‡)	7 (190.2)	2 (137.5)	13 (194.9)	10 (64.4)
2-19	Population	33,205	11,635	49,487	145,504
	Cases (rate‡)	4 (12.1)	0 (0)	13 (26.3)	8 (5.5)
20-64	Population	42,435	47,431	70,896	341,407
	Cases (rate‡)	18 (42.4)	6 (12.7)	43 (60.7)	39 (11.4)
65+	Population	3,385	3,731	7,828	39,667
	Cases (rate‡)	3 (88.6)	0 (0)	9 (115)	15 (37.8)
All	Population	82,705	61,716	134,881	542,106
Ages	Cases (rate‡)	32 (38.7)	8 (13)	78 (57.8)	72 (13.3)

\*Race unknown in 2 cases 2-19 years, 2 cases 20-64 years, 1 case 65+ years

‡Number of cases per 100,000 per year

### Clinical Presentation

The most common clinical presentations associated with *S. pneumoniae* were pneumonia, bacteremia, and meningitis. Clinical diagnoses other than bacteremia and meningitis are not reported in the Finland and N. Sweden *S. pneumoniae* data. In N. Canada, Norway, and the U.S. Arctic the clinical presentation reported most often was pneumonia (71%, 58% and 63%, respectively); in Finland, Iceland and N. Sweden it was bacteremia (96%, 84% and 93%, respectively) and in Greenland meningitis was reported in 40% of cases.

### Clinical Presentation of Reported *Streptococcus pneumoniae* Cases, ICS 2007 Data

	Finland n (%)	Greenland n (%)	Iceland n (%)	N Canada n (%)	N Sweden n (%)	Norway n (%)	US Arctic n (%)
<b>Pneumonia*</b>	0 (0)	1 (20)	0 (0)	32 (71)	0 (0)	550 (58)	94 (63)
<b>Bacteremia</b>	741 (96)	1 (20)	36 (84)	11 (24)	66 (93)	280 (29)	25 (17)
<b>Meningitis</b>	27 (4)	2 (40)	5 (12)	1 (2)	5 (7)	71 (7)	13 (9)
<b>Empyema</b>	0 (0)	1 (20)	0 (0)	0 (0)	0 (0)	0 (0)	10 (7)
<b>Septic arthritis</b>	0 (0)	0 (0)	2 (4)	0 (0)	0 (0)	1 (<1)	2 (1)
<b>Endocarditis</b>	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	3 (2)
<b>Cellulitis</b>	0 (0)	0 (0)	0 (0)	1 (2)	0 (0)	0 (0)	2 (1)
<b>Other</b>	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	49 (5)	0 (0)
<b>Total Cases</b>	768	5	43	45	71	951	150

\*with bacteremia

### Risk Factors

N. Canada and the U.S. Arctic reported medical conditions or risk factors associated with *S. pneumoniae*. In adults 18 years and older, cigarette smoking and alcohol abuse were the most common associated conditions occurring in 26 to 50% of patients.

### *Streptococcus pneumoniae* Risk Factor/Medical Conditions in Adults\*, ICS 2007 Data

	N. Canada n (%)	U.S. Arctic n (%)
<b>Cigarette Smoking</b>	9 (26)	53 (50)
<b>Alcohol Abuse</b>	14 (41)	35 (33)
<b>Chronic Lung Disease and/or Asthma</b>	1 (3)	32 (30)
<b>Immunosuppressive Therapy</b>	0 (0)	5 (5)
<b>Diabetes</b>	7 (21)	24 (23)
<b>Injection Drug Use</b>	0 (0)	1 (1)
<b>Asplenia</b>	0 (0)	0 (0)
<b>Total Adult* Cases</b>	31	106

\*≥ 18 years

### Vaccination Policy

In Finland, Iceland, N. Canada, Norway, and the U.S. Arctic, 23-valent pneumococcal polysaccharide vaccine (PS23) is recommended for persons 55 years and older (U.S. Arctic), over 60 years (Iceland) or over 65 years of age (Finland, N. Canada, Norway), and to persons greater than two years of age (Finland, Iceland, Norway, U.S. Arctic) or greater than five years of age (N. Canada) with specific medical problems. The vaccine is only recommended for certain risk groups in N. Sweden. The pneumococcal 7-valent conjugate vaccine (PCV7) was introduced into the infant immunization schedule in the U.S. Arctic in January, 2001, and in Norway in July, 2006. In N. Canada, PCV7 was introduced in northern Quebec and Nunavut in 2002, Newfoundland and Yukon in 2005 and Northwest Territory in 2006.

### Vaccination Status

Fifty-six and 91 percent of *S. pneumoniae* cases in children less than 2 years of age with known vaccination status were vaccinated with PCV7 in N. Canada and the U.S. Arctic, respectively. Only 17% and 6% of cases in Norway eligible for PCV7 and PS23, respectively, were vaccinated indicating much less frequent use of these

vaccines than in N. Canada and the U.S. Arctic. Vaccine coverage data were not reported from Finland and Iceland.

***Streptococcus pneumoniae* Case Vaccination Status for Pneumococcal Vaccine, ICS 2007 Data**

	N. Canada	Norway	U.S. Arctic
<b>Total cases eligible for PCV7 vaccine*</b>	9	37	23
<b>Vaccine status known in cases eligible for PCV7</b>	9	23	23
<b>Cases eligible for PCV7 vaccinated (%)†</b>	5 (56%)	4 (17%)	21 (91%)
<b>Total cases eligible for PS23 vaccine‡</b>	4	456	48
<b>Vaccine status known in cases eligible for PS23</b>	4	147	31
<b>Cases eligible for PS23 vaccinated (%)†</b>	3 (75%)	9 (6%)	24 (77%)

\*Children less than 2 years of age

†Percent of vaccine status known cases

‡Adults 55 years and older in the U.S. Arctic, 65 years and older in N. Canada and Norway

Serotypes

The *S. pneumoniae* serotypes reported by ICS regions in 2007 are listed in the following table; yellow highlights the most common serotypes in each country. Serotypes included in the 7-valent conjugate vaccine are the most prevalent in the countries that did not include the vaccine in their universal vaccine programs in 2007 (Greenland, Iceland). Finland did not provide serotype data.

***Streptococcus pneumoniae* Serotypes by Country, ICS 2007 Data**

Serotype	Greenland n (%)	Iceland n (%)	N. Canada† n (%)	N. Sweden* n (%)	U.S. Arctic† n (%)
<b>1</b>	0 (0)	0 (0)	0 (0)	0 (0)	1 (1)
<b>3</b>	0 (0)	1 (2)	1 (2)	<b>5 (14)</b>	10 (7)
<b>4‡</b>	0 (0)	<b>9 (21)</b>	1 (2)	1 (3)	1 (1)
<b>5</b>	0 (0)	0 (0)	4 (10)	0 (0)	1 (1)
<b>6</b>	0 (0)	0 (0)	0 (0)	3 (8)	0 (0)
<b>6A</b>	0 (0)	0 (0)	1 (2)	0 (0)	4 (3)
<b>6B‡</b>	0 (0)	3 (7)	1 (2)	0 (0)	0 (0)
<b>6C</b>	0 (0)	0 (0)	0 (0)	0 (0)	4 (3)
<b>7</b>	0 (0)	0 (0)	0 (0)	<b>7 (19)</b>	0 (0)
<b>7F</b>	0 (0)	4 (10)	0 (0)	0 (0)	<b>24 (17)</b>
<b>8</b>	0 (0)	0 (0)	<b>5 (12)</b>	2 (6)	3 (2)
<b>9</b>	0 (0)	0 (0)	0 (0)	3 (8)	0 (0)
<b>9N</b>	1 (20)	1 (2)	3 (7)	0 (0)	2 (1)
<b>9V‡</b>	0 (0)	4 (10)	0 (0)	0 (0)	0 (0)
<b>10</b>	0 (0)	0 (0)	0 (0)	1 (3)	0 (0)
<b>10A</b>	0 (0)	0 (0)	0 (0)	0 (0)	2 (1)
<b>11</b>	0 (0)	1 (2)	0 (0)	1 (3)	0 (0)
<b>11A</b>	0 (0)	0 (0)	0 (0)	0 (0)	1 (1)
<b>12</b>	0 (0)	1 (2)	0 (0)	0 (0)	0 (0)
<b>12F</b>	0 (0)	0 (0)	<b>5 (12)</b>	0 (0)	16 (11)
<b>13</b>	0 (0)	0 (0)	1 (2)	0 (0)	1 (1)
<b>14‡</b>	0 (0)	<b>5 (12)</b>	3 (7)	4 (11)	0 (0)
<b>15</b>	0 (0)	1 (2)	0 (0)	0 (0)	0 (0)

<b>Serotype</b>	<b>Greenland n (%)</b>	<b>Iceland n (%)</b>	<b>N. Canada† n (%)</b>	<b>N. Sweden* n (%)</b>	<b>U.S. Arctic† n (%)</b>
<b>15A</b>	0 (0)	0 (0)	2 (5)	0 (0)	5 (4)
<b>15C</b>	0 (0)	0 (0)	0 (0)	0 (0)	1 (1)
<b>16F</b>	0 (0)	0 (0)	1 (2)	0 (0)	5 (4)
<b>17</b>	0 (0)	0 (0)	0 (0)	1 (3)	0 (0)
<b>17F</b>	0 (0)	0 (0)	1 (2)	0 (0)	1 (1)
<b>18</b>	0 (0)	0 (0)	0 (0)	2 (6)	0 (0)
<b>18C‡</b>	3 (60)	0 (0)	2 (5)	0 (0)	0 (0)
<b>19</b>	0 (0)	0 (0)	0 (0)	3 (8)	0 (0)
<b>19A</b>	0 (0)	2 (5)	3 (7)	0 (0)	25 (18)
<b>19F‡</b>	0 (0)	4 (10)	2 (5)	0 (0)	0 (0)
<b>20</b>	0 (0)	0 (0)	1 (2)	0 (0)	6 (4)
<b>22</b>	0 (0)	3 (7)	0 (0)	0 (0)	0 (0)
<b>22A</b>	0 (0)	0 (0)	0 (0)	0 (0)	3 (2)
<b>22F</b>	1 (20)	0 (0)	1 (2)	0 (0)	7 (5)
<b>23</b>	0 (0)	0 (0)	0 (0)	3 (8)	0 (0)
<b>23A</b>	0 (0)	1 (2)	0 (0)	0 (0)	1 (1)
<b>23B</b>	0 (0)	0 (0)	0 (0)	0 (0)	2 (1)
<b>23F‡</b>	0 (0)	1 (2)	1 (2)	0 (0)	0 (0)
<b>31</b>	0 (0)	0 (0)	0 (0)	0 (0)	8 (6)
<b>33A</b>	0 (0)	0 (0)	1 (2)	0 (0)	0 (0)
<b>33F</b>	0 (0)	0 (0)	1 (2)	0 (0)	3 (2)
<b>35B</b>	0 (0)	0 (0)	0 (0)	0 (0)	1 (1)
<b>35F</b>	0 (0)	0 (0)	0 (0)	0 (0)	2 (1)
<b>38</b>	0 (0)	0 (0)	0 (0)	0 (0)	1 (1)

\*Serogroup level data from Vasterbotten

†PCV7 included in universal vaccine program

‡Serotype included in PCV7 vaccine

### Vaccine-Preventable Cases and Deaths

For the countries reporting serotype data, 72% or more of *S. pneumoniae* cases in persons  $\geq 2$  years of age were preventable with use of the 23-valent polysaccharide vaccine. Use of the 7-valent conjugate vaccine would have potentially prevented 83% of *Strep pneumoniae* cases in children  $< 2$  years of age in Iceland and 43% of cases  $< 2$  years of age in N. Canada. There were no cases of disease caused by a serotype contained in the 7-valent vaccine in U.S. Arctic children less than 2 reflecting widespread introduction of this vaccine and elimination of vaccine preventable disease in this population. The proportion of deaths potentially preventable with use of the 23-valent polysaccharide vaccine related to *S. pneumoniae* ranged from 69% to 100%.

## Proportion of Vaccine Preventable Cases/Deaths from Invasive Pneumococcal Disease, ICS 2007 Data

	Greenland n/Denom* (%)	Iceland n/Denom* (%)	N. Canada n/Denom* (%)	U.S. Arctic n/Denom* (%)
Cases ≥ 2 years old with serotype in the 23-valent pneumococcal polysaccharide vaccine	5/5 (100)	28/36 (78)	29/34 (85)	86/120 (72)
Cases < 2 years old with serotype in the 7-valent pneumococcal conjugate vaccine	0/0 (0)	5/6 (83)	3/7 (43)	0/21 (0)
Deaths (all ages) for which the serotype was contained in the 23-valent pneumococcal vaccine	1 (100‡)	3 (75‡)	2 (100‡)	9 (69‡)

\*Number of isolates serotyped by country by age group

‡Percentage of total deaths

### Outcome

A total of 94 deaths associated with *S. pneumoniae* were reported to ICS in 2007. Overall, the highest case fatality ratio (CFR) occurred in persons 65+ years of age (27%). Finland and N. Sweden did not report outcome data.

## *Streptococcus pneumoniae* Age-Specific Case-Fatality Ratios (CFR), ICS 2007 Data

		<2 years	2-19 years	20-64 years	65+ years	All Ages
<b>Greenland</b>	Deaths/Cases*	0/0	0/2	1/3	0/0	1/5
	(CFR)	(0%)	(0%)	(33%)	(0%)	(20%)
<b>Iceland</b>	Deaths/Cases*	0/6	0/2	2/20	2/15	4/43
	(CFR)	(0%)	(0%)	(10%)	(13%)	(9%)
<b>N. Canada</b>	Deaths/Cases*	1/9	0/5†	0/24†	1/4	2/42
	(CFR)	(11%)	(0%)	(0%)	(25%)	(5%)
<b>Norway</b>	Deaths/Cases*	0/21†	1/27†	12/181†	61/208†	74/437
	(CFR)	(0%)	(4%)	(7%)	(29%)	(17%)
<b>U.S. Arctic</b>	Deaths/Cases*	0/23	0/21	9/82	4/24	13/150
	(CFR)	(0%)	(0%)	(11%)	(17%)	(9%)
<b>Total</b>	Deaths/Cases*	1/59	1/57	24/310	68/251	94/677
	(CFR)	(2%)	(2%)	(8%)	(27%)	(14%)

\*Cases with known outcome.

†Outcome unknown in (16) Norway cases < 2 years; (1) N. Canada, (18) Norway cases 2-19 years; (2) N. Canada, (232) Norway cases 20-64 years; (248) Norway cases 65+ years

### Antimicrobial Susceptibility

In 2007, antimicrobial susceptibility results were reported to ICS from Finland, Greenland, Iceland, N. Canada, N. Sweden and the U.S. Arctic. The following table outlines for each country the antibiotics tested, the number of isolates reported tested for each antibiotic and the proportion (NS%) of isolates tested that showed any level of non-susceptibility.



***Streptococcus pneumoniae* Antibiotic Susceptibility Testing, ICS 2007 Data**

Antibiotic	Finland n (NS%)	Greenland n (NS%)	Iceland n (NS%)	N. Canada (NS%)	N. Sweden n (NS%)	U.S. Arctic n (NS%)
Ceftriaxone	0	4 (0%)	22 (9%)	36 (0%)	3 (0%)	141 (2%)
Chloramphenicol	0	0	37 (0%)	37 (0%)	0	141 (0%)
Clindamycin	0	0	0	37 (3%)	35 (0%)	141 (2%)
Erythromycin	0	0	37 (11%)	39 (18%)	71 (1%)	141 (8%)
Levofloxacin	0	0	0	37 (0%)	0	141 (0%)
Penicillin	768 (3%)	4 (0%)	37 (8%)	41 (7%)	71 (1%)	141 (16%)
Rifampin	0	0	0	0	0	141 (1%)
TMP Sulfa*	0	0	37 (8%)	36 (19%)	37 (0%)	141 (21%)
Vancomycin	0	0	37 (0%)	40 (0%)	0	141 (0%)

\*Trimethoprim-sulfamethoxazole

Of the antibiotics tested, the largest numbers of isolates were resistant to penicillin, TMP-Sulfa and erythromycin. Results by country for each of these antibiotics are shown in the tables below. In the U.S. Arctic, serotypes 6A, 6C and 19A showed multi-drug resistance. Twenty-one of 24 serotype 19A isolates (87.5%) were resistant to at least one antibiotic, 50% were resistant to two antibiotics, 8% were resistant to three, 4% were resistant to four and 8% were resistant to five antibiotics. Seventy-five percent (3 of 4) of serotype 6A isolates were resistant to at least one antibiotic; 25% were resistant to two or three antibiotics. Fifty percent of serotype 6C isolate (2 of 4) were resistant to three antibiotics. In N. Canada, one of two serotype 15A isolates was resistant four antibiotics. In Iceland, 2 of 4 serotype 19F isolates were antibiotic resistant; one showed resistance to three antibiotics and one showed resistance to four antibiotics. One of two serotype 19A isolates was resistant to two antibiotics. Finland and N. Sweden did not provide serotype data.

***Streptococcus pneumoniae* Penicillin Susceptibility Results, ICS 2007 Data**

	# Tested	I* (%)	I* Serotypes (n)	R* (%)	R* Serotypes (n)
Finland	768	21 (3%) †		2 (<1%) †	
Greenland	4	0 (0%)		0 (0%)	
Iceland	37	2 (5%)	19F (1), 9V (1)	1 (3%)	19F (1)
N. Canada	41	3 (7%)	15A (1), 19A (2)	0 (0%)	
N. Sweden	71	1 (1%) †		0 (0%)	
U.S. Arctic	141	19 (13%)	19A (15), 6C (2), 23A (1), 6A (1)	3 (2%)	19A (3)

\*I=Intermediate resistance, R=Fully resistant

†Serotypes not provided

***Streptococcus pneumoniae* TMP-Sulfa Susceptibility Results, ICS 2007 Data**

	# Tested	I* (%)	I* Serotypes (n)	R* (%)	R* Serotypes (n)
Iceland	37	0 (0%)		3 (8%)	19F (2), 19A (1)
N. Canada	36	5 (14%)	5 (3), 6A (1), 6B (2)	2 (6%)	15A (1), 19F (1)
N. Sweden	36	0 (0%)		0 (0%)	
U.S. Arctic	141	6 (4%)	19A (3), 5 (1), 9N (1), 33F (1)	24 (17%)	19A (17), 6A (2), 6C (2), 33F (2), 10A (1)

\*I=Intermediate resistance, R=Fully resistant

### ***Streptococcus pneumoniae* Erythromycin Susceptibility Results, ICS 2007 Data**

	<b># Tested</b>	<b>I* (%)</b>	<b>I* Serotypes</b>	<b>R* (%)</b>	<b>R* Serotypes (n)</b>
<b>Iceland</b>	37	0 (0%)		4 (11%)	14 (2), 19F (2)
<b>N. Canada</b>	39	0 (0%)		7 (18%)	12F (4), 14 (1), 15A (1), unknown (1)
<b>N. Sweden</b>	71	0 (0%)		1 (1%)	†
<b>U.S. Arctic</b>	141	0 (0%)		11 (8%)	19A (6), 6A (2), 6C (2), 20 (1)

\*I=Intermediate resistance, R=Fully resistant

†Serotypes not provided

### Quality Control

In 2007, two QC panels of seven *S. pneumoniae* isolates plus a control strain each were shipped and tested. Beginning in 2005, the MIC data was analyzed in two ways. The first comparison is based on MIC data provided by the distributing laboratory and is the method used historically in the QC program. The new methodology provides an analysis of MIC data for all the participating laboratories by using the modal MIC for each antibiotic-organism combination as the value to which the other data are compared. The modal MIC is the MIC most frequently reported. When two MIC values were reported with equal frequency, both were accepted as a modal value. Antibiotic-organism combinations for which there was no consensus on a modal MIC were excluded from the analysis. The rationale for initiating the second analysis recognizes that there is an allowable variation of one log<sub>2</sub> dilution inherent for any MIC testing system. This means that there is no one absolutely correct MIC value to which all others can be compared. The modal MIC may be a better representation of this 'true' value than any one laboratory can provide. For Panel 2007-A, serotyping performance ranged between 86%-100% with an overall agreement of 97.1%. The modal MIC comparison resulted in an overall correlation of 93.7% with individual participant correlation ranging from 77.5%-100%. Overall category agreement was 97.9% with individual participant agreement ranging from 90%-100%. For Panel 2007-B, overall serotyping correlation was 97.1% with individual participant serotyping performance ranging between 89%-100%. The overall modal MIC correlation was 95.1% with individual correlation ranging from 78%-100%. Overall category agreement was 94.1% with individual participant agreement ranging from 87.9%-100% [1].

### Conclusions

*Streptococcus pneumoniae* remains a major cause of invasive bacterial disease in circumpolar regions. Disease rates are highest in indigenous populations. The impact of the conjugate vaccine is clear in the U.S. Arctic and is beginning to be seen in N. Canada. Surveillance for evidence of impact in other circumpolar countries will be important to confirm effectiveness and provide support for continuing immunization programs.

## *Haemophilus influenzae*

### Case Demographics

Greenland, N. Canada, N. Sweden (Norrbotten), Norway and the U.S. Arctic reported the occurrence of *H. influenzae* in each country during 2007. Greenland reported no cases. A total of 106 cases of invasive disease caused by *H. influenzae* were reported to ICS during 2007 by N. Canada, N. Sweden (Norrbotten), Norway and the U.S. Arctic. The highest rate of disease among regions reporting cases was in N. Canada (7.6 per 100,000) and the lowest in N. Sweden (0.8/100,000). Median age of cases was highest in Norway (69.5 years) and lowest in N. Canada (0.8 years).

### *Haemophilus influenzae* Case Demographics, ICS 2007 Data

Country	Population	# Cases	Rate*	Sex M (%)	Median Age (min-max) yrs	Deaths n (CFR†)
Greenland	56,648	0	0	No cases	No cases	No cases
N. Canada	144,421	11	7.6	6 (55)	0.8 (0.4-48.2)	1 (10%)‡
N. Sweden	250,602	2	0.8	0 (0)	44 (34-54)	‡
Norway	4,681,134	78	1.7	43 (55)	69.5 (0-98.5)	12 (32%)‡
U.S. Arctic	676,987	15	2.2	10 (67)	29.7 (0-90.6)	3 (20%)
<b>Total</b>	<b>5,809,792</b>	<b>106</b>	<b>1.8</b>	<b>59 (56)</b>	<b>62 (0-98.5)</b>	<b>16 (25%)</b>

\*Number of cases per 100,000 per year

†Case fatality ratio

‡Case outcome unknown in (1) N. Canada, (40) Norway cases; N. Sweden did not report case outcomes

When stratified by age, the highest rates of disease for both N. Canada and the U.S. Arctic were in the <2 years age category; no disease was reported in the <2 years age category in N. Sweden. The highest rate of disease in Norway was in the 65+ years of age category.

### *Haemophilus influenzae* by Age Category, ICS 2007 Data

Age		N. Canada	N. Sweden	Norway	U.S. Arctic
<2 yrs	Population	5,135	4,892	116,435	22,198
	Cases (%)	9 (82)	0 (0)	7 (9)	4 (27)
	Rate*	175.3	0	6	18
2-19 yrs	Population	44,840	51,904	1,097,766	194,991
	Cases (%)	1 (9)	0 (0)	6 (8)	1 (7)
	Rate*	2.2	0	0.6	0.5
20-64 yrs	Population	89,863	144,596	2,781,336	412,303
	Cases (%)	1 (9)	2 (100)	19 (24)	5 (33)
	Rate*	1.1	1.4	0.7	1.2
65+ yrs	Population	7,116	49,210	685,597	47,495
	Cases (%)	0 (0)	0 (0)	46 (59)	5 (33)
	Rate*	0	0	6.7	10.5
<b>All ages</b>	Population	144,421	250,602	4,681,134	676,987
	Cases	11	2	78	15
	Rate*	7.6	0.8	1.7	2.2

\*Number of cases per 100,000 per year

## Race

Rates of disease were highest (244.6 per 100,000) in N. Canada Aboriginal cases less than two years of age. In the U.S. Arctic, rates of disease were higher in Native populations than in non-Native populations in all age categories except 20-64 year olds.

### ***Haemophilus influenzae* by Race and Age Categories, ICS 2007 Data**

Age (yrs)	N. Canada		U.S. Arctic		
	Aboriginal	Non-Aboriginal	Native	Non-Native	
<2	Population	3,680	1,455	6,670	15,528
	Cases (rate†)	9 (244.6)	0 (0)	2 (30)	2 (12.9)
2-19	Population	33,205	11,635	49,487	145,504
	Cases (rate†)	1 (3)	0 (0)	1 (2)	0 (0)
20-64	Population	42,435	47,431	70,896	341,407
	Cases (rate†)	1 (2.4)	0 (0)	0 (0)	5 (1.5)
65+	Population	3,385	3,731	7,828	39,667
	Cases (rate†)	0 (0)	0 (0)	1 (12.8)	4 (10.1)
All	Population	82,705	61,716	134,881	542,106
Ages	Cases (rate†)	11 (13.3)	0 (0)	4 (3)	11 (2)

†Number of cases per 100,000 per year

## Clinical Presentation

In N. Sweden, Norway and the U.S. Arctic, the most common clinical presentation associated with *H. influenzae* was bacteremia (50%, 49% and 40% of reported cases, respectively). In N. Canada, the most common clinical presentation was pneumonia with bacteremia (36%).

### **Clinical Presentation of Reported *Haemophilus influenzae* Cases, ICS 2007 Data**

	N. Canada n (%)	N. Sweden n (%)	Norway n (%)	U.S. Arctic n (%)
<b>Pneumonia*</b>	4 (36)	0 (0)	19 (24)	4 (27)
<b>Bacteremia</b>	1 (9)	1 (50)	38 (49)	6 (40)
<b>Meningitis</b>	3 (27)	0 (0)	6 (8)	3 (20)
<b>Empyema</b>	1 (9)	0 (0)	0 (0)	0 (0)
<b>Peritonitis</b>	0 (0)	1 (50)	0 (0)	0 (0)
<b>Septic arthritis</b>	1 (9)	0 (0)	2 (3)	0 (0)
<b>Cellulitis</b>	1 (9)	0 (0)	0 (0)	1 (7)
<b>Other/Unknown</b>	0 (0)	0 (0)	13 (17)	1 (7)
<b>Total</b>	11	2	78	15

\*with bacteremia

## Risk Factors

Thirty percent of adult ( $\geq 18$  years) cases of *H. influenzae* reported in the U.S. Arctic indicated diabetes as an associated risk factor; 20% indicated smoking, chronic lung disease or alcohol abuse as an associated risk factor. Fifty percent of adult N. Canadian *H. influenzae* cases reported chronic lung disease as a risk factor. N. Sweden and Norway did not report risk factor data.

## Vaccination Status

The *H. influenzae* type b (Hib) conjugate vaccine is required as part of routine childhood vaccination in N. Canada, N. Sweden, Norway and the U.S. Arctic. One case of Hib was reported in N. Canada in children less than five years and the case patient had received Hib vaccine. Data on vaccine status were not provided by N. Sweden and Norway.

### ***Haemophilus influenzae* Case Vaccination Status for Hib Vaccine, ICS 2007 Data**

	N. Canada	U.S. Arctic
<b>Total cases* eligible for Hib vaccine†</b>	9	4
<b>Vaccine status known in cases* eligible for Hib vaccine</b>	9	3
<b>Cases* eligible for Hib vaccine vaccinated (%)‡</b>	9 (100%)	2 (67%)

\*All serotypes

†Children less than 5 years of age

‡Percent of vaccine status known cases

## Serotypes

### ***Haemophilus influenzae* Serotypes by Country, ICS 2007 Data**

Serotype	N. Canada	Norway	U.S. Arctic
	n (%)	n (%)	n (%)
<b>a</b>	6 (60)	0 (0)	2 (15)
<b>b</b>	1 (10)	4 (6)	0 (0)
<b>c</b>	0 (0)	0 (0)	0 (0)
<b>d</b>	2 (20)	0 (0)	0 (0)
<b>e</b>	0 (0)	1 (2)	1 (8)
<b>f</b>	1 (10)	1 (2)	0 (0)
<b>Non-b</b>	0 (0)	59 (89)	0 (0)
<b>Non-typeable</b>	0 (0)	1 (2)	10 (77)
<b>Total*</b>	10	66	13

\*Number of cases serotyped

The most common *H. influenzae* serotype in N. Canada and the U.S. Arctic was type a (60% and 15% of serotyped cases, respectively). In Norway, non-serotype b types comprised 89% of cases (including non-typeables), however, specific serotypes were not reported except for in a small number of cases. Non-typeable cases made up a large proportion of cases in the U.S. Arctic (77%). N. Sweden did not provide serotype data.

## Outcome

Sixteen deaths were associated with *H. influenzae* cases reported to ICS in 2007; one from N. Canada, three from the U.S. Arctic and 12 from Norway. N. Sweden did not provide outcome data.

### ***Haemophilus influenzae* Deaths by Country, ICS 2007 Data**

	<b>N. Canada</b>	<b>Norway</b>	<b>U.S. Arctic</b>
<b>No. Deaths</b>	1	12	3
<b>Case Fatality Ratio</b>	10%*	32%*	20%
<b>Min-Max (yrs)</b>	0.8 (1 case)	57.8-98.5	22-90.6
<b>Serotypes (n)</b>	Unknown	Non-b (10), unknown (2)	NT (3)
<b>Clinical Presentations (n)</b>	Pneumonia	Bacteremia (6), pneumonia (3), meningitis (1), other (2)	Pneumonia (1), cellulitis (1), bacteremia (1)

\* Case outcome unknown in (1) N. Canada, (40) Norway cases

#### Quality Control

Two QC panels of five *H. influenzae* and *N. meningitidis* isolates were shipped and serogrouped or serotyped. Discrepant results from one lab were due to the primer set available that did not include all possible serogroups [2].

#### Conclusions

Widespread use of Hib conjugate vaccines has led to the virtual disappearance of Hib disease in these populations. Substantial replacement with other serotypes has not occurred, however, disease caused by other serotypes is similar in severity to Hib disease. The proportion of disease caused by non-typeable organisms is increasing.

## *Neisseria meningitidis*

### Case Demographics

Greenland, N. Canada, N. Sweden (Norbotten), Norway and the U.S. Arctic reported the occurrence of *N. meningitidis* during 2007. A total of 34 cases of invasive disease caused by *N. meningitidis* were reported to ICS; no cases occurred in N. Canada or N. Sweden in 2007. Among regions reporting cases, Greenland had the highest disease rate (1.8 per 100,000). Two deaths associated with *N. meningitidis* were reported from Norway.

### ***Neisseria meningitidis* Case Demographics, ICS 2007 Data**

Country	Population	# Cases	Rate*	Sex M (%)	Median Age (min-max) yrs	Deaths n (CFR†)
<b>Greenland</b>	56,648	1	1.8	0 (0)	2.2 (1 case)	0 (0%)
<b>N. Canada</b>	144,421	0	0	No cases	No cases	No cases
<b>N. Sweden</b>	250,602	0	0	No cases	No cases	No cases
<b>Norway</b>	4,681,134	28	0.6	18 (64)	13.3 (0.2-85.3)	2 (7%)‡
<b>U.S. Arctic</b>	676,987	5	0.8	3 (60)	23.3 (3.6-61.9)	0 (0%)
<b>Total</b>	5,809,792	34	0.6	21 (62)	13.3 (0.2-85.3)	2 (6%)

\*Number of cases per 100,000 per year

†Case fatality ratio

‡Outcome unknown in 1 case

When stratified by age, the highest rates of disease occurred in the less than 2 year old age category in Norway and the 2-19 year old category in Greenland and the U.S. Arctic.

### ***Neisseria meningitidis* by Age Category, ICS 2007 Data**

Age		Greenland	Norway	U.S. Arctic
<b>&lt;2 yrs</b>	Pop	1,684	116,435	22,198
	N (%)	0 (0)	9 (32)	0 (0)
	Rate*	0	7.7	0
<b>2-19 yrs</b>	Pop	16,764	1,097,766	194,991
	N (%)	1 (100)	10 (36)	2 (40)
	Rate*	6	0.9	1
<b>20-64 yrs</b>	Pop	34,821	2,781,336	412,303
	N (%)	0 (0)	7 (25)	3 (60)
	Rate*	0	0.3	0.7
<b>65+ yrs</b>	Pop	3,379	685,597	47,495
	N (%)	0 (0)	2 (7)	0 (0)
	Rate*	0	0.3	0
<b>All ages</b>	Pop	56,648	4,681,134	676,987
	N	1	28	5
	Rate*	1.8	0.6	0.8

\*Number of cases per 100,000 per year

## Race

In the U.S. Arctic, two cases of *N. meningitidis* occurred in AK Native people (rate 1.5/100,000) and three in non-Native persons (rate 0.6/100,000).

## Clinical Presentation

The most common clinical presentation in all countries reporting invasive *N. meningitidis* in 2007 was meningitis ranging from 61% to 100% of cases.

### **Clinical Presentation of Reported *Neisseria meningitidis* Cases, ICS 2007 Data**

	<b>Greenland n (%)</b>	<b>Norway n (%)</b>	<b>U.S. Arctic n (%)</b>
<b>Pneumonia*</b>	0 (0)	2 (7)	1 (20)
<b>Bacteremia</b>	0 (0)	9 (32)	0 (0)
<b>Meningitis</b>	1 (100)	17 (61)	4 (80)
<b>Total</b>	1	28	5

\*with bacteremia

## Risk Factors

Risk factor data was reported by the U.S. Arctic; chronic lung disease and immune suppressive treatment were each reported in one adult case.

## Serogroups

Thirty-one of 34 invasive *N. meningitidis* reported to ICS in 2007 included serogroup data. The most common serogroup in all countries was B which occurred in 60% to 100% of cases.

### ***Neisseria meningitidis* Serogroups by Country, ICS 2007 Data**

<b>Serogroup</b>	<b>Greenland n (%)</b>	<b>Norway n (%)</b>	<b>U.S. Arctic n (%)</b>
<b>B</b>	1 (100)	24 (86)	3 (60)
<b>W</b>	0 (0)	1 (3.5)	0 (0)
<b>Y</b>	0 (0)	2 (7)	0 (0)
<b>Unknown</b>	0 (0)	1 (3.5)	2 (40)
<b>Total</b>	1	28	5

## Conclusions

*Neisseria meningitidis* is a relatively uncommon cause of invasive bacterial disease in the circumpolar area under surveillance, however, continued surveillance is warranted due to high morbidity and mortality associated with outbreaks.



## Group A *Streptococcus*

### Case Demographics

Greenland, N. Canada, N. Sweden (Norrbotten) and the U.S. Arctic each reported the occurrence of GAS during 2007. A total of 57 cases of invasive disease caused by GAS were reported to ICS; no cases occurred in Greenland in 2007. The rate of disease among regions reporting cases was highest in N. Canada (9.7 per 100,000) compared to the lowest in N. Sweden (4.4 per 100,000). Six deaths were associated with GAS, two in N. Canada and four in the U.S. Arctic.

### Group A *Streptococcus* Case Demographics, ICS 2007 Data

Country	Population	# Cases	Rate*	Sex M (%)	Median Age (min-max) yrs	Deaths n (CFR†)
<b>Greenland</b>	56,648	0	0	No cases	No cases	No cases
<b>N. Canada</b>	144,421	14	9.7	8 (57)	37.3 (0.3-90.8)	2 (17%) <sup>a</sup>
<b>N. Sweden</b>	250,602	11	4.4	6 (55)	56 (0.6-98)	‡
<b>U.S. Arctic</b>	676,987	32	4.7	23 (72)	53.2 (2-88.3)	4 (13%)
<b>Total</b>	1,128,658	57	5.1	37 (65)	53.7 (0.3-98)	6 (14%)

\*Number of cases per 100,000 per year

†Case fatality ratio

‡Outcomes not reported from N. Sweden

<sup>a</sup>Outcome unknown in 2 cases from N. Canada

When stratified by age, the highest rates of disease occurred in children <2 years and in individuals 65+ years of age in N. Canada (58 per 100,000 and 56 per 100,000, respectively).

### Group A *Streptococcus* by Age Category, ICS 2007 Data

Age		N. Canada	N. Sweden	U.S. Arctic
<2 yrs	Population	5,135	4,892	22,198
	Cases (%)	3 (21)	1 (9)	0 (0)
	Rate*	58.4	20.4	0
2-19 yrs	Population	44,840	51,904	194,991
	Cases (%)	1 (7)	2 (18)	4 (13)
	Rate*	2.2	3.9	2.1
20-64 yrs	Population	89,863	144,596	412,303
	Cases (%)	6 (43)	3 (27)	19 (59)
	Rate*	6.7	2.1	4.6
65+ yrs	Population	7,116	49,210	47,495
	Cases (%)	4 (29)	5 (45)	9 (28)
	Rate*	56.2	10.2	19
All ages	Population	144,421	250,602	676,987
	Total Cases	14	11	32
	Rate*	9.7	4.4	4.7

\*Number of cases per 100,000 per year

## Race

Race and ethnicity data were collected by N. Canada and the U.S. Arctic. Higher rates of disease occurred in U.S. Arctic Native people than in non-Native people. All GAS cases in N. Canada occurred in Aboriginal people.

### **Group A *Streptococcus* by Race and Age Categories, ICS 2007 Data**

Age (yrs)		N. Canada*		U.S. Arctic	
		Aboriginal	Non-Aboriginal	Native	Non-Native
<2	Population	3,680	1,455	6,670	15,528
	Cases (rate†)	3 (81.5)	0 (0)	0 (0)	0 (0)
2-19	Population	33,205	11,635	49,487	145,504
	Cases (rate†)	1 (3)	0 (0)	2 (4)	2 (1.4)
20-64	Population	42,435	47,431	70,896	341,407
	Cases (rate†)	6 (14.1)	0 (0)	8 (11.3)	11 (3.2)
65+	Population	3,385	3,731	7,828	39,667
	Cases (rate†)	4 (118.2)	0 (0)	5 (63.9)	4 (10.1)
All	Population	82,705	61,716	134,881	542,106
	Cases (rate†)	14 (16.9)	0 (0)	15 (11.1)	17 (3.1)

†Number of cases per 100,000 per year

## Clinical Presentation

The most common clinical presentation for GAS cases in N. Sweden (100%) was bacteremia; in N. Canada and the U.S. Arctic it was cellulitis, 36% and 28% respectively.

### **Clinical Presentation of Reported group A *Streptococcus* Cases, ICS 2007 Data**

	N. Canada n (%)	N. Sweden n (%)	U.S. Arctic n (%)
<b>Bacteremia</b>	4 (29)	11 (100)	6 (19)
<b>Pneumonia*</b>	0 (0)	0 (0)	4 (13)
<b>Meningitis</b>	0 (0)	0 (0)	1 (3)
<b>Empyema</b>	0 (0)	0 (0)	2 (6)
<b>Cellulitis*</b>	5 (36)	0 (0)	9 (28)
<b>Necrotizing fasciitis</b>	1 (7)	0 (0)	1 (3)
<b>Septic arthritis</b>	2 (14)	0 (0)	4 (13)
<b>Osteomyelitis</b>	0 (0)	0 (0)	1 (3)
<b>Epiglottitis</b>	0 (0)	0 (0)	1 (3)
<b>Endometritis</b>	1 (7)	0 (0)	0 (0)
<b>Peritonitis</b>	0 (0)	0 (0)	1 (3)
<b>Endocarditis</b>	0 (0)	0 (0)	1 (3)
<b>Other</b>	1 (7)	0 (0)	1 (3)
<b>Total</b>	14	11	32

\*with bacteremia

## Risk Factors

Alcohol abuse was the most common risk factor associated with adult ( $\geq 18$  years) GAS cases in the U.S. Arctic; it was reported in 28% of cases. In N. Canada, the most common risk factors were chronic lung disease and cigarette smoking which were each reported in 18% of cases. N. Sweden did not report risk factor data.

### **Group A *Streptococcus* Risk Factor/Medical Conditions in Adults\*, ICS 2007 Data**

	<b>N. Canada n (%)</b>	<b>U.S. Arctic n (%)</b>
<b>Cigarette Smoking</b>	2 (18)	7 (24)
<b>Alcohol Abuse</b>	1 (9)	8 (28)
<b>Chronic Lung Disease and/or Asthma</b>	2 (18)	7 (24)
<b>Immunosuppressive Therapy</b>	1 (1)	3 (10)
<b>Diabetes</b>	1 (1)	6 (21)
<b>Injection Drug Use</b>	0 (0)	1 (3)
<b>Asplenia</b>	0 (0)	0 (0)
<b>Total Adult* Cases</b>	11	29

\* $\geq 18$  years

## Outcome

Four deaths in cases with GAS were reported from the U.S. Arctic (CFR 12%); one occurred in the 2-19 years old age category and three occurred in persons  $\geq 65$ . Two deaths were reported in N. Canada (CFR 17%); the deaths occurred one each in the  $<2$  and 65+ year old age categories. N. Sweden did not report case outcome data.

## Conclusions

These data suggest markedly higher rates in indigenous populations. Increased awareness of risk may help target improved treatment responses.

## Group B *Streptococcus*

### Case Demographics

Greenland, N. Canada, N. Sweden and the U.S. Arctic each reported the occurrence of GBS during 2007. A total of 54 cases of invasive disease caused by GBS were reported to ICS. Among regions reporting cases, the rate of disease was highest in N. Sweden (6 per 100,000) compared to N. Canada (0.7 per 100,000). Greenland reported no GBS cases in 2007. Two deaths were reported in the U.S. Arctic associated with GBS in 2007.

### Group B *Streptococcus* Case Demographics, ICS 2007 Data

Country	Population	# Cases	Rate*	Sex M (%)	Median Age (min-max) yrs	Deaths n (CFR†)
Greenland	56,648	0	0	No cases	No cases	No cases
N. Canada	144,421	1	0.7	Unknown	1 case – 55.6	0 (0)
N. Sweden	250,602	15	6	10 (67)	61 (0-86)	‡
U.S. Arctic	676,987	38	5.6	21 (55)	55.5 (0-87.9)	2 (5.4)‡
<b>Total</b>	<b>1,128,658</b>	<b>54</b>	<b>4.8</b>	<b>31 (57)</b>	<b>56.1 (0-87.9)</b>	<b>2 (5.3)</b>

\*Number of cases per 100,000 per year

†Case fatality ratio

‡ Outcome unknown in 1 case from U.S. Arctic; no outcomes reported from N. Sweden

When stratified by age, the highest rates of disease occurred in cases less than two years of age in N. Sweden (61.3/100,000) and the U.S. Arctic (18 per 100,000).

### Group B *Streptococcus* by Age Category, ICS 2007 Data

Age		N. Canada	N. Sweden	U.S. Arctic
<2 yrs	Population	5,135	4,892	22,198
	Cases (%)	0 (0)	3 (20)	4 (11)
	Rate*	0	61.3	18
2-19 yrs	Population	44,840	51,904	194,991
	Cases (%)	0 (0)	0 (0)	0 (0)
	Rate*	0	0	0
20-64 yrs	Population	89,863	144,596	412,303
	Cases (%)	1 (100)	5 (33)	26 (68)
	Rate*	1.1	3.5	6.3
65+ yrs	Population	7,116	49,210	47,495
	Cases (%)	0 (0)	7 (47)	8 (21)
	Rate*	0	14.2	16.8
<b>All ages</b>	Population	144,421	250,602	676,987
	Total Cases	1	15	38
	Rate*	0.7	6	5.6

\*Number of cases per 100,000 per year

There were four cases of early-onset disease (cases less than 7 days old); two in N. Sweden (0.8 cases per 1,000 births) and two in the U.S. Arctic (0.2 cases per 1,000 births).

## Race

Race and ethnicity data were collected in N. Canada and the U.S. Arctic. The overall rate of disease caused by GBS in AK Natives was more than two times that in non-Natives. The single case of GBS reported in N. Canada occurred in a non-Aboriginal person.

### **Group B *Streptococcus* by Race and Age Categories, ICS 2007 Data**

Age (yrs)	N. Canada		U.S. Arctic		
	Aboriginal	Non-Aboriginal	Native	Non-Native	
<2	Population	3,680	1,455	6,670	15,528
	Cases (rate*)	0 (0)	0 (0)	2 (30)	3 (12.9)
2-19	Population	33,205	11,635	49,487	145,504
	Cases (rate*)	0 (0)	0 (0)	0 (0)	0 (0)
20-64	Population	42,435	47,431	70,896	341,407
	Cases (rate*)	0 (0)	1 (2.1)	8 (11.3)	17 (5)
65+	Population	3,385	3,731	7,828	39,667
	Cases (rate*)	0 (0)	0 (0)	4 (51.1)	4 (10.1)
All	Population	82,705	61,716	134,881	542,106
Ages	Cases (rate*)	0 (0)	1 (1.6)	14 (10.4)	23 (4.2)

\*Number of cases per 100,000 per year

## Clinical Presentation

In the U.S. Arctic, bacteremia (29%) was the most common clinical presentation reported for cases of GBS in 2007 followed by septic arthritis (11%), osteomyelitis (11%), and endocarditis (11%). The single case in N. Canada presented with septic arthritis. Fourteen of fifteen cases in N. Sweden were reported as bacteremia which may reflect a difference in reporting practices; one case presented with peritonitis.

### **Clinical Presentation of Reported group B *Streptococcus* Cases, ICS 2007 Data**

	N. Canada n (%)	N. Sweden n (%)	U.S. Arctic n (%)
<b>Bacteremia</b>	0 (0)	14 (93)	11 (29)
<b>Pneumonia*</b>	0 (0)	0 (0)	5 (13)
<b>Meningitis</b>	0 (0)	0 (0)	1 (2.5)
<b>Septic arthritis</b>	1 (100)	0 (0)	4 (10.5)
<b>Cellulitis*</b>	0 (0)	0 (0)	6 (16)
<b>Osteomyelitis</b>	0 (0)	0 (0)	4 (10.5)
<b>Endocarditis</b>	0 (0)	0 (0)	4 (10.5)
<b>Pericarditis</b>	0 (0)	0 (0)	1 (2.5)
<b>Peritonitis</b>	0 (0)	1 (7)	1 (2.5)
<b>Amnionitis</b>	0 (0)	0 (0)	1 (2.5)
<b>Total</b>	1	15	38

\*with bacteremia

## Risk Factors

Forty-four percent of GBS adult ( $\geq 18$  years) cases reviewed in the U.S. Arctic indicated diabetes as a risk factor in 2007; 26% were cigarette smokers and 18% had chronic lung disease or abused alcohol. The GBS case in N. Canada did not indicate any risk factors on review. N. Sweden does not report risk factor data.

## Outcome

Two deaths in cases with GBS were reported in the U.S. Arctic (CFR 5.4%); both deaths occurred in the 20-65 years. No deaths were reported in Canada and N. Sweden did not report case outcome data.

## Conclusions

Guidelines for universal screening of pregnant women for GBS carriage were established in 2002 which have resulted in decreases in early onset disease. Cases continue to occur in older age groups which warrants continued surveillance.

## **CONCLUSIONS**

The ICS program continued to expand in 2007. Monitoring rates of disease and levels of antimicrobial resistance in *S. pneumoniae*, *H. influenzae*, *N. meningitidis*, GAS and GBS via use of the ICS system is important in providing data on groups at risk for disease, measurement of effectiveness of prevention measures, and emerging challenges in serotype distribution and antimicrobial resistance. Efforts to expand ICS to include all circumpolar nations will continue.

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