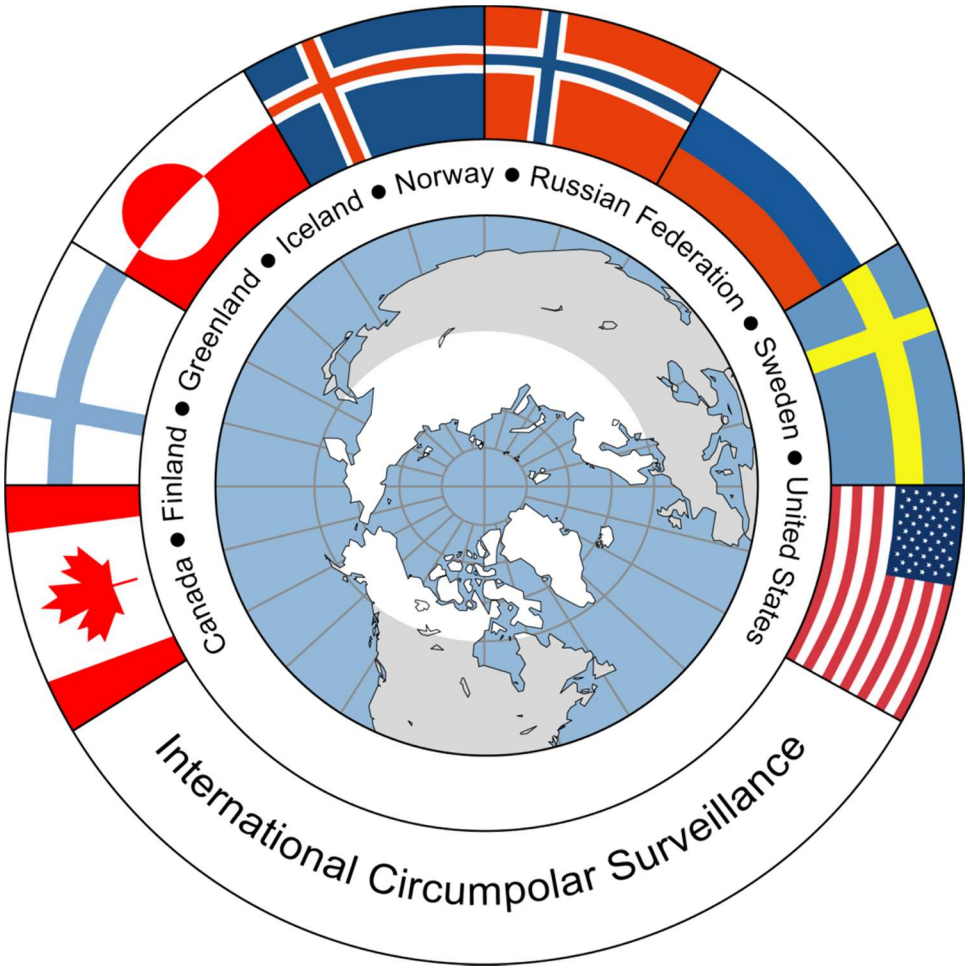
INTERNATIONAL CIRCUMPOLAR SURVEILLANCE (ICS) SUMMARY REPORT



YEAR 2006 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 S*treptococcus* (GAS, GBS). This report reviews the data collected for the year 2006.

Data on invasive disease with the organism *S. pneumoniae* are collected from all participating countries. A total of 2,006 cases of invasive pneumococcal disease were identified in 2006. Overall, rates of invasive *S. pneumoniae* were highest in individuals less than 2 years of age or in persons 65 years and older. Case fatality ratios ranged from 4-29%. Race and ethnicity data are collected only in N. Canada and the U.S. Arctic; rates of invasive pneumococcal disease in Northern Canadian Aboriginals and U.S. Arctic Native populations were 23 and 57 cases per 100,000 population, respectively, which represents an increase in disease from 2005 in both populations. Pneumonia 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 Finland was 14; in Greenland and Iceland the most common serotype was 4, in the U.S. Arctic the most common serotype was 7F; and in N. Canada the most common serotype was 8.

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 113 *H. influenzae* cases, 42 *N. meningitidis* cases, 60 GAS cases, and 44 GBS cases were reported in 2006. 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.

Surveillance Organisms Reported by Country, ICS 2006 Data

Country	*S. pneumoniae* n (rate*)	*H. influenzae* n (rate*)	*N. meningitidis* n (rate*)	GAS n (rate*)	GBS n (rate*)
Finland	745 (14.1)	N/A	N/A	N/A	N/A
Greenland	8 (14.1)	0 (0)	0 (0)	0 (0)	1 (1.8)
Iceland	52 (17.1)	N/A	N/A	N/A	N/A
N. Canada	27 (18.8)	15 (10.5)	5 (3.5)	18 (12.5)	2 (1.4)
N. Sweden	61 (12)†	2 (0.8)‡	0 (0)‡	3 (1.2)‡	16 (6.4)‡
Norway	974 (21)	76 (1.6)	34 (0.7)	N/A	N/A
U.S. Arctic	139 (20.7)	20 (3)	3 (0.4)	39 (5.8)	25 (3.7)
Total	2,006 (17.3)	113 (2)	42 (0.7)	60 (5.3)	44 (3.9)

*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 2006

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

- Serotyping is performed at the KTL laboratory by counter-immune-electrophoresis.

- Population estimates for 2006 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 2006 were obtained from the website http://www.statgreen.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 Landspitali 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 2006 were obtained from the website http://www.hagstofa.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 Laborador.
  - 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 2006 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 2006 were obtained from the website 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 2006 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-specfic 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 2006 were obtained from the website http://www.labor.state.ak.us

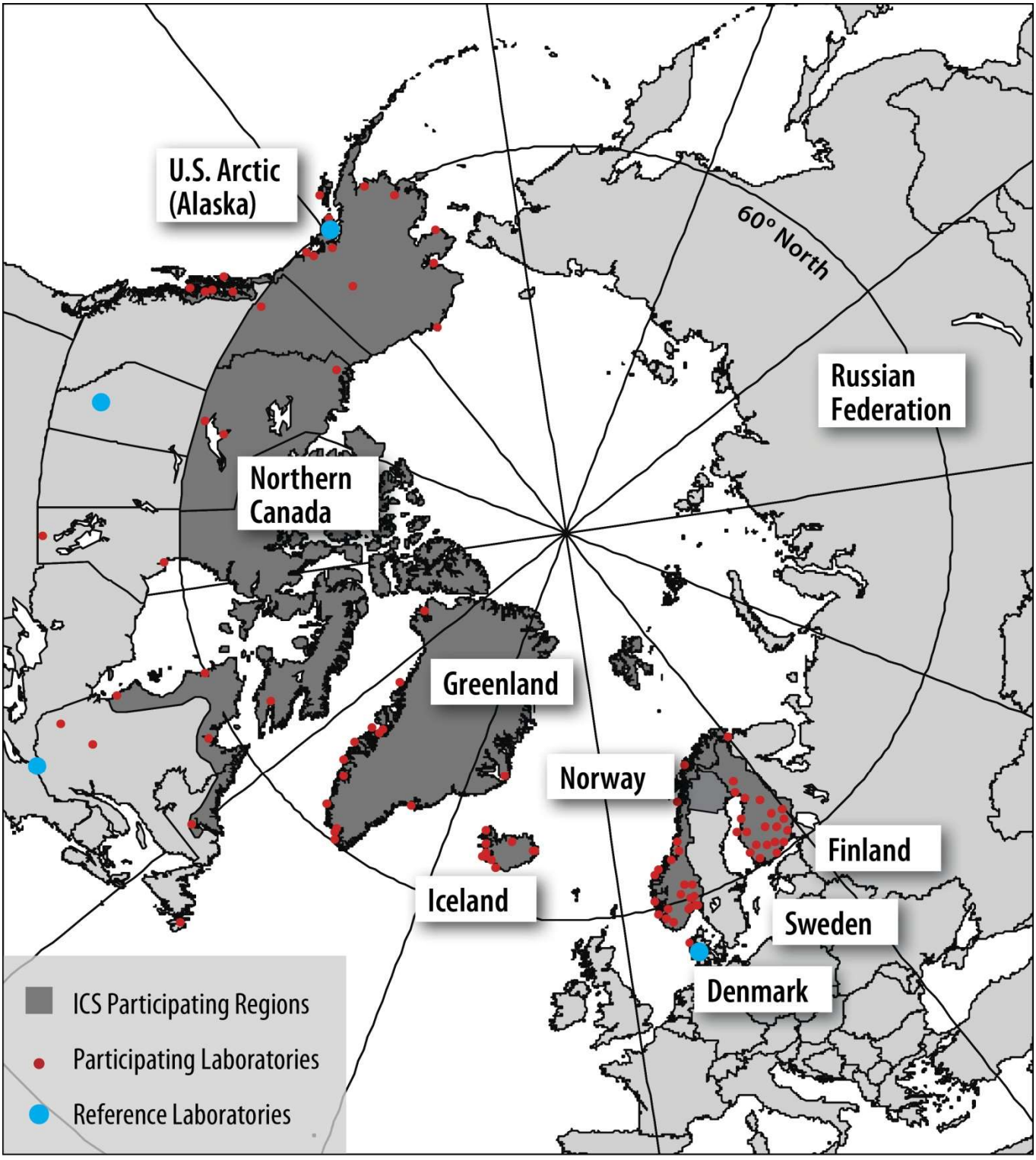
Quality Control

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. This year, the Landspitali University Hospital in Reykjavik, Iceland, joined the program.

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 2006. 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 $\log_2$ 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 2006



RESULTS

Streptococcus pneumoniae

Case Demographics

A total of 2,006 cases of invasive disease caused by *S. pneumoniae* were reported to ICS during 2006 by Finland, Greenland, Iceland, N. Canada, N. Sweden, Norway, and the U.S. Arctic. The highest rates of disease (21 per 100,000) occurred in Norway and the U.S. Arctic and the lowest in N. Sweden (12 per 100,000) with an overall rate for the ICS circumpolar region of 17.3 per 100,000; 54% of all cases occurred in males. The median age of cases overall was 60 years with the lowest median age in N. Canada (31 years) and the highest in Norway (65 years). Case fatality ratios ranged from 4% in N. Canada to 29% in Greenland; the overall case fatality ratio was 11%.

***Streptococcus pneumoniae* Case Demographics, ICS 2006 Data**

Country	Population	# Cases	Rate*	Sex M (%)	Median Age (min-max) yrs	Deaths n (CFR†)
Finland	5,276,955	745	14.1	427 (57)	56 (0-101)	‡
Greenland	56,901	8	14.1	4 (50)	51 (0-77)	2 (28.6)[b]
Iceland	304,334	52	17.1	30 (58)	56 (0.7-99)	6 (11.5)
N. Canada	143,444	27	18.8	12 (44)	31 (0.3-87)	1 (3.9)[b]
N. Sweden	509,467[a]	61	12	26 (43)	64 (1-92)	‡
Norway	4,640,219	974	21	499 (51)	65 (0-99)	55 (12.2)[b]
U.S. Arctic	670,053	139	20.7	77 (55)	46 (0-102)	12 (8.7)[b]
Total	11,601,373	2,006	17.3	1,075 (54)	60 (0-102)	76 (11.3)

*Number of cases per 100,000 per year
†Case fatality ratio
‡Case outcomes not reported from Finland, N. Sweden
[a] Population for Norbotten and Vasterbotten
[b] Case outcomes unknown in 1 case from Greenland, 1 case from N. Canada, 522 cases from Norway, 1 case from U.S. Arctic

***Streptococcus pneumoniae* by Age Category, ICS 2006 Data**

Age		Finland	Greenland	Iceland	N. Canada	N. Sweden	Norway	U.S. Arctic
<2 yrs	Pop	116,829	1,737	8,720	5,071	10,315	114,729	21,099
	N (%)	82 (11)	1 (12.5)	6 (11.5)	7 (26)	3 (5)	68 (7)	30 (22)
	Rate*	70.2	57.6	68.8	138	29.1	59.3	142.2
2-19 yrs	Pop	1,109,699	16,922	79,374	45,078	107,613	1,091,257	194,387
	N (%)	49 (7)	0 (0)	3 (6)	3 (6)	3 (5)	54 (5)	15 (11)
	Rate*	4.4	0	3.8	6.7	2.8	5	7.7
20-64 yrs	Pop	3,181,710	34,972	180,981	86,460	296,997	2,751,764	409,078
	N (%)	343 (46)	6 (75)	24 (46)	15 (56)	25 (41)	378 (39)	63 (45)
	Rate*	10.8	17.2	13.3	17.4	8.4	13.7	15.4
65+ yrs	Pop	868,717	3,270	35,259	6,835	94,542	682,469	45,489
	N (%)	271 (36)	1 (12.5)	19 (36.5)	2 (7)	30 (49)	474 (49)	31 (22)
	Rate*	31.2	30.6	53.9	29.3	31.7	69.5	68.2
All ages	Pop	5,276,955	56,901	304,334	143,444	509,467	4,640,219	670,053
	N	745	8	52	27	61	974	139
	Rate*	14.1	14.1	17.1	18.8	12	21	20.7

*Number of cases per 100,000 per year

When stratified by age, the highest rates of disease in all countries occurred in those cases less than two years of age and in cases 65+ years of age.

Seasonality

S. pneumoniae was diagnosed throughout the year in 2006 in each country. For all countries except N. Canada, higher proportions of disease were seen in the first and second quarters of the year with declines during the third quarter and rising again during the fourth quarter. In N. Canada, the highest proportion of cases was seen in the first quarter and the lowest in the second quarter of the year.

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 than in non-Aboriginal and non-Native populations with the exception of non-Aboriginals less than 2 years old in N. Canada. 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 2006 Data**

Age (yrs)		N. Canada*		U.S. Arctic	
		Aboriginal	**Non-Aboriginal**	**Native**	**Non-Native**
<2	Population	3,680	1,391	6,252	14,847
	Cases (rate‡)	5 (135.9)	1 (71.9)	21 (335.9)	9 (60.6)
2-19	Population	33,205	11,873	48,594	145,793
	Cases (rate‡)	3 (9)	0 (0)	8 (16.5)	7 (4.8)
20-64	Population	42,435	44,025	68,553	340,525
	Cases (rate‡)	9 (21.2)	4 (9.1)	33 (48.1)	30 (8.8)
65+	Population	3,385	3,450	7,603	37,886
	Cases (rate‡)	2 (59.1)	0 (0)	12 (157.8)	19 (50.2)
All Ages	Population	82,705	60,739	131,002	539,051
	Cases (rate‡)	19 (23)	5 (8.2)	74 (56.5)	65 (12.1)

*Race unknown in 1 case < 2 years, 2 cases 20-64 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 Iceland, Finland and N. Sweden *S. pneumoniae* data. In N. Canada, Norway, and the U.S. Arctic the clinical presentation reported most often was pneumonia (81%, 51% and 67%, respectively); in Finland, Iceland and N. Sweden it was bacteremia (96%, 97% and 96%, respectively) and in Greenland both bacteremia and meningitis were reported in 37.5% of cases.

Clinical Presentation of Reported *Streptococcus pneumoniae* Cases, ICS 2006 Data

	Finland n (%)	Greenland n (%)	Iceland n (%)	N Canada n (%)	N Sweden n (%)	Norway n (%)	US Arctic n (%)
Pneumonia*	0 (0)	0 (0)	0 (0)	22 (81)	0 (0)	495 (51)	93 (67)
Bacteremia	712 (96)	3 (37.5)	48 (92)	3 (11)	56 (92)	362 (37)	24 (17)
Meningitis	33 (4)	3 (37.5)	4 (8)	1 (4)	5 (8)	81 (8)	12 (9)
Empyema	0 (0)	1 (12.5)	0 (0)	0 (0)	0 (0)	0 (0)	7 (5)
Septic arthritis	0 (0)	0 (0)	0 (0)	1 (4)	0 (0)	4 (<1)	0 (0)
Endocarditis	0 (0)	1 (12.5)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Cellulitiis	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (1)
Other	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	32 (3)	1 (1)
Total Cases	745	8	52	27	61	974	139

*with bacteremia

Risk Factors

Greenland, N. Canada and the U.S. Arctic report 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 14 to 55% of patients.

***Streptococcus pneumoniae* Risk Factor/Medical Conditions in Adults*, ICS 2006 Data**

	Greenland n (%)	N. Canada n (%)	U.S. Arctic n (%)
Cigarette Smoking	0 (0)	9 (50)	43 (46)
Alcohol Abuse	1 (14)	10 (55)	36 (38)
Chronic Lung Disease and/or Asthma	1 (14)	2 (11)	29 (31)
Immunosuppressive Therapy	0 (0)	0 (0)	5 (5)
Diabetes	0 (0)	4 (22)	14 (15)
Injection Drug Use	0 (0)	1 (6)	1 (1)
Asplenia	0 (0)	0 (0)	0 (0)
Total Adult* Cases	7	18	94

*≥ 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

Twenty-nine and 87 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 4% of cases eligible for

PS23 in Norway were vaccinated indicating much less frequent use of this vaccine than in N. Canada and the U.S. Arctic. Vaccine coverage data was not reported from Finland and Iceland.

***Streptococcus pneumoniae* Case Vaccination Status for Pneumococcal Vaccine, ICS 2006 Data**

	N. Canada	Norway	U.S. Arctic
Total cases eligible for PCV7 vaccine*	7	[a]	30
Vaccine status known in cases eligible for PCV7	7	[a]	30
Cases eligible for PCV7 vaccinated (%)†	2 (29)	[a]	26 (87)
Total cases eligible for PS23 vaccine‡	2	474	43
Vaccine status known in cases eligible for PS23	2	149	23
Cases eligible for PS23 vaccinated (%)†	2 (100)	6 (4)	21 (91)

*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
[a]PCV7 is not used routinely in Norway

Serotypes

The *S. pneumoniae* serotypes reported by ICS regions in 2006 are listed in the following table; yellow highlights the most common serotypes in each country. Serotypes 4 and 14, both 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 2006 (Finland, Greenland, Iceland, N. Sweden).

***Streptococcus pneumoniae* Serotypes by Country, ICS 2006 Data**

Serotype	Finland n (%)	Greenland n (%)	Iceland n (%)	N. Canada† n (%)	N. Sweden* n (%)	U.S. Arctic† n (%)
1	4 (<1)	0 (0)	3 (6)	0 (0)	1 (4)	1 (<1)
3	46 (6)	0 (0)	3 (6)	1 (4)	1 (4)	7 (5)
4‡	87 (11)	2 (40)	9 (17)	1 (4)	0 (0)	3 (2)
6	0 (0)	0 (0)	0 (0)	0 (0)	7 (28)	0 (0)
6A	26 (3)	0 (0)	3 (6)	2 (8)	0 (0)	4 (3)
6B‡	72 (10)	0 (0)	3 (6)	2 (8)	0 (0)	1 (<1)
6C	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	2 (2)
7	0 (0)	0 (0)	0 (0)	0 (0)	4 (16)	0 (0)
7C	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (<1)
7F	43 (6)	0 (0)	5 (10)	0 (0)	0 (0)	23 (17)
8	7 (1)	0 (0)	0 (0)	4 (15)	0 (0)	13 (10)
9	0 (0)	0 (0)	0 (0)	0 (0)	1 (4)	0 (0)
9N	27 (4)	0 (0)	0 (0)	0 (0)	0 (0)	3 (2)
9V‡	35 (5)	0 (0)	6 (12)	1 (4)	0 (0)	1 (<1)
10	3 (<1)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
10A	0 (0)	0 (0)	0 (0)	1 (4)	0 (0)	1 (<1)
10F	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (<1)
11	0 (0)	0 (0)	0 (0)	0 (0)	2 (8)	0 (0)
11A	9 (1)	0 (0)	0 (0)	0 (0)	0 (0)	1 (<1)
12F	9 (1)	0 (0)	0 (0)	2 (8)	0 (0)	12 (9)
13	1 (<1)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
14	154 (20)	0 (0)	4 (8)	0 (0)	4 (16)	2 (2)

Serotype	Finland n (%)	Greenland n (%)	Iceland n (%)	N. Canada† n (%)	N. Sweden* n (%)	U.S. Arctic† n (%)
15	0 (0)	0 (0)	1 (2)	0 (0)	0 (0)	0 (0)
15A	3 (<1)	0 (0)	0 (0)	0 (0)	0 (0)	4 (3)
15B	1 (<1)	0 (0)	0 (0)	0 (0)	0 (0)	1 (<1)
15C	7 (1)	0 (0)	0 (0)	0 (0)	0 (0)	1 (<1)
16	2 (<1)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
16F	0 (0)	0 (0)	0 (0)	3 (12)	0 (0)	2 (2)
17	5 (<1)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
17F	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	3 (2)
18	0 (0)	0 (0)	0 (0)	0 (0)	1 (4)	0 (0)
18B	1 (<1)	0 (0)	1 (2)	0 (0)	0 (0)	0 (0)
18C‡	32 (4)	0 (0)	0 (0)	2 (8)	0 (0)	0 (0)
19A	30 (4)	1 (20)	1 (2)	2 (8)	0 (0)	19 (14)
19F‡	37 (5)	0 (0)	0 (0)	1 (4)	0 (0)	0 (0)
20	2 (<1)	0 (0)	0 (0)	0 (0)	0 (0)	5 (4)
22	0 (0)	0 (0)	1 (2)	0 (0)	0 (0)	0 (0)
22F	21 (3)	2 (40)	0 (0)	0 (0)	0 (0)	4 (3)
23	5 (<1)	0 (0)	0 (0)	0 (0)	3 (12)	0 (0)
23A	0 (0)	0 (0)	3 (6)	0 (0)	0 (0)	3 (2)
23B	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	3 (2)
23F‡	58 (8)	0 (0)	8 (15)	2 (8)	0 (0)	0 (0)
28	1 (<1)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
31	4 (<1)	0 (0)	0 (0)	0 (0)	0 (0)	1 (<1)
33	5 (<1)	0 (0)	1 (2)	0 (0)	0 (0)	0 (0)
33A	0 (0)	0 (0)	0 (0)	1 (4)	0 (0)	1 (<1)
33F	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	3 (2)
34	3 (<1)	0 (0)	0 (0)	0 (0)	0 (0)	2 (2)
35	0 (0)	0 (0)	0 (0)	0 (0)	1 (4)	0 (0)
35B	7 (1)	0 (0)	0 (0)	0 (0)	0 (0)	2 (2)
35F	10 (1)	0 (0)	0 (0)	0 (0)	0 (0)	3 (2)
NT	0 (0)	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, more than 78% of *S. pneumoniae* cases in persons ≥ 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 88% of *Strep pneumoniae* cases in children < 2 years of age in Iceland and 84% of cases < 2 years of age in Finland. 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 five years earlier 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 50% to 64%.

Proportion of Vaccine Preventable Cases/Deaths from Invasive Pneumococcal Disease, ICS 2006 Data

	Finland n/Denom* (%)	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	618/696 (89)	4/4 (100)	36/44 (82)	16/20 (80)	82/105 (78)
Cases < 2 years old with serotype in the 7-valent pneumococcal conjugate vaccine	51/61 (84)	0/1 (0)	7/8 (88)	3/8 (38)	0/29 (0)
Deaths (all ages) for which the serotype was contained in the 23-valent pneumococcal vaccine	†	1 (50‡)	†	1 (50‡)	7 (64‡)

*Number of isolates serotyped by country by age group
†Serotype data not matched with case data in Finland; outcome data not reported in Iceland
‡Percentage of total death

Outcome

A total of 76 deaths associated with *S. pneumoniae* were reported to ICS in 2006. Overall, the highest case fatality ratio (CFR) occurred in persons 65+ years of age (19%). Finland and N. Sweden did not report outcome data.

***Streptococcus pneumoniae* Age-Specific Case-Fatality Ratios (CFR), ICS 2006 Data**

		<2 years	2-19 years	20-64 years	65+ years	All Ages
Greenland	Deaths/Cases*	0/1	0/0	2/5†	0/1	2/7
	(CFR)	(0%)	(0%)	(40%)	(0%)	(29%)
Iceland	Deaths/Cases*	1/6	0/3	0/24	5/19	6/52
	(CFR)	(17%)	(0%)	(0%)	(26%)	(12%)
N. Canada	Deaths/Cases*	0/7	0/3	0/14†	1/2	1/26
	(CFR)	(0%)	(0%)	(0%)	(50%)	(4%)
Norway	Deaths/Cases*	2/38†	1/29†	15/169†	37/216†	55/452
	(CFR)	(5%)	(3%)	(9%)	(17%)	(12%)
U.S. Arctic	Deaths/Cases*	1/30	1/15	4/63	6/30†	12/138
	(CFR)	(3%)	(7%)	(6%)	(20%)	(9%)
Total	Deaths/Cases*	4/77	2/47	21/251	49/254	76/629
	(CFR)	(5%)	(4%)	(8%)	(19%)	(12%)

*Cases with known outcome.
†Outcome unknown in (30) Norway cases < 2 years; (25) Norway cases 2-19 years; (1) Greenland, (1) N. Canada, and (209) Norway cases 20-64 years; (258) Norway and (1) US Arctic cases 65+ years

Antimicrobial Susceptibility

In 2006, antimicrobial susceptibility results were reported to ICS from Finland, Greenland, Iceland, N. Canada, N. Sweden and the U.S. Arctic. Of those isolates tested from the U.S. Arctic, five (4%) were fully resistant to penicillin (serotypes 6A, 6B, 9V, 19A, 35B), 18% had intermediate resistance. The isolates that showed intermediate resistance were serotypes 6A (8%), 14 (4%), 19A (64%), 23A (12%), 23B (4%), 35B (4%) and NT (4%). Finland submitted results from 745 isolates; 2% were fully resistant to penicillin and 5.5% had intermediate resistance. The Finnish serotype data is not linked to the antimicrobial susceptibility data, so no comparisons can be made. In Iceland, 4% of isolates tested had intermediate resistance to penicillin and consisted of serotypes 6B (50%) and 9V (50%). In N. Canada, one isolate had intermediate resistance (serotype

19A). N. Sweden did not report serotype data; 61 isolates were tested and one had intermediate resistance to penicillin.

***Streptococcus pneumoniae* Penicillin Susceptibility Results, ICS 2006 Data**

	# Tested	I* (%)	I* Serotypes	R* (%)	R* Serotypes
Finland	745	41 (5.5)	†	15 (2)	†
Greenland	6	0 (0)		0 (0)	
Iceland	51	2 (4)	6B (1), 9V (1)	0 (0)	
N. Canada	26	1 (4)	19A	0 (0)	
N. Sweden	61	1 (2)	‡	0 (0)	
U.S. Arctic	134	25 (18)	6A (2), 14 (1), 19A (11), 23A (3), 23B (1), 35B (1), NT (1)	5 (4)	6A (1), 6B (1), 9V (1), 19A (1), 35B (1)

*I=Intermediate resistance, R=Fully resistant
†Finnish serotype data is not linked to antimicrobial susceptibility data
‡Serotypes not provided

Full resistance to trimethoprimsulfamethoxizole (TMP-Sulfa) was found in 17% of tested isolates from Iceland 12% from N. Canada and the U.S. Arctic and 7% from N. Sweden. Isolates from Iceland that were fully resistant to TMP-Sulfa were serotypes 9V (44%), 23F (22%), and one each of serotypes 6A, 6B and 19A. Fully resistant isolated in N. Canada were 6A (67%) and 9V (33%). The isolates that were fully resistant in the U.S. Arctic were serotypes 6A (9%), 19A (44%) 33F (19%) and one each 6B, 6C, 9V and 14. Intermediate resistance to TMP-Sulfa was found in 4% of tested isolates from Iceland and 7.5% from the U.S. Arctic.

***Streptococcus pneumoniae* TMP-Sulfa Susceptibility Results, ICS 2006 Data**

	# Tested	I* (%)	I* Serotypes	R* (%)	R* Serotypes
Iceland	52	2 (4)	23F (2)	9 (17)	6A (1), 6B (1), 9V (4), 19A (1), 23F (2)
N. Canada	25	0 (0)		3 (12)	6A (2), 9V (1)
N. Sweden	28	0 (0)		2 (7)	†
U.S. Arctic	134	10 (7.5)	8 (1), 12F (5), 19A (3), 23B (1)	16 (12)	6A (2), 6B (1), 6C (1), 9V (1), 14 (1), 19A (7), 33F (3)

*I=Intermediate resistance, R=Fully resistant
†Serotypes not provided

In Iceland and N. Sweden, 10% of tested isolates were fully resistant to erythromycin, 6% from the U.S. Arctic and 4% from N. Canada, In Iceland, the isolates that were fully resistant to erythromycin were serotypes 14 (80%) and 6B (20%). In N. Canada, the resistant isolate was a serotype 14. In the U.S. Arctic, isolates that were fully resistant were serotypes 6A (33%), 14 (22%) and one each 6B, 9V, 17F and non-typeable (NT).

***Streptococcus pneumoniae* Erythromycin Susceptibility Results, ICS 2006 Data**

	# Tested	I* (%)	I* Serotypes	R* (%)	R* Serotypes
Iceland	52	0 (0)		5 (10)	6B (1), 14 (4)
N. Canada	25	0 (0)		1 (4)	14
N. Sweden	61	0 (0)		6 (10)	†
U.S. Arctic	134	0 (0)		9 (6)	6A (3), 6B (1), 9V (1), 14 (2), 17F (1), NT (1)

*I=Intermediate resistance, R=Fully resistant
†Serotypes not provided

Antimicrobial testing was also done for ceftriaxone, ofloxacin/levofloxacin, chloramphenicol, vancomycin, clindamycin, and rifampin. One of 134 (<1%) isolates tested in the U.S. Arctic was fully resistant to ceftriaxone (serotype 9V) and two (1.5%) were fully resistant to levofloxacin (serotype 17F and NT). One of 52 (2%) isolates tested in Iceland was fully resistant to chloramphenicol (serotype 6B). Two of 36 (6%) isolates tested in N. Sweden were fully resistant to clindamycin. All isolates tested in N. Canada, N. Sweden and the U.S. Arctic were sensitive to rifampin and vancomycin.

Quality Control

In 2006, two QC panels of seven *S. pneumoniae* isolates plus a control strain each were shipped and tested. Iceland joined the QC program starting with the 2006-B panel. 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 $\log_2$ 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 2006-A, overall serogrouping performance was 100%; for one isolate there was disagreement on the factor typing. The modal MIC comparison resulted in an overall correlation of 94% with individual participant correlation ranging from 71%-100%. Some variances of more than one $\log_2$ dilution for this distribution were due to differences in testing methodology. With this taken in account the modal MIC comparison resulted in a good overall correlation of 97%, with individual lab correlation ranging from 89% to 100%. For Panel 2006-B, overall serotyping correlation was 100%. The overall modal MIC correlation was 89% with individual correlation ranging from 75%-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 (Norbotten), Norway and the U.S. Arctic reported the occurrence of *H. influenzae* in each country during 2006. Greenland reported no cases. A total of 113 cases of invasive disease caused by *H. influenzae* were reported to ICS during 2006 by N. Canada, N. Sweden (Norbotten), Norway and the U.S. Arctic. The highest rate of disease among regions reporting cases was in N. Canada (10.5 per 100,000) and the lowest in N. Sweden (0.8/100,000). Median age of cases was highest in Norway (72.1 years) and lowest in N. Canada (1.2 years).

***Haemophilus influenzae* Case Demographics, ICS 2006 Data**

Country	Population	# Cases	Rate*	Sex M (%)	Median Age (min-max) yrs	Deaths n (CFR†)
Greenland	56,901	0	0	No cases	No cases	No cases
N. Canada	143,444	15	10.5	9 (60)	1.2 (0.2-72.7)	0 (0%)‡
N. Sweden	251,886	2	0.8	1 (50)	37.3 (14-60.3)	‡
Norway	4,640,219	76	1.6	35 (46)	72.1 (0-95.9)	5 (8%)‡
U.S. Arctic	670,053	20	3	12 (60)	45.7 (0-73.1)	4 (20%)
Total	5,762,503	113	2	57 (50)	62.4 (0-95.9)	8 (8%)

*Number of cases per 100,000 per year
†Case fatality ratio
‡ Case outcome unknown in (2) N. Canada, (8) 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 and 65+ years age categories; 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 2006 Data**

Age		N. Canada	N. Sweden	Norway	U.S. Arctic
<2 yrs	Population	4,849	4,839	114,729	21,099
	Cases (%)	8 (53)	0 (0)	2 (3)	7 (35)
	Rate*	157.8	0	1.7	33.2
2-19 yrs	Population	44,845	52,842	1,091,257	194,387
	Cases (%)	2 (13)	1 (50)	4 (5)	2 (10)
	Rate*	4.4	1.9	0.4	1
20-64 yrs	Population	77,823	145,589	2,751,764	409,078
	Cases (%)	2 (13)	1 (50)	27 (35.5)	8 (40)
	Rate*	2.3	0.7	1	2
65+ yrs	Population	5,439	48,616	682,469	45,489
	Cases (%)	3 (20)	0 (0)	43 (56.5)	3 (15)
	Rate*	43.9	0	6.3	6.6
All ages	Population	143,444	251,886	4,640,219	670,053
	Cases	15	2	76	20
	Rate*	10.5	0.8	1.6	3

*Number of cases per 100,000 per year

Race

Rates of disease were highest (217.4 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.

***Haemophilus influenzae* by Race and Age Categories, ICS 2006 Data**

Age (yrs)		N. Canada		U.S. Arctic	
		Aboriginal	Non-Aboriginal	Native	Non-Native
<2	Population	3,680	1,391	6,252	14,847
	Cases (rate†)	8 (217.4)	0 (0)	6 (96)	1 (6.7)
2-19	Population	33,205	11,873	48,594	145,793
	Cases (rate†)	2 (6)	0 (0)	2 (4.1)	0 (0)
20-64	Population	42,435	44,025	68,553	340,525
	Cases (rate†)	2 (4.7)	0 (0)	3 (4.4)	5 (1.5)
65+	Population	3,385	3,450	7,603	37,886
	Cases (rate†)	3 (88.6)	0 (0)	2 (26.3)	1 (2.6)
All Ages	Population	82,705	60,739	131,002	539,051
	Cases (rate†)	15 (18.1)	0 (0)	13 (9.9)	7 (1.3)

†Number of cases per 100,000 per year

Clinical Presentation

In N. Canada, Norway and the U.S. Arctic, the most common clinical presentation associated with *H. influenzae* was pneumonia (40%, 46% and 50% of reported cases, respectively). In N. Sweden, the most common clinical presentation was bactermia (100%).

Clinical Presentation of Reported *Haemophilus influenzae* Cases, ICS 2006 Data

	N. Canada n (%)	N. Sweden n (%)	Norway n (%)	U.S. Arctic n (%)
Pneumonia*	6 (40)	0 (0)	35 (46)	10 (50)
Bacteremia	5 (33)	2 (100)	28 (37)	6 (30)
Meningitis	2 (13)	0 (0)	5 (7)	3 (15)
Septic arthritis	2 (13)	0 (0)	1 (1)	0 (0)
Other/Unknown	0 (0)	0 (0)	7 (9)	1 (5)
Total	15	2	76	20

*with bacteremia

Risk Factors

Fifty percent of adult (≥ 18 years) cases of *H. influenzae* reported in the U.S. Arctic indicated smoking or alcohol abuse as an associated risk factor; 40% indicated chronic lung disease, 20% diabetes and 10% immune suppressive treatment as an associated risk factor. Twenty percent of adult N. Canadian *H. influenzae* cases reported smoking, chronic lung disease or alcohol abuse 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. Three cases of Hib were reported in N. Canada and one case in the U.S. Arctic in children less than five years. All Hib cases in N. Canada and the U.S. Arctic 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 2006 Data**

	N. Canada	U.S. Arctic
Total cases* eligible for Hib vaccine†	10	8
Vaccine status known in cases* eligible for Hib vaccine	10	8
Cases* eligible for Hib vaccine vaccinated (%)‡	9 (90%)	7 (87.5%)

*All serotypes
†Children less than 5 years of age
‡Percent of vaccine status known cases

Serotypes

***Haemophilus influenzae* Serotypes by Country, ICS 2006 Data**

Serotype	N. Canada n (%)	Norway n (%)	U.S. Arctic n (%)
a	6 (40)	0 (0)	2 (11)
b	4 (27)	2 (3)	3 (16)
c	1 (6.5)	0 (0)	0 (0)
d	1 (6.5)	0 (0)	1 (5)
e	0 (0)	0 (0)	1 (5)
f	0 (0)	12 (21)	4 (21)
Non-b	0 (0)	10 (17)	0 (0)
Non-typeable	3 (20)	34 (59)	8 (42)
Total	15	58	19

The most common *H. influenzae* serotype in N. Canada was type a (40% of cases), in Norway it was type f (21% of cases) and in the U.S. Arctic it was type f (21% of cases). Non-typeable cases also made up a large proportion of cases in each country; 20% in N. Canada, 59% in Norway and 42% in the U.S. Arctic. N. Sweden did not provide serotype data.

Outcome

Nine deaths were associated with *H. influenzae* cases reported to ICS in 2006; four from the U.S. Arctic and five from Norway. No deaths were reported in N. Canada and N. Sweden did not provide outcome data. In the U.S. Arctic, 2 deaths were in children less than 5 years old and 2 in persons greater than 40 years old. The serotypes in the cases from children less than 5 years old were 1 a and 1 non-typeable; in the adults the serotypes were all non-typeable. In Norway, all cases occurred in persons greater than 70 years of age; the serotypes included 1 f, 3 non-typeable and 1 unknown. Clinical presentations included pneumonia and bacteremia in both the U.S Arctic and Norway.

Quality Control

Two QC panels of five *H. influenzae* and *N. meningitidis* isolates were shipped and serogrouped or serotyped. The single discrepant result may have been the result of an unintentional switching of the isolates at the time of shipping or receiving [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. 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 2006. A total of 42 cases of invasive disease caused by *N. meningitidis* were reported to ICS; no cases occurred in Greenland or N. Sweden in 2006. N. Canada had the highest disease rate (3.5 per 100,000). Eight deaths associated with *N. meningitidis* were reported.

***Neisseria meningitidis* Case Demographics, ICS 2006 Data**

Country	Population	# Cases	Rate*	Sex M (%)	Median Age (min-max) yrs	Deaths n (CFR†)
Greenland	56,901	0	0	No cases	No cases	No cases
N. Canada	143,444	5	3.5	1 (20)	0.9 (0.1-44)	1 (20%)
N. Sweden	251,886	0	0	No cases	No cases	No cases
Norway	4,640,219	34	0.7	15 (44)	19.5 (0.7-87)	7 (21%)‡
U.S. Arctic	670,053	3	0.4	1 (33)	2 (1.9-25.7)	0 (0%)
Total	5,762,503	42	0.7	17 (40.5)	19 (0.1-87)	8 (19.5%)

*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 in each country occurred in the less than 2 years old age category, ranging from 2.6/100,000 in Norway to 78.9/100,000 in N. Canada.

***Neisseria meningitidis* by Age Category, ICS 2006 Data**

Age		N. Canada	Norway	U.S. Arctic
<2 yrs	Pop	5,071	114,729	21,099
	N (%)	4 (80)	3 (9)	1 (33.3)
	Rate*	78.9	2.6	4.7
2-19 yrs	Pop	45,078	1,091,257	194,387
	N (%)	0 (0)	14 (41)	1 (33.3)
	Rate*	0	1.3	0.5
20-64 yrs	Pop	86,460	2,751,764	409,078
	N (%)	1 (20)	10 (29)	1 (33.3)
	Rate*	1.2	0.4	0.2
65+ yrs	Pop	6,835	682,469	45,489
	N (%)	0 (0)	7 (21)	0 (0)
	Rate*	0	1	0
All ages	Pop	143,444	4,640,219	670,053
	N	5	34	3
	Rate*	3.5	0.7	0.4

*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 one in a non-Native person (rate 0.2/100,000). In N. Canada, four cases occurred in Aboriginal people (rate 5.3/100,000) and one in a non-Aboriginal person (rate 1.9/100,000).

Clinical Presentation

The most common clinical presentation in all countries reporting invasive *N. meningitis* in 2006 was meningitis ranging from 40% to 67% of cases.

Clinical Presentation of Reported *Neisseria meningitidis* Cases, ICS 2006 Data

	N. Canada n (%)	Norway n (%)	U.S. Arctic n (%)
Pneumonia*	1 (20)	1 (3)	0 (0)
Bacteremia	1 (20)	15 (44)	1 (33)
Meningitis	2 (40)	17 (50)	2 (67)
Septic arthritis	1 (20)	1 (3)	0 (0)
Total	5	34	3

*with bacteremia

Risk Factors

Risk factor data was reported by N. Canada and the U.S. Arctic; chronic lung disease and alcohol abuse were each reported in one adult case in N. Canada.

Serogroups

All cases of invasive *N. meningitidis* reported to ICS in 2006 included serogroup data. The most common serogroup in all countries was B which occurred in 67% to 80% of cases.

***Neisseria meningitidis* Serogroups by Country, ICS 2006 Data**

Serogroup	N. Canada n (%)	Norway n (%)	U.S. Arctic n (%)
A	0 (0)	1 (3)	0 (0)
B	4 (80)	27 (79)	2 (67)
C	1 (20)	1 (3)	0 (0)
W135	0 (0)	1 (3)	0 (0)
Y	0 (0)	4 (12)	1 (33)
Total	5	34	3

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 and the U.S. Arctic each reported the occurrence of GAS during 2006. A total of 60 cases of invasive disease caused by GAS were reported to ICS; no cases occurred in Greenland in 2006. The rate of disease among regions reporting cases was highest in N. Canada (12.5 per 100,000) compared to the lowest in N. Sweden (1.2 per 100,000). Four deaths were associated with GAS, one in N. Canada and three in the U.S. Arctic.

Group A *Streptococcus* Case Demographics, ICS 2006 Data

Country	Population	# Cases	Rate*	Sex M (%)	Median Age (min-max) yrs	Deaths n (CFR†)
Greenland	56,901	0	0	No cases	No cases	No cases
N. Canada	143,444	18	12.5	12 (67)	43.5 (0.7-83)	1 (5.6%)
N. Sweden	251,886	3	1.2	2 (67)	42.6 (33.2-80.8)	‡
U.S. Arctic	670,053	39	5.8	21 (54)	39.6 (0.8-93.4)	3 (7.9%)[a]
Total	1,122,284	60	5.3	35 (58)	41.3 (0.7-93.4)	4 (6.8%)[a]

*Number of cases per 100,000 per year
†Case fatality ratio
‡Outcomes not reported from N. Sweden
[a] Outcome unknown in 1 case from U.S. Arctic

When stratified by age, the highest rates of disease occurred in children <2 years and in individuals 65+ years of age in N. Canada (59 per 100,000 and 73 per 100,000, respectively).

Group A *Streptococcus* by Age Category, ICS 2006 Data

Age		N. Canada	N. Sweden	U.S. Arctic
<2 yrs	Population	5,071	4,839	21,099
	Cases (%)	3 (17)	0 (0)	6 (15)
	Rate*	59.2	0	28.4
2-19 yrs	Population	45,078	52,842	194,387
	Cases (%)	3 (17)	0 (0)	6 (15)
	Rate*	6.7	0	3.1
20-64 yrs	Population	86,460	145,589	409,078
	Cases (%)	7 (39)	2 (67)	21 (55)
	Rate*	8.1	1.4	5.1
65+ yrs	Population	6,835	48,616	45,489
	Cases (%)	5 (28)	1 (23)	6 (15)
	Rate*	73.2	2.1	13.2
All ages	Population	143,444	251,886	670,053
	Total Cases	18	3	39
	Rate*	12.5	1.2	5.3

*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 all age categories in N. Canada Aboriginal people and U.S. Arctic Native people than in non-Aboriginal and non-Native people.

Group A *Streptococcus* by Race and Age Categories, ICS 2006 Data

Age (yrs)		N. Canada*		U.S. Arctic	
		Aboriginal	Non-Aboriginal	Native	Non-Native
<2	Population	3,680	1,391	6,252	14,847
	Cases (rate†)	3 (81.5)	0 (0)	4 (64)	2 (13.5)
2-19	Population	33,205	11,873	48,594	145,793
	Cases (rate†)	3 (9)	0 (0)	2 (4.1)	4 (2.7)
20-64	Population	42,435	44,025	68,553	340,525
	Cases (rate†)	6 (14.1)	1 (2.3)	12 (17.5)	9 (2.6)
65+	Population	3,385	3,450	7,603	37,886
	Cases (rate†)*	4 (118.2)	0 (0)	2 (26.3)	4 (10.6)
All Ages	Population	82,705	60,739	131,002	539,051
	Cases (rate†)	16 (19.3)	1 (1.6)	20 (15.3)	19 (3.5)

†Number of cases per 100,000 per year
*Race unknown in one N. Canada case ≥ 65

Clinical Presentation

The most common clinical presentation for GAS cases in N. Sweden (100%) was bacteremia, in N. Canada it was bacteremia (22%) and pneumonia (22%), and in the U.S. Arctic it was cellulitis (31%).

Clinical Presentation of Reported group A *Streptococcus* Cases, ICS 2006 Data

	N. Canada n (%)	N. Sweden n (%)	U.S. Arctic n (%)
Bacteremia	4 (22)	3 (100)	10 (26)
Pneumonia*	4 (22)	0 (0)	4 (10)
Empyema	1 (6)	0 (0)	2 (5)
Cellulitis*	2 (11)	0 (0)	12 (31)
Necrotizing fasciitis	2 (11)	0 (0)	0 (0)
Septic arthritis	2 (11)	0 (0)	6 (15)
Osteomylitis	1 (6)	0 (0)	0 (0)
Bursitis	0 (0)	0 (0)	1 (2.5)
Septic abortion	0 (0)	0 (0)	1 (2.5)
Peritonitis	0 (0)	0 (0)	1 (2.5)
Endocarditis	0 (0)	0 (0)	1 (2.5)
Other	2 (11)	0 (0)	1 (2.5)
Total	18	3	39

*with bacteremia

Risk Factors

Cigarette smoking was the most common risk factor associated with adult (≥18 years) GAS cases in the U.S. Arctic; it was reported in 36% of cases. In N. Canada, the most common risk factors were chronic lung disease and diabetes which were each reported in 33% of cases. N. Sweden did not report risk factor data.

Group A *Streptococcus* Risk Factor/Medical Conditions in Adults*, ICS 2006 Data

	N. Canada n (%)	U.S. Arctic n (%)
Cigarette Smoking	0 (0)	10 (36)
Alcohol Abuse	2 (17)	9 (32)
Chronic Lung Disease and/or Asthma	4 (33)	4 (14)
Immunosuppressive Therapy	1 (8)	1 (3.5)
Diabetes	4 (33)	7 (25)
Injection Drug Use	0 (0)	0 (0)
Asplenia	0 (0)	0 (0)
Total Adult* Cases	11	28

*≥ 18 years

Outcome

Three deaths in cases with GAS were reported from the U.S. Arctic (CFR 8%); all occurred in the 20-64 years old age category. One death was reported in N. Canada (CFR 6%); the death occurred in the 65+ year old age category. 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 2006. A total of 44 cases of invasive disease caused by GBS were reported to ICS. The rate of disease was highest in N. Sweden (6.4 per 100,000) compared to N. Canada (1.4 per 100,000). One death was reported in the U.S. Arctic associated with GBS in 2006.

Group B *Streptococcus* Case Demographics, ICS 2006 Data

Country	Population	# Cases	Rate*	Sex M (%)	Median Age (min-max) yrs	Deaths n (CFR†)
Greenland	56,901	1	1.8	0 (0)	64.5 (1 case)	0 (0%)
N. Canada	143,444	2	1.4	1 (50)	29.8 (0-59.6)	0 (0%)
N. Sweden	251,886	16	6.4	8 (50)	71.4 (0-84)	‡
U.S. Arctic	670,053	25	3.7	16 (64)	57 (0-85.7)	1 (4%)
Total	1,122,284	44	3.9	25 (57)	59.2 (0-85.7)	1 (2.3%)

*Number of cases per 100,000 per year
†Case fatality ratio
‡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 (103.3/100,000) and the U.S. Arctic (28.4 per 100,000).

Group B *Streptococcus* by Age Category, ICS 2006 Data

Age		Greenland	N. Canada	N. Sweden	U.S. Arctic
<2 yrs	Population	1,737	5,071	4,839	21,099
	Cases (%)	0 (0)	1 (50)	5 (31)	6 (24)
	Rate*	0	19.7	103.3	28.4
2-19 yrs	Population	16,922	45,078	52,842	194,387
	Cases (%)	0 (0)	0 (0)	0 (0)	1 (4)
	Rate*	0	0	0	0.5
20-64 yrs	Population	34,972	86,460	145,589	409,078
	Cases (%)	1 (100)	1 (50)	1 (6)	12 (48)
	Rate*	2.9	1.2	4.1	2.9
65+ yrs	Population	3,270	6,835	48,616	45,489
	Cases (%)	0 (0)	0 (0)	10 (63)	6 (24)
	Rate*	0	0	20.6	13.2
All ages	Population	56,901	143,444	251,886	670,053
	Total Cases	1	2	16	25
	Rate*	1.8	1.4	6.4	3.7

*Number of cases per 100,000 per year

There was no early-onset disease (cases less than 7 days old).

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 two times that in non-Natives. Both cases of GBS reported in N. Canada occurred in Aboriginal people.

Group B *Streptococcus* by Race and Age Categories, ICS 2006 Data

Age (yrs)		N. Canada		U.S. Arctic	
		Aboriginal	Non-Aboriginal	Native	Non-Native
<2	Population	3,680	1,391	6,252	14,847
	Cases (rate*)	1 (27.2)	0 (0)	3 (48)	3 (20.2)
2-19	Population	33,205	11,873	48,594	145,793
	Cases (rate*)	0 (0)	0 (0)	1 (2.1)	0 (0)
20-64	Population	42,435	44,025	68,553	340,525
	Cases (rate*)	1 (2.4)	0 (0)	4 (5.8)	8 (2.3)
65+	Population	3,385	3,450	7,603	37,886
	Cases (rate*)	0 (0)	0 (0)	0 (0)	6 (15.8)
All Ages	Population	82,705	60,739	131,002	539,051
	Cases (rate*)	2 (2.4)	0 (0)	8 (6.1)	17 (3.2)

*Number of cases per 100,000 per year

Clinical Presentation

In the U.S. Arctic, bacteremia (56%) was the most common clinical presentation reported for cases of GBS in 2006 followed by septic arthritis (12%), meningitis (8%), pneumonia and cellulitis (8%). The single case in Greenland presented with pneumonia; one case in N. Canada presented with bacteremia, the second with meningitis. Fourteen of fifteen cases in N. were reported as bacteremia which may reflect a difference in reporting practices; one case presented with meningitis.

Clinical Presentation of Reported group B *Streptococcus* Cases, ICS 2006 Data

	Greenland n (%)	N. Canada n (%)	N. Sweden n (%)	U.S. Arctic n (%)
Bacteremia	0 (0)	1 (50)	15 (94)	14 (56)
Pneumonia*	1 (100)	0 (0)	0 (0)	0 (0)
Meningitis	0 (0)	1 (50)	1 (6)	2 (8)
Septic arthritis	0 (0)	0 (0)	0 (0)	3 (12)
Cellulitis*	0 (0)	0 (0)	0 (0)	2 (8)
Osteomyelitis	0 (0)	0 (0)	0 (0)	1 (4)
Endocarditis	0 (0)	0 (0)	0 (0)	1 (4)
Endometritis	0 (0)	0 (0)	0 (0)	1 (4)
Other	0 (0)	0 (0)	0 (0)	1 (4)
Total	1	2	16	25

*with bacteremia

Risk Factors

Fifty percent of GBS adult (≥ 18 years) cases reviewed in the U.S. Arctic indicated diabetes as a risk factor in 2006; 17% were cigarette smokers and 11% had chronic lung disease. The GBS cases in Greenland and N. Canada case did not indicate any risk factors on review. N. Sweden does not report risk factor data.

Outcome

Four deaths in cases with GBS were reported in the U.S. Arctic (CFR 17%); one death occurred in the less than 2 years age category, two deaths occurred in the 20-65 years age category and one death occurred in the 65+ age category. 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 2006. 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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