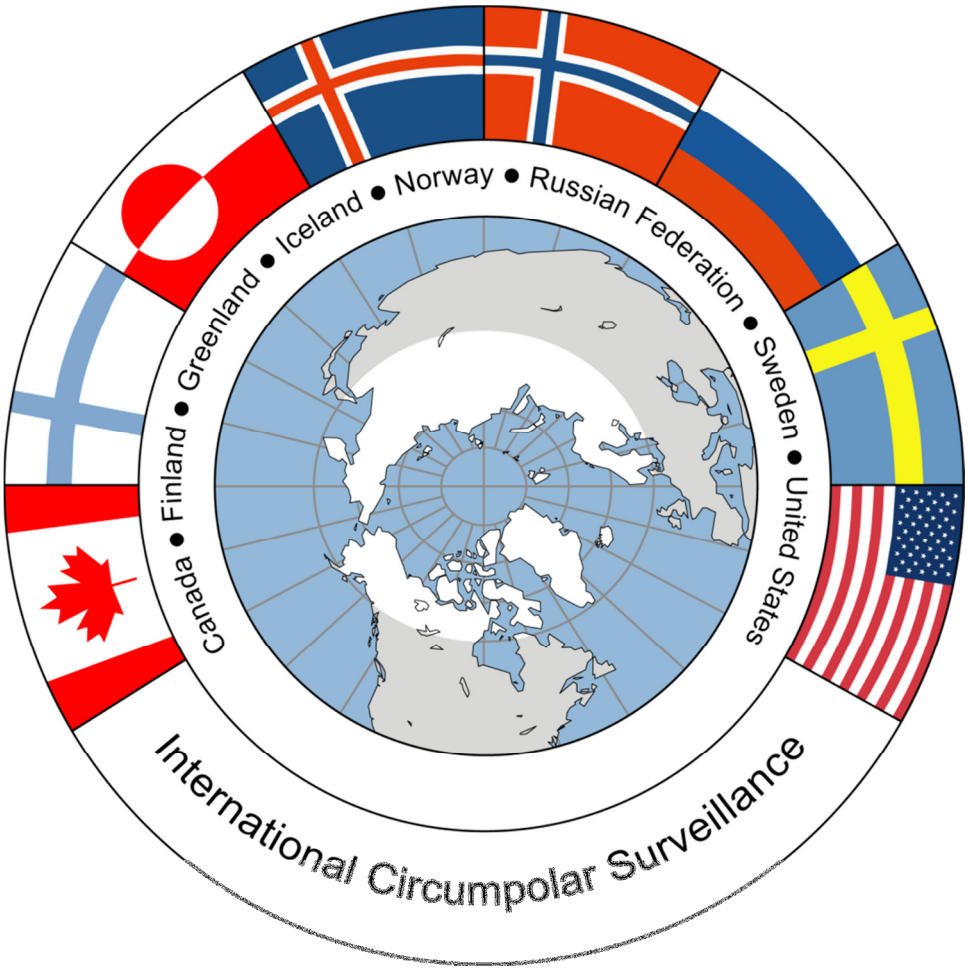
INTERNATIONAL CIRCUMPOLAR SURVEILLANCE (ICS) SUMMARY REPORT



YEAR 2009 DATA

TABLE OF CONTENTS

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 2009.

Data on invasive disease with the organism *S. pneumoniae* are collected from all participating countries. A total of 1,967 cases of invasive pneumococcal disease were identified in 2009. 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 8-14%. 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 40 and 35 cases per 100,000 population, respectively, which represents an increase in disease from 2008 in Northern Canadian Aboriginal people and a decrease in disease in U.S. Arctic Native people. 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 Iceland was 9V; in Greenland, N. Canada and the U.S. Arctic the most common serotype was 7F.

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 104 *H. influenzae* cases, 52 *N. meningitidis* cases, 47 GAS cases, and 45 GBS cases were reported in 2009. 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 and persons 65 and older.

Surveillance Organisms Reported by Country, ICS 2009 Data

Country	*S. pneumoniae* n (rate*)	*H. influenzae* n (rate*)	*N. meningitidis* n (rate*)	GAS n (rate*)	GBS n (rate*)
Finland	855 (16)	N/A	N/A	N/A	N/A
Greenland	11 (19.6)	0 (0)	1 (1.8)	0 (0)	0 (0)
Iceland	39 (12.2)	N/A	N/A	N/A	N/A
N. Canada	46 (31.3)	12 (8.2)	1 (0.7)	3 (2)	2 (1.4)
N. Sweden	82 (16.2)†	2 (0.8)‡	1 (0.4)‡	9 (3.6)‡	12 (4.8)‡
Norway	786 (16.4)	69 (1.4)	44 (0.9)	N/A	N/A
U.S. Arctic	148 (21.4)	21 (3)	5 (0.7)	35 (5.1)	31 (4.5)
Total	1,967 (16.6)	104 (1.7)	52 (0.9)	47 (4.1)	45 (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 2009

Country	*S. pneumoniae*	*H. influenzae*	*N. meningitidis*	GAS	GBS	Serotype	Demographics	Race/Ethnicity	Risk Factors	Outcome
Finland	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.

- Population estimates for 2009 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 2009 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 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 2009 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 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 2009 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 2009 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 2009 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 2009 were obtained from the website http://www.labor.state.ak.us

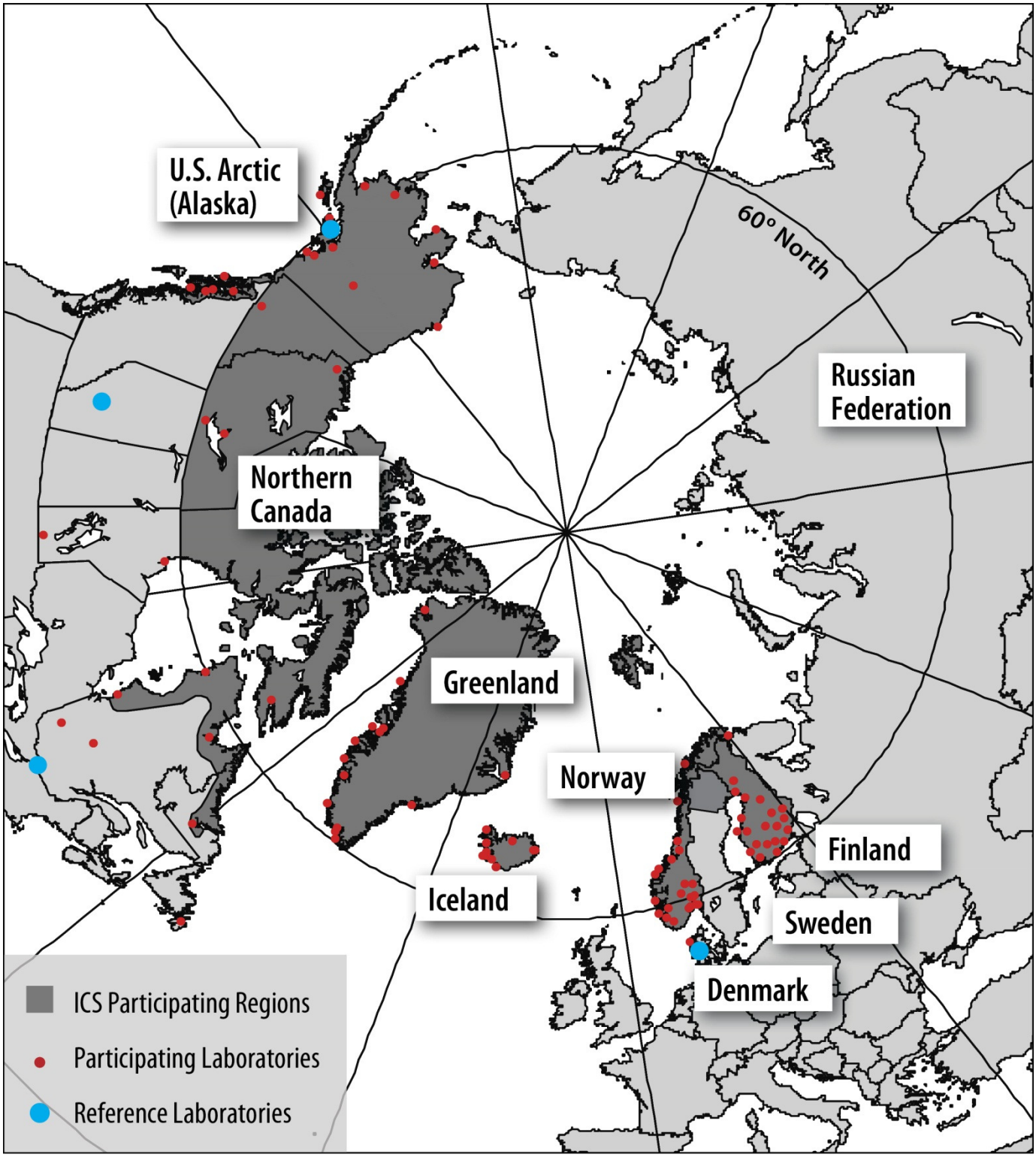
Quality Control

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 2009. 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 2009



RESULTS

Streptococcus pneumoniae

Case Demographics

A total of 1,967 cases of invasive disease caused by *S. pneumoniae* were reported to ICS during 2009 by Finland, Greenland, Iceland, N. Canada, N. Sweden, Norway, and the U.S. Arctic. The highest rates of disease (31.3 per 100,000) occurred in N. Canada and the lowest in Iceland (12.2 per 100,000) with an overall rate for the ICS circumpolar region of 16.6 per 100,000; 51% of all cases occurred in males. The median age of cases overall was 59.8 years with the lowest median age in N. Canada (37.5 years) and the highest in Norway (64.3 years). Case fatality ratios ranged from 8.1% in the U.S. Arctic to 14.3% in N. Canada; the overall case fatality ratio was 9.4%.

***Streptococcus pneumoniae* Case Demographics, ICS 2009 Data**

Country	Population	# Cases	Rate*	Sex M (%)	Median Age (min-max) yrs	Deaths n (CFR†)
Finland	5,351,427	855	16	441 (54)	57 (0.1-96)	‡
Greenland	56,194	11	19.6	9 (82)	48.7 (0-66.2)	1 (9.1%)
Iceland	319,368	39	12.2	18 (46)	55.4 (0.2-86.1)	4 (10.3%)
N. Canada	147,067	46	31.3	28 (61)	37.5 (0.1-92)	6 (14.3)[b]
N. Sweden	507,567[a]	82	16.2	39 (48)	64 (0.2-90)	‡
Norway	4,799,252	786	16.4	375 (48)	64.3 (0-96)	37 (8.5%)[b]
U.S. Arctic	692,314	148	21.4	82 (55)	48.2 (0.2-97)	12 (8.1%)
Total	11,873,189	1,967	16.6	1,006 (51)	59.8 (0-97)	60 (9.4%)

*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 4 cases from N. Canada, 351 cases from Norway

***Streptococcus pneumoniae* by Age Category, ICS 2009 Data**

Age		Finland	Greenland	Iceland	N. Canada	N. Sweden	Norway	U.S. Arctic
<2 yrs	Pop	120,450	1,626	9,520	5,347	10,613	120,143	23,471
	N (%)	62 (7)	1 (9)	7 (18)	11 (24)	2 (2)	29 (4)	16 (11)
	Rate*	51.5	61.5	73.5	205.7	18.8	24.1	68.2
2-19 yrs	Pop	1,102,509	15,935	80,940	44,505	103,198	1,111,287	198,034
	N (%)	69 (8)	2 (18)	2 (5)	5 (11)	1 (1)	39 (5)	8 (5)
	Rate*	6.3	12.6	2.5	11.2	1	3.5	4
20-64 yrs	Pop	3,218,027	34,953	191,735	91,842	294,177	2,863,010	418,546
	N (%)	429 (50)	6 (55)	17 (44)	22 (48)	41 (50)	339 (43)	86 (58)
	Rate*	13.3	17.2	8.9	24	13.9	11.8	20.6
65+ yrs	Pop	910,441	3,680	37,173	7,935	99,579	704,812	52,263
	N (%)	295 (35)	2 (18)	13 (33)	8 (17)	38 (47)	379 (48)	38 (26)
	Rate*	32.4	54.4	35	100.8	38.2	53.8	72.7
All ages	Pop	5,351,427	56,194	319,368	147,067	507,567	4,799,252	692,314
	N	855	11	39	46	82	786	148
	Rate*	16	19.6	12.2	31.3	16.2	16.4	21.4

*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 2009 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 third quarter and the lowest in the fourth 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. 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 2009 Data**

Age (yrs)		N. Canada*		U.S. Arctic	
		Aboriginal	**Non-Aboriginal**	**Native**	**Non-Native**
<2	Population	3,680	1,667	6,886	16,585
	Cases (rate‡)	10 (271.7)	0 (0)	6 (87.1)	10 (60.3)
2-19	Population	33,205	11,300	49,604	148,430
	Cases (rate‡)	4 (12.1)	1 (8.9)	4 (8.1)	4 (2.7)
20-64	Population	42,435	49,407	73,597	344,949
	Cases (rate‡)	13 (30.6)	2 (4.1)	28 (38.1)	58 (16.8)
65+	Population	3,385	4,550	8,342	43,921
	Cases (rate‡)	6 (177.3)	2 (44)	11 (131.9)	27 (61.5)
All Ages	Population	82,705	64,362	138,429	553,885
	Cases (rate‡)	33 (39.9)	5 (7.8)	49 (35.4)	99 (17.9)

*Race unknown in 1 case < 2 years, 7 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 were not reported in the Finland and N. Sweden *S. pneumoniae* data. In Greenland, N. Canada, Norway, and the U.S. Arctic the clinical presentation reported most often was pneumonia (55%, 50%, 43% and 70%, respectively); in Finland, Iceland and N. Sweden it was bacteremia (96%, 95% and 96%, respectively).

Clinical Presentation of Reported *Streptococcus pneumoniae* Cases, ICS 2009 Data

	Finland n (%)	Greenland n (%)	Iceland n (%)	N Canada n (%)	N Sweden n (%)	Norway n (%)	US Arctic n (%)
Pneumonia*	0 (0)	6 (55)	0 (0)	23 (50)	0 (0)	340 (43)	104 (70)
Bacteremia	820 (96)	1 (9)	37 (95)	10 (22)	79 (96)	313 (40)	19 (13)
Meningitis	35 (4)	1 (9)	1 (2.5)	5 (11)	3 (4)	52 (7)	3 (2)
Empyema	0 (0)	1 (9)	0 (0)	4 (9)	0 (0)	0 (0)	13 (9)
Septic arthritis	0 (0)	1 (9)	1 (2.5)	1 (2)	0 (0)	6 (1)	3 (2)
Endocarditis	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (1)
Cellulitis	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (1)
Osteomyelitis	0 (0)	0 (0)	0 (0)	1 (2)	0 (0)	1 (<1)	1 (1)
Peritonitis	0 (0)	1 (9)	0 (0)	1 (2)	0 (0)	0 (0)	1 (1)
Other	0 (0)	0 (0)	0 (0)	1 (2)	0 (0)	71 (9)	0 (0)
Total Cases	855	11	39	46	82	786	148

*with bacteremia

Risk Factors

Greenland, 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 chronic lung disease were the most common associated conditions in N. Canada and the U.S. Arctic occurring in 23 to 43% of patients.

***Streptococcus pneumoniae* Risk Factor/Medical Conditions in Adults*, ICS 2009 Data**

	Greenland n (%)	N. Canada n (%)	U.S. Arctic n (%)
Cigarette Smoking	0 (0)	7 (23)	53 (43)
Alcohol Abuse	0 (0)	4 (13)	25 (21)
Chronic Lung Disease and/or Asthma	0 (0)	7 (23)	46 (37)
Immunosuppressive Therapy	1 (13)	1 (3)	12 (10)
Diabetes	0 (0)	5 (17)	21 (17)
Injection Drug Use	0 (0)	1 (3)	0 (0)
Asplenia	0 (0)	1 (3)	0 (0)
Total Adult* Cases	8	30	124

*≥ 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 over 60 years (Iceland) or over 65 years of age (Finland, N. Canada, Norway, U.S. Arctic), 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, in Norway in July, 2006 and in Greenland in 2009. 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-three, 89 and 80 percent of *S. pneumoniae* cases in children less than 2 years of age with known vaccination status were vaccinated with PCV7 in Norway, N. Canada and the U.S. Arctic, respectively. Only 6% 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 were not reported from Finland and Iceland.

***Streptococcus pneumoniae* Case Vaccination Status for Pneumococcal Vaccine, ICS 2009 Data**

	N. Canada	Norway	U.S. Arctic
Total cases eligible for PCV7 vaccine*	11	29	16
Vaccine status known in cases eligible for PCV7	9	17	15
Cases eligible for PCV7 vaccinated (%)†	8 (89%)	9 (53%)	12 (80%)
Total cases eligible for PS23 vaccine‡	8	379	38
Vaccine status known in cases eligible for PS23	8	83	27
Cases eligible for PS23 vaccinated (%)†	7 (87.5%)	5 (6%)	26 (96%)

*Children less than 2 years of age
†Percent of vaccine status known cases
‡Adults 65 years and older

Serotypes

The *S. pneumoniae* serotypes reported by ICS regions in 2009 are listed in the following table; yellow highlights the most common serotypes in each country. Serotypes included in the 7-valent conjugate vaccine were the most prevalent in Iceland where the vaccine was not included in their universal vaccine program in 2009.

***Streptococcus pneumoniae* Serotypes by Country, ICS 2009 Data**

Serotype	Greenland† n (%)	Iceland n (%)	N. Canada† (%)	N. Sweden* n (%)	U.S. Arctic† n (%)
1	1 (9)	1 (3)	1 (3)	0 (0)	1 (1)
3	0 (0)	1 (3)	3 (8)	4 (10)	12 (9)
4‡	1 (9)	0 (0)	1 (3)	7 (17.5)	1 (2)
6	0 (0)	0 (0)	1 (3)	0 (0)	0 (0)
6A	0 (0)	2 (5)	0 (0)	0 (0)	1 (1)
6B‡	0 (0)	4 (10)	0 (0)	0 (0)	0 (0)
6C	0 (0)	0 (0)	0 (0)	0 (0)	5 (4)
7	0 (0)	0 (0)	0 (0)	2 (5)	0 (0)
7C	0 (0)	0 (0)	0 (0)	0 (0)	2 (2)
7F	3 (27)	4 (10)	7 (18)	0 (0)	39 (29)
8	0 (0)	0 (0)	5 (13)	1 (2.5)	4 (3)
9	0 (0)	0 (0)	0 (0)	7 (17.5)	0 (0)
9N	1 (9)	0 (0)	1 (3)	0 (0)	8 (6)
9V‡	0 (0)	9 (23)	0 (0)	0 (0)	0 (0)
10A	0 (0)	0 (0)	3 (8)	0 (0)	1 (1)
11	0 (0)	1 (3)	0 (0)	2 (5)	0 (0)
11A	0 (0)	0 (0)	0 (0)	0 (0)	2 (2)
12	0 (0)	0 (0)	1 (3)	0 (0)	0 (0)
12F	1 (9)	0 (0)	1 (3)	0 (0)	1 (1)

Serotype	Greenland† n (%)	Iceland n (%)	N. Canada† (%)	N. Sweden* n (%)	U.S. Arctic† n (%)
14‡	0 (0)	6 (15)	2 (5)	3 (7.5)	1 (1)
15	0 (0)	0 (0)	0 (0)	1 (2.5)	0 (0)
15A	0 (0)	0 (0)	2 (5)	0 (0)	5 (4)
15B	0 (0)	0 (0)	0 (0)	0 (0)	3 (2)
15C	0 (0)	0 (0)	1 (3)	0 (0)	1 (1)
16F	0 (0)	0 (0)	2 (5)	0 (0)	5 (4)
17F	0 (0)	0 (0)	1 (3)	0 (0)	1 (1)
18	0 (0)	0 (0)	0 (0)	3 (7.5)	0 (0)
19	0 (0)	1 (3)	0 (0)	1 (2.5)	0 (0)
19A	0 (0)	4 (10)	0 (0)	0 (0)	29 (21)
19F‡	0 (0)	0 (0)	0 (0)	0 (0)	1 (1)
20	1 (9)	1 (3)	1 (3)	0 (0)	1 (1)
22F	0 (0)	0 (0)	2 (5)	0 (0)	4 (3)
23	0 (0)	0 (0)	0 (0)	3 (7.5)	0 (0)
23A	0 (0)	0 (0)	1 (3)	0 (0)	2 (2)
23B	0 (0)	0 (0)	0 (0)	0 (0)	1 (1)
23F‡	0 (0)	2 (5)	0 (0)	0 (0)	0 (0)
25A	0 (0)	1 (3)	0 (0)	0 (0)	0 (0)
28	0 (0)	0 (0)	0 (0)	0 (0)	1 (1)
29	0 (0)	1 (3)	0 (0)	0 (0)	0 (0)
31	0 (0)	0 (0)	1 (3)	0 (0)	2 (2)
33	0 (0)	1 (3)	0 (0)	0 (0)	0 (0)
33F	1 (9)	0 (0)	1 (3)	0 (0)	3 (2)
35	0 (0)	0 (0)	0 (0)	2 (5)	0 (0)
35F	1 (9)	0 (0)	0 (0)	0 (0)	0 (0)
38	1 (9)	0 (0)	0 (0)	0 (0)	0 (0)

*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 86% of *Strep pneumoniae* cases in children < 2 years of age in Iceland. There were no cases of disease caused by a serotype contained in the 7-valent vaccine in Greenland, N. Canada and 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 58% to 100%.

Proportion of Vaccine Preventable Cases/Deaths from Invasive Pneumococcal Disease, ICS 2009 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	8/10 (80)	26/32 (81)	25/32 (78)	98/121 (81)
Cases < 2 years old with serotype in the 7-valent pneumococcal conjugate vaccine	0/1 (0)	6/7 (86)	0/6 (0)	0/16 (0)
Deaths (all ages) for which the serotype was contained in the 23-valent pneumococcal vaccine	1 (100‡)	4 (100‡)	4 (67‡)	7 (58‡)

*Number of isolates serotyped by country by age group
‡Percentage of total death

Outcome

A total of 60 deaths associated with *S. pneumoniae* were reported to ICS in 2009. Overall, the highest case fatality ratio (CFR) occurred in persons 65+ years of age (13%). Finland and N. Sweden did not report outcome data.

***Streptococcus pneumoniae* Age-Specific Case-Fatality Ratios (CFR), ICS 2009 Data**

		<2 years	2-19 years	20-64 years	65+ years	All Ages
Greenland	Deaths/Cases*	0/1	0/2	1/6	0/2	1/11
	(CFR)	(0%)	(0%)	(17%)	(0%)	(9%)
Iceland	Deaths/Cases*	1/7	0/2	2/17	1/13	4/39
	(CFR)	(14%)	(0%)	(12%)	(8%)	(10%)
N. Canada	Deaths/Cases*	0/8†	0/5	2/21†	4/8	6/42
	(CFR)	(0%)	(0%)	(10%)	(50%)	(14%)
Norway	Deaths/Cases*	3/20†	0/27†	13/186†	21/202†	37/435
	(CFR)	(15%)	(0%)	(7%)	(10%)	(9%)
U.S. Arctic	Deaths/Cases*	0/16	0/8	5/86	7/38	12/148
	(CFR)	(0%)	(0%)	(6%)	(18%)	(8%)
Total	Deaths/Cases*	4/52	0/44	23/316	33/263	60/675
	(CFR)	(8%)	(0%)	(7%)	(13%)	(9%)

*Cases with known outcome.
†Outcome unknown in (3) N. Canada and (9) Norway cases < 2 years; (12) Norway cases 2-19 years; (1) N. Canada and (153) Norway cases 20-64 years; (177) Norway cases 65+ years

Antimicrobial Susceptibility

In 2009, 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 2009 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	0	39 (0%)	14 (0%)	5 (0%)	137 (6%)
Chloramphenicol	0	0	39 (0%)	29 (0%)	0	137 (1%)
Clindamycin	0	0	0	26 (8%)	42 (0%)	137 (9%)
Erythromycin	0	10 (0%)	39 (8%)	26 (12%)	42 (0%)	137 (18%)
Levofloxacin	0	0	0	28 (0%)	0	137 (1%)
Penicillin	824 (4%)	10 (0%)	39 (0%)	19 (16%)	41 (0%)	137 (18%)
Rifampin	0	0	0	0	0	137 (1%)
TMP Sulfa*	0	0	39 (10%)	29 (0%)	2 (0%)	137 (24%)
Vancomycin	0	0	0	31 (0%)	0	137 (0%)

*Trimethoprimsulfamethoxizole

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, 36 isolates comprised of 8 serotypes (3, 6A, 6C, 14, 15A, 19A, 19F, 33F) showed multi-drug resistance. The largest proportion (n = 23, 64%) of the multi-drug resistant isolates was serotype 19A and 21% of isolates with this serotype were resistant to more than three antibiotics. In N. Canada, one of two serotype 15A isolates was resistant to two antibiotics. In Iceland, none of the isolates tested were resistant to more than one antibiotic. Finland and N. Sweden did not report serotypes.

***Streptococcus pneumoniae* Penicillin Susceptibility Results, ICS 2009 Data**

	# Tested	I* (%)	I* Serotypes (n)	R* (%)	R* Serotypes (n)
Finland	824	24 (3%)	†	7 (<1%)	†
Greenland	10	0 (0%)		0 (0%)	
Iceland	39	0 (0%)		0 (0%)	
N. Canada	19	1 (5%)	Unknown	2 (11%)	6, 15A
N. Sweden	41	0 (0%)		0 (0%)	
U.S. Arctic	137	18 (13%)	19A (10), 15A (4), 6C (2), 6A (1), 14 (1)	7 (5%)	19A (6), 19F (1)

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

***Streptococcus pneumoniae* TMP-Sulfa Susceptibility Results, ICS 2009 Data**

	# Tested	I* (%)	I* Serotypes (n)	R* (%)	R* Serotypes (n)
Iceland	39	0 (0%)		4 (10%)	6A, 19A, 23F, 33
N. Canada	29	0 (0%)		0 (0%)	
N. Sweden	2	0 (0%)		0 (0%)	
U.S. Arctic	137	7 (5%)	19A (2), 7C (1), 14 (1), 15A (1), 28 (1), 33F (1)	26 (19%)	19A (21), 6C (2), 15A (1), 19F (1), 33F (1)

*I=Intermediate resistance, R=Fully resistant

***Streptococcus pneumoniae* Erythromycin Susceptibility Results, ICS 2009 Data**

	# Tested	I* (%)	I* Serotypes	R* (%)	R* Serotypes (n)
Greenland	10	0 (0%)		0 (0%)	
Iceland	39	0 (0%)		3 (8%)	14 (2), 6B (1)
N. Canada	26	0 (0%)		3 (12%)	14 (2), 15A (1)
N. Sweden	42	0 (0%)		0 (0%)	
U.S. Arctic	137	0 (0%)		24 (18%)	19A (11), 15A (4), 6C (3), 3 (1), 6A (1), 9N (1), 11A (1), 19F (1), 33F (1)

*I=Intermediate resistance, R=Fully resistant

Quality Control

In 2009, 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 $\log_2$ 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 2009-A, lack of consensus for the reported serotype of one strain resulted in its exclusion from the analysis. The modal MIC comparison resulted in an overall correlation of 94.9% with individual participant correlation ranging from 75%-100%. Overall category agreement was 97.7% with individual participant agreement ranging from 85%-100%. For Panel 2009-B, overall serotyping correlation was 100%. The overall modal MIC correlation was 96.4% with individual participant correlation ranging from 93.3%-100%. Overall category agreement was 97.5% with individual participant agreement ranging from 88.4%-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 2009. Greenland reported no cases. A total of 104 cases of invasive disease caused by *H. influenzae* were reported to ICS during 2009 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 (8.2 per 100,000) and the lowest in N. Sweden (0.8/100,000). Median age of cases was highest in Norway (60.6 years) and lowest in N. Canada (1 year).

***Haemophilus influenzae* Case Demographics, ICS 2009 Data**

Country	Population	# Cases	Rate*	Sex M (%)	Median Age (min-max) yrs	Deaths n (CFR†)
Greenland	56,194	0	0	No cases	No cases	No cases
N. Canada	147,067	12	8.2	5 (42)	1 (0.3-69)	1 (13%)‡
N. Sweden	249,019	2	0.8	1 (50)	40 (7-73)	0 (0%)
Norway	4,799,252	69	1.4	26 (38)	60.6 (0-92.1)	9 (20%)‡
U.S. Arctic	692,314	21	3	8 (38)	48.8 (0-80.4)	1 (5%)‡
Total	5,943,846	104	1.7	40 (39)	53.8 (0-92.1)	11 (15%)

*Number of cases per 100,000 per year
†Case fatality ratio
‡ Case outcome unknown in (4) N. Canada, (23) Norway, (1) U.S. Arctic cases; N. Sweden did not report case outcomes

When stratified by age, the highest rates of disease for N. Canada, Norway 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.

***Haemophilus influenzae* by Age Category, ICS 2009 Data**

Age		N. Canada	N. Sweden	Norway	U.S. Arctic
<2 yrs	Population	5,347	4,760	120,143	23,471
	Cases (%)	7 (58.3)	0 (0)	8 (12)	4 (19)
	Rate*	130.9	0	6.7	17
2-19 yrs	Population	44,505	49,978	1,111,287	198,034
	Cases (%)	3 (25)	1 (50)	4 (6)	5 (24)
	Rate*	6.7	2	0.4	2.5
20-64 yrs	Population	91,842	143,079	2,863,010	418,546
	Cases (%)	1 (8.3)	0 (0)	27 (39)	6 (28.5)
	Rate*	1.1	0	0.9	1.4
65+ yrs	Population	7,935	51,202	704,812	52,263
	Cases (%)	1 (8.3)	1 (50)	30 (43)	6 (28.5)
	Rate*	12.6	2	4.3	11.5
All ages	Population	147,067	249,019	4,799,252	692,314
	Cases	12	2	69	21
	Rate*	8.2	0.8	1.4	3

*Number of cases per 100,000 per year

Race

Rates of disease were highest (190.2 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 2009 Data**

Age (yrs)		N. Canada		U.S. Arctic	
		Aboriginal	Non-Aboriginal	Native	Non-Native
<2	Population	3,680	1,667	6,886	16,585
	Cases (rate†)	7 (190.2)	0 (0)	3 (43.6)	1 (6)
2-19‡	Population	33,205	11,300	49,604	148,430
	Cases (rate†)	1 (3)	1 (8.9)	4 (8.1)	1 (0.7)
20-64	Population	42,435	49,407	73,597	344,949
	Cases (rate†)	1 (2.4)	0 (0)	2 (2.7)	4 (1.2)
65+	Population	3,385	4,550	8,342	43,921
	Cases (rate†)	1 (29.5)	0 (0)	3 (36)	3 (6.8)
All Ages	Population	82,705	64,362	138,429	553,885
	Cases (rate†)	10 (12.1)	1 (1.6)	12 (8.7)	9 (1.6)

†Number of cases per 100,000 per year
‡Race unknown in (1) N. Canada case 2-19 years

Clinical Presentation

In N. Sweden and Norway, the most common clinical presentation associated with *H. influenzae* was bacteremia (100% and 54% of reported cases, respectively). Pneumonia, bacteremia and meningitis were each reported in 25% of N. Canada cases. In the U.S. Arctic, the most common clinical presentation was pneumonia (48%).

Clinical Presentation of Reported *Haemophilus influenzae* Cases, ICS 2009 Data

	N. Canada n (%)	N. Sweden n (%)	Norway n (%)	U.S. Arctic n (%)
Pneumonia*	3 (25)	0 (0)	14 (20)	10 (48)
Bacteremia	3 (25)	2 (100)	37 (54)	8 (38)
Meningitis	3 (25)	0 (0)	7 (10)	0 (0)
Cellulitis	0 (0)	0 (0)	0 (0)	2 (9.5)
Septic arthritis	2 (16.7)	0 (0)	0 (0)	0 (0)
Septic abortion	0 (0)	0 (0)	0 (0)	1 (4.5)
Other/Unknown	1 (8.3)	0 (0)	11 (16)	0 (0)
Total	12	2	69	21

*with bacteremia

Risk Factors

Fifty percent of adult (≥ 18 years) cases of *H. influenzae* reported in the U.S. Arctic indicated chronic lung disease as an associated risk factor; 33% indicated smoking, 25% immune suppressive treatment and 8% diabetes or alcohol abuse as an associated risk factor. Fifty percent of adult N. Canadian *H. influenzae* cases reported smoking, alcohol abuse, diabetes or asplenia 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 and two cases 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 2009 Data**

	N. Canada	U.S. Arctic
Total cases* eligible for Hib vaccine†	8	5
Vaccine status known in cases* eligible for Hib vaccine	7	5
Cases* eligible for Hib vaccine vaccinated (%)‡	6 (86%)	4 (80%)

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

Serotypes

***Haemophilus influenzae* Serotypes by Country, ICS 2009 Data**

Serotype	N. Canada n (%)	Norway n (%)	U.S. Arctic n (%)
a	9 (82)	0 (0)	2 (10)
b	1 (9)	6 (9)	4 (20)
c	0 (0)	0 (0)	0 (0)
d	0 (0)	0 (0)	0 (0)
e	0 (0)	2 (3)	4 (20)
f	0 (0)	11 (17)	2 (10)
Non-typeable	1 (9)	45 (70)	8 (40)
Total	11	64	20

The most common *H. influenzae* serotype in N. Canada was type a (82% of cases), in Norway, type f (17% of cases) and in the U.S. Arctic it was types b and e (20% of cases each). Non-typeable cases also made up a large proportion of cases in Norway (70%) and the U.S. Arctic (40%). N. Sweden did not provide serotype data.

Outcome

Eleven deaths were associated with *H. influenzae* cases reported to ICS in 2009; one from N. Canada, one from the U.S. Arctic and nine from Norway. N. Sweden did not provide outcome data.

***Haemophilus influenzae* Deaths by Country, ICS 2009 Data**

	N. Canada	Norway	U.S. Arctic
No. Deaths	1	9	1
Case Fatality Ratio	13%*	20%*	5%*
Min-max (yrs)	7 (1 case)	0.2 – 92.1	74.8 (1 case)
Serotypes (n)	a	e (1), NT (7), unknown (1)	NT
Clinical Presentations (n)	Bacteremia	Pneumonia (4), bacteremia (2), meningitis (1), other (2)	Bacteremia

*Case outcome unknown in (4) N. Canada, (23) Norway, (1) U.S. Arctic cases

Quality Control

Two QC panels of five *H. influenzae* and *N. meningitidis* isolates were shipped and serogrouped or serotyped. The single discrepant result was 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. The proportion of disease caused by non-typeable organisms continues to be substantial.

Neisseria meningitidis

Case Demographics

Greenland, N. Canada, N. Sweden (Norbotten), Norway and the U.S. Arctic reported the occurrence of *N. meningitidis* during 2009. A total of 52 cases of invasive disease caused by *N. meningitidis* were reported to ICS. Greenland had the highest disease rate (1.8 per 100,000). Seven deaths associated with *N. meningitidis* were reported from Norway.

***Neisseria meningitidis* Case Demographics, ICS 2009 Data**

Country	Population	# Cases	Rate*	Sex M (%)	Median Age (min-max) yrs	Deaths n (CFR†)
Greenland	56,194	1	1.8	0 (0)	17.1 (1 case)	0 (0%)
N. Canada	147,067	1	0.7	1 (100)	0.4 (1 case)	0 (0%)
N. Sweden	249,019	1	0.4	0 (0)	79 (1 case)	0 (0%)
Norway	4,799,252	44	0.9	22 (50)	18.9 (0.6-85.8)	7 (19%)‡
U.S. Arctic	692,314	5	0.7	2 (40)	47.9 (0.3-77.1)	0 (0%)
Total	5,943,846	52	0.9	25 (48)	18.9 (0.3-85.8)	7 (16%)

*Number of cases per 100,000 per year
†Case fatality ratio
‡Outcome unknown in 8 cases

When stratified by age, the highest rates of disease occurred in the less than 2 year old age category in Norway and the U.S. Arctic. One case was reported in Greenland, N. Canada and N. Sweden; the age category for each case varied by country.

***Neisseria meningitidis* by Age Category, ICS 2009 Data**

Age		Greenland	N. Canada	N. Sweden	Norway	U.S. Arctic
<2 yrs	Pop	1,626	5,347	4,760	120,143	23,471
	N (%)	0 (0)	1 (100)	0 (0)	6 (14)	2 (40)
	Rate*	0	0	0	5	8.5
2-19 yrs	Pop	15,935	44,505	49,978	1,111,287	198,034
	N (%)	1 (100)	0 (0)	0 (0)	19 (43)	0 (0)
	Rate*	6.3	0	0	1.7	0
20-64 yrs	Pop	34,953	91,842	143,079	2,863,010	418,546
	N (%)	0 (0)	0 (0)	0 (0)	11 (25)	2 (40)
	Rate*	0	0	0	0.4	0.5
65+ yrs	Pop	3,680	7,935	51,202	704,812	52,263
	N (%)	0 (0)	0 (0)	1 (100)	8 (19)	1 (20)
	Rate*	0	0	2	1.1	1.9
All ages	Pop	56,194	147,067	249,019	4,799,252	692,314
	N	1	1	1	44	5
	Rate*	1.8	0.7	0.4	0.9	0.7

*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 1.4/100,000) and three in non-Native persons (rate 0.5/100,000). In N. Canada, the single NM case occurred in an Aboriginal person (rate 1.2/100,000).

Clinical Presentation

The most common clinical presentation in N. Canada, Norway and the U.S. Arctic for *N. meningitidis* cases was meningitis ranging from 40% to 100% of cases. In Greenland and N. Sweden, bacteremia was reported as the clinical presentation for the single case reported in each country.

Clinical Presentation of Reported *Neisseria meningitidis* Cases, ICS 2009 Data

	Greenland n (%)	N. Canada n (%)	N. Sweden n (%)	Norway n (%)	U.S. Arctic n (%)
Pneumonia*	0 (0)	0 (0)	0 (0)	2 (5)	1 (20)
Bacteremia	1 (100)	0 (0)	1 (100)	9 (21)	2 (40)
Meningitis	0 (0)	1 (100)	0 (0)	29 (66)	2 (40)
Other	0 (0)	0 (0)	0 (0)	4 (9)	0 (0)
Total	1	1	1	44	5

*with bacteremia

Risk Factors

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

Serogroups

Forty-nine of 52 cases of invasive *N. meningitidis* reported to ICS in 2009 included serogroup data. The most common serogroup in all countries was B which occurred in 50% to 100% of cases. N. Sweden did not report serogroup data.

***Neisseria meningitidis* Serogroups by Country, ICS 2009 Data**

Serogroup	Greenland n (%)	N. Canada n (%)	Norway n (%)	U.S. Arctic n (%)
B	1 (100)	1 (100)	22 (50)	4 (80)
C	0 (0)	0 (0)	8 (18)	0 (0)
W135	0 (0)	0 (0)	1 (2)	0 (0)
Y	0 (0)	0 (0)	11 (25)	1 (20)
Unknown	0 (0)	0 (0)	2 (5)	0 (0)
Total	1	1	44	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 and the U.S. Arctic each reported the occurrence of GAS during 2009. A total of 47 cases of invasive disease caused by GAS were reported to ICS; no cases occurred in Greenland in 2006. Among regions reporting cases, the rate of disease was highest in the U.S. Arctic (5.1 per 100,000) compared to the lowest in N. Canada (2 per 100,000). Three deaths were associated with GAS, all occurred in the U.S. Arctic.

Group A *Streptococcus* Case Demographics, ICS 2009 Data

Country	Population	# Cases	Rate*	Sex M (%)	Median Age (min-max) yrs	Deaths n (CFR†)
Greenland	56,194	0	0	No cases	No cases	No cases
N. Canada	147,067	3	2	2 (67)	64 (2.2-66)	0 (0%)
N. Sweden	249,019	9	3.6	1 (11)	76 (52-91)	‡
U.S. Arctic	692,314	35	5.1	21 (60)	48.3 (0.5-90.5)	3 (9%)
Total	1,144,594	47	4.1	24 (51)	52.7 (0.5-91)	3 (8%)

*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 the U.S. Arctic (17 per 100,000 and 15.3 per 100,000, respectively).

Group A *Streptococcus* by Age Category, ICS 2009 Data

Age		N. Canada	N. Sweden	U.S. Arctic
<2 yrs	Population	5,347	4,760	23,471
	Cases (%)	0 (0)	0 (0)	4 (11)
	Rate*	0	0	17
2-19 yrs	Population	44,505	49,978	198,034
	Cases (%)	1 (33.3)	0 (0)	4 (11)
	Rate*	2.3	0	2
20-64 yrs	Population	91,842	143,079	418,546
	Cases (%)	1 (33.3)	4 (44)	19 (54)
	Rate*	1.1	2.8	4.5
65+ yrs	Population	7,935	51,202	52,263
	Cases (%)	1 (33.3)	5 (56)	8 (23)
	Rate*	12.6	9.8	15.3
All ages	Population	147,067	249,019	692,314
	Total Cases	3	9	35
	Rate*	2	3.6	5.1

*Number of cases per 100,000 per year

Race

Race and ethnicity data were collected by N. Canada and the U.S. Arctic. The highest rates of disease occurred in N. Canada non-Aboriginal people 65 years and older and in U.S. Arctic Native children less than 2 years old.

Group A *Streptococcus* by Race and Age Categories, ICS 2009 Data

Age (yrs)		N. Canada		U.S. Arctic	
		Aboriginal	Non-Aboriginal	Native	Non-Native
<2	Population	3,680	1,667	6,886	16,585
	Cases (rate†)	0 (0)	0 (0)	3 (43.6)	1 (6)
2-19	Population	33,205	11,300	49,604	148,430
	Cases (rate†)	1 (3)	0 (0)	3 (6.1)	1 (0.7)
20-64	Population	42,435	49,407	73,597	344,949
	Cases (rate†)	1 (2.4)	0 (0)	12 (16.3)	7 (2)
65+	Population	3,385	4,550	8,342	43,921
	Cases (rate†)*	0 (0)	1 (22)	2 (24)	6 (13.7)
All Ages	Population	82,705	64,362	138,429	553,885
	Cases (rate†)	2 (2.4)	1 (1.6)	20 (14.5)	15 (2.7)

†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 there was one case each presenting with bacteremia, pneumonia, or empyema. In the U.S. Arctic the most common clinical presentation was cellulitis (37%).

Clinical Presentation of Reported group A *Streptococcus* Cases, ICS 2009 Data

	N. Canada n (%)	N. Sweden n (%)	U.S. Arctic n (%)
Bacteremia	1 (33)	9 (100)	6 (17)
Pneumonia*	1 (33)	0 (0)	3 (8)
Empyema	1 (33)	0 (0)	2 (6)
Cellulitis*	0 (0)	0 (0)	13 (37)
Necrotizing fasciitis	0 (0)	0 (0)	2 (6)
Septic arthritis	0 (0)	0 (0)	3 (8)
Osteomyelitis	0 (0)	0 (0)	2 (6)
Strep toxic shock	0 (0)	0 (0)	1 (3)
Endometritis	0 (0)	0 (0)	2 (6)
Endocarditis	0 (0)	0 (0)	1 (3)
Total	3	9	35

*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 26% of cases. In N. Canada, the only risk factor reported was diabetes which occurred in one of the two adult cases. N. Sweden did not report risk factor data.

Group A *Streptococcus* Risk Factor/Medical Conditions in Adults*, ICS 2009 Data

	N. Canada n (%)	U.S. Arctic n (%)
Cigarette Smoking	0 (0)	7 (26)
Alcohol Abuse	0 (0)	6 (22)
Chronic Lung Disease and/or Asthma	0 (0)	4 (15)
Immunosuppressive Therapy	0 (0)	1 (4)
Diabetes	1 (50)	5 (19)
Injection Drug Use	0 (0)	0 (0)
Asplenia	0 (0)	0 (0)
Total Adult* Cases	2	27

*≥ 18 years

Outcome

Three deaths in cases with GAS were reported from the U.S. Arctic (CFR 9%); one occurred in the 20-64 years old age category and two in persons ≥ 65. No deaths were reported in N. Canada. 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 2009. A total of 45 cases of invasive disease caused by GBS were reported to ICS. Greenland reported no cases. Among regions reporting cases, the rate of disease was highest in N. Sweden (4.8 per 100,000) compared to N. Canada (1.4 per 100,000). Seven deaths were associated with GBS in 2009.

Group B *Streptococcus* Case Demographics, ICS 2009 Data

Country	Population	# Cases	Rate*	Sex M (%)	Median Age (min-max) yrs	Deaths n (CFR†)
Greenland	56,194	0	0	No cases	No cases	No cases
N. Canada	147,067	2	1.4	1 (50)	24 (0.1-48)	1 (50%)
N. Sweden	249,019	12	4.8	4 (33)	63 (0-93)	‡
U.S. Arctic	692,314	31	4.5	20 (65)	55.7 (0-88.1)	6 (20%)‡
Total	1,144,594	45	3.9	25 (56)	57 (0-93)	7 (22%)

*Number of cases per 100,000 per year
†Case fatality ratio
‡Outcome unknown in (1) U.S. Arctic case; 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 all regions.

Group B *Streptococcus* by Age Category, ICS 2009 Data

Age		N. Canada	N. Sweden	U.S. Arctic
<2 yrs	Population	5,347	4,760	23,471
	Cases (%)	1 (50)	2 (16)	7 (23)
	Rate*	18.7	42	29.8
2-19 yrs	Population	44,505	49,978	198,034
	Cases (%)	0 (0)	0 (0)	0 (0)
	Rate*	0	0	0
20-64 yrs	Population	91,842	143,079	418,546
	Cases (%)	1 (50)	5 (42)	14 (45)
	Rate*	1.1	3.5	3.3
65+ yrs	Population	7,935	51,202	52,263
	Cases (%)	0 (0)	5 (42)	10 (32)
	Rate*	0	9.8	19.1
All ages	Population	147,067	249,019	692,314
	Total Cases	2	12	31
	Rate*	1.4	4.8	4.5

*Number of cases per 100,000 per year

There were three cases of early-onset disease (cases less than 7 days old) in the U.S. Arctic (0.3 cases per 1,000 births).

Race

Race and ethnicity data were collected in N. Canada and the U.S. Arctic. The overall rates of disease caused by GBS were similar in AK Native and Aboriginal people compared to non-Native and non-Aboriginal people. The highest rates of disease occurred in non-Aboriginal and non-Native children less than 2 years old.

Group B *Streptococcus* by Race and Age Categories, ICS 2009 Data

Age (yrs)		N. Canada		U.S. Arctic	
		Aboriginal	Non-Aboriginal	Native	Non-Native
<2	Population	3,680	1,667	6,886	16,585
	Cases (rate*)	0 (0)	1 (60)	1 (14.5)	6 (36.2)
2-19	Population	33,205	11,300	49,604	148,430
	Cases (rate*)	0 (0)	0 (0)	0 (0)	0 (0)
20-64	Population	42,435	49,407	73,597	344,949
	Cases (rate*)	1 (2.4)	0 (0)	4 (5.4)	10 (2.9)
65+	Population	3,385	4,550	8,342	43,921
	Cases (rate*)	0 (0)	0 (0)	1 (12)	9 (20.5)
All Ages	Population	82,705	64,362	138,429	553,885
	Cases (rate*)	1 (1.2)	1 (1.6)	6 (4.3)	25 (4.5)

*Number of cases per 100,000 per year

Clinical Presentation

In the U.S. Arctic, bacteremia (36%) was the most common clinical presentation reported for cases of GBS in 2009 followed by pneumonia (19%) and cellulitis (13%). One case in N. Canada presented with bacteremia, the second with pneumonia. Ten of twelve cases in N. Sweden were reported as bacteremia which may reflect a difference in reporting practices; two cases presented with meningitis.

Clinical Presentation of Reported group B *Streptococcus* Cases, ICS 2009 Data

	N. Canada n (%)	N. Sweden n (%)	U.S. Arctic n (%)
Bacteremia	1 (50)	10 (83)	11 (36)
Pneumonia*	1 (50)	0 (0)	6 (19)
Meningitis	0 (0)	2 (17)	2 (6.5)
Septic arthritis	0 (0)	0 (0)	1 (3)
Cellulitis*	0 (0)	0 (0)	4 (13)
Osteomyelitis	0 (0)	0 (0)	3 (10)
Endocarditis	0 (0)	0 (0)	2 (6.5)
Other	0 (0)	0 (0)	1 (3)
Unknown	0 (0)	0 (0)	1 (3)
Total	2	12	31

*with bacteremia

Risk Factors

Thirty-three percent of GBS adult (≥ 18 years) cases reviewed in the U.S. Arctic indicated smoking as a risk factor in 2009; 25% had diabetes, 13% abused alcohol or had chronic lung disease and 8% were receiving immune suppressive treatment. Risk factor data was not available for the one adult GBS case in N. Canada. N. Sweden does not report risk factor data.

Outcome

Six deaths in cases with GBS were reported in the U.S. Arctic (CFR 20%); one death occurred in the less than 2 years age category, two deaths occurred in the 20-65 years age category and three deaths occurred in the 65+ age category. One death occurred in N. Canada GBS cases (CFR 50%); the death occurred in the 20-64 years age category. 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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