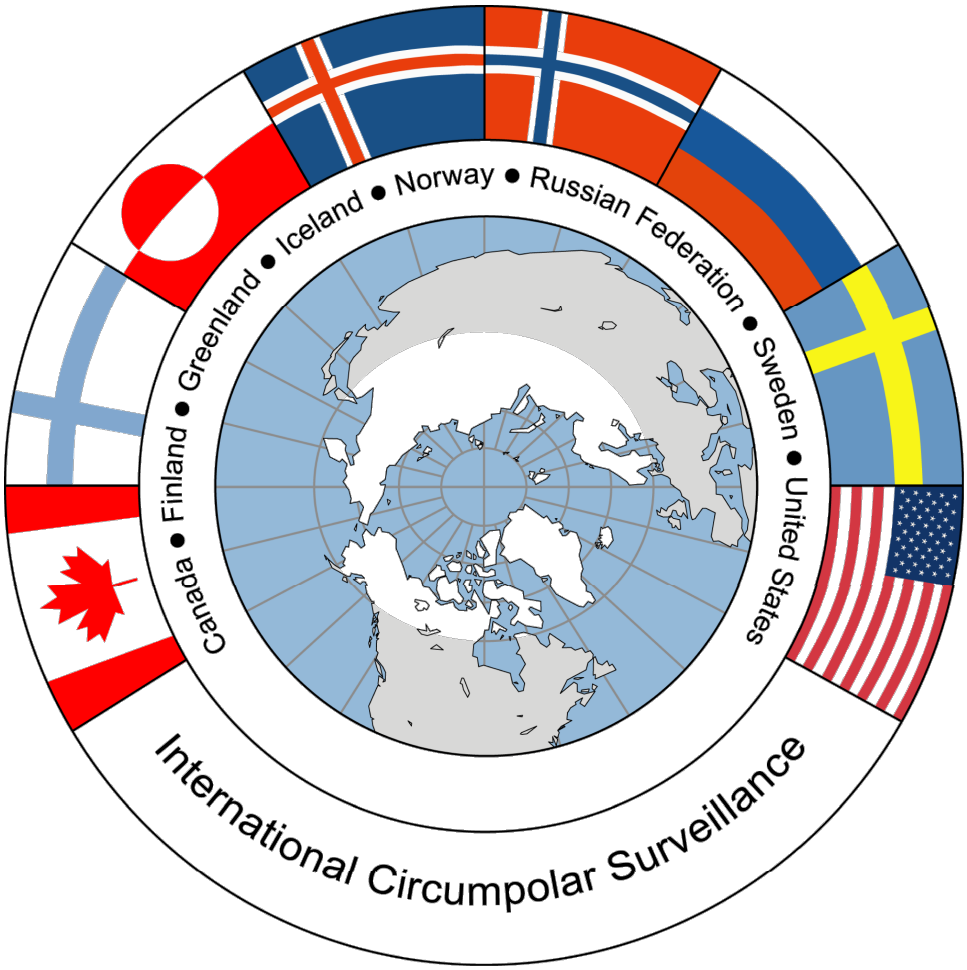
INTERNATIONAL CIRCUMPOLAR SURVEILLANCE (ICS) SUMMARY REPORT



YEAR 2005 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 2005.

Data on invasive disease with the organism *S. pneumoniae* are collected from all participating countries. A total of 1,987 cases of invasive pneumococcal disease were identified in 2005. Overall, rates of invasive *S. pneumoniae* were highest in individuals less than 2 years of age except in Greenland where rates were highest in persons 65 years and older. Case fatality ratios ranged from 5-25%. 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 20 and 47 cases per 100,000 population, respectively, which represents a decrease in disease from 2004 in Northern Canadian Aboriginal people and an increase in disease in U.S. Arctic Native people. Pneumonia with bacteremia and bacteremia were the most common clinical presentations for invasive disease; cigarette smoking and alcohol abuse were the most common risk factors. The most common *S. pneumoniae* serotype in Finland and Iceland is 14; in Greenland the most common serotype is 22F, in the U.S. Arctic the most common serotype is 19A; and in N. Canada the most common serotypes are 1 and 3.

Data on invasive disease due to *H. influenzae*, *N. meningitidis*, GAS and GBS are currently collected in Greenland, Northern Canada, Northern Sweden and the U.S. Arctic; Norway began contributing data on cases of *N. meningitidis* in 2005. A total of 22 *H. influenzae* cases, 42 *N. meningitidis* cases, 55 GAS cases, and 36 GBS cases were reported in 2005. 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 2005 Data

Country	*S. pneumoniae* n (rate*)	*H. influenzae* n (rate*)	*N. meningitidis* n (rate*)	GAS n (rate*)	GBS n (rate*)
Finland	735 (14)	N/A	N/A	N/A	N/A
Greenland	17 (29.8)	0 (0)	1 (1.8)	1 (1.8)	0 (0)
Iceland	38 (12.8)	N/A	N/A	N/A	N/A
N. Canada	23 (17.3)	11 (8.3)	1 (0.8)	14 (10.5)	1 (0.8)
N. Sweden	23 (9.1)	2 (0.8)	0 (0)	4 (1.6)	11 (4.4)
Norway	1,029 (22.3)	N/A	37 (0.8)	N/A	N/A
U.S. Arctic	122 (18.4)	9 (1.4)	3 (0.5)	36 (5.4)	24 (3.6)
Total	1,987 (17.6)	22 (2)	42 (0.7)	55 (5)	36 (3.3)

*Cases per 100,000

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; and Northern Sweden joined in 2003. This report contains year 2005 data on all five surveillance organisms from Greenland, Northern Canada, Northern Sweden, and the U.S. Arctic, *N. meningitidis* and *S. pneumoniae* data from Norway, and *S. pneumoniae* data from Finland and Iceland.

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*. *S. pneumoniae* causes pneumonia, meningitis, and bacteremia in both the very young and the elderly. Once easily treated with antibiotics, *S. pneumoniae* is now becoming 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 2005

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			
Norway	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 is 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 2005 were obtained from the website http://www.stat.fi

Greenland

- 15 district hospital laboratories participate in ICS.
  - Provides diagnostic microbiology services for all residents of Greenland.
  - All invasive isolates of *S. pneumoniae*, *H. influenzae*, *N. meningitidis*, GAS, and GBS are submitted to reference laboratories in Nuuk and Copenhagen.

- Antimicrobial susceptibility testing of *S. pneumoniae* isolates is performed by agar dilution at the central laboratory at Queen Ingrid's Hospital in Nuuk.

- Serotyping is 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 2005 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 2005 were obtained form 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 2005 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 County
  - 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 2005 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 2005 were obtained from the website http://www.ssb.no

U.S. Arctic

- Population-based surveillance in the state of Alaska
  - Since 1980 for invasive *H. influenzae*.
  - Since 1986 for invasive *S. pneumoniae*.
  - Since 1999 for invasive diseases caused by *N. meningitidis*, GAS, and GBS.
  - Coordinated by the Arctic Investigations Program (AIP), National Center for Infectious Disease, Centers for Disease Control and Prevention, in Anchorage, Alaska.

- 23 laboratories provide diagnostic services to residents of Alaska and submit 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 2005 were obtained from the website http://www.labor.state.ak.us

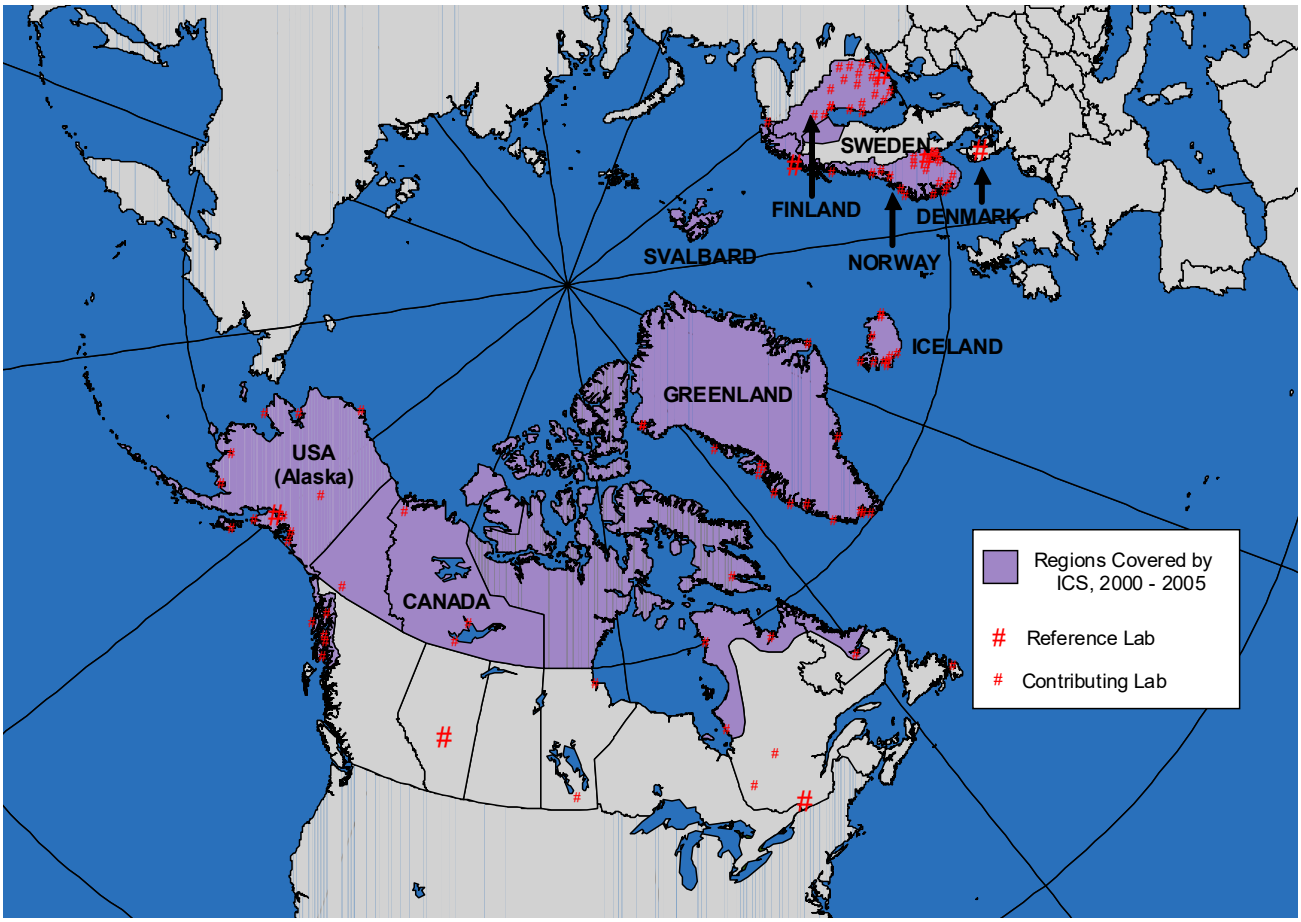
Quality Control

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 each year to each of the other laboratories using a transportation medium of their choice for a total of 28 *Strep pneumoniae* isolates in 2004. 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.

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.

Participating Countries, ICS 2005



RESULTS

Streptococcus pneumoniae

Case Demographics

A total of 1,987 cases of invasive disease caused by *S. pneumoniae* were reported to ICS during 2005 by Finland, Greenland, Iceland, N. Canada, N. Sweden, Norway, and the U.S. Arctic. The highest rates of disease (29.8 per 100,000) occurred in Greenland and the lowest in N. Sweden (9.1 per 100,000) with an overall rate for the ICS circumpolar region of 17.6 per 100,000; 52% of all cases occurred in males. The median age of cases overall was 58 years with the lowest median age in N. Canada (6 years) and the highest in Norway (62 years). Case fatality ratios ranged from 5% in N. Canada to 25% in Greenland; the overall case fatality ratio was 7%.

***Streptococcus pneumoniae* Case Demographics, ICS 2005 Data**

Country	Population	# Cases	Rate*	Sex M (%)	Median Age (min-max) yrs	Deaths n (CFR†)
Finland	5,255,580	735	14	401 (55)	55 (0-95)	‡
Greenland	56,969	17	29.8	8 (47)	48 (24-91)	4 (25)[a]
Iceland	295,864	38	12.8	24 (63)	53 (0.4-95)	‡
N. Canada	132,956	23	17.3	15 (65)	6 (0-77)	1 (5)[a]
N. Sweden	251,740	23	9.1	9 (39)	61 (1.7-89)	‡
Norway	4,606,363	1,029	22.3	503 (49)	62 (0-97)	70 (14)[a]
U.S. Arctic	663,661	122	18.4	69 (57)	42 (0.2-90)	12 (10)[a]
Total	11,263,133	1,987	17.6	1,029 (52)	58 (0-97)	87 (13)

*Number of cases per 100,000 per year
†Case fatality ratio
‡Case outcomes not reported from Finland, Iceland, N. Sweden
[a]Case outcomes unknown in 1 case from Greenland, 2 cases from N. Canada, 535 cases from Norway, 1 case from U.S. Arctic

***Streptococcus pneumoniae* by Age Category, ICS 2005 Data**

Age		Finland	Greenland	Iceland	N. Canada	N. Sweden	Norway	U.S. Arctic
<2 yrs	Pop	115,509	1,670	8,499	4,849	4,789	114,499	21,121
	N (%)	73 (10)	0 (0)	8 (21)	8 (35)	1 (4)	85 (8)	18 (15)
	Rate*	63.2	0	94.1	165	20.9	74.2	85.2
2-19 yrs	Pop	1,112,337	17,133	78,668	44,845	53,227	1,083,862	194,002
	N (%)	61 (8)	0 (0)	4 (10)	4 (17)	0 (0)	59 (6)	16 (13)
	Rate*	5.5	0	5.1	8.9	0	5.4	8.2
20-64 yrs	Pop	3,186,569	35,023	173,984	77,823	145,638	2,730,282	405,162
	N (%)	371 (51)	14 (82)	11 (30)	7 (31)	14 (61)	408 (40)	67 (55)
	Rate*	11.6	40	6.3	9	9.6	14.9	16.5
65+ yrs	Pop	841,165	3,143	34,713	5,439	48,077	677,720	43,376
	N (%)	230 (31)	3 (18)	15 (39)	4 (17)	8 (35)	477 (46)	21 (17)
	Rate*	27.3	95.5	43.2	73.5	16.6	70.4	48.4
All ages	Pop	5,255,580	56,969	295,864	132,956	251,740	4,606,363	663,661
	N	735	17	38	23	23	1,029	122
	Rate*	14	29.8	12.8	17.3	9.1	22.3	18.4

*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, with the exception of Greenland, where no cases were reported in individuals less than two years of age.

Seasonality

S. pneumoniae was diagnosed throughout the year in 2005 in each country. For all countries, higher proportions of disease were seen in the first and second quarters of the year with declines during the third quarter. In all countries except the U.S. Arctic, proportions rose again during the fourth quarter.

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 2005 Data**

Age (yrs)		N. Canada*		U.S. Arctic	
		Aboriginal	**Non-Aboriginal**	**Native**	**Non-Native**
<2	Population	3,597	1,252	6,156	14,965
	Cases (rate‡)	3 (83.4)	3 (239.6)	14 (227.4)	4 (26.7)
2-19	Population	31,840	13,005	48,568	145,434
	Cases (rate‡)	4 (12.6)	0 (0)	7 (14.4)	9 (6.2)
20-64	Population	37,377	40,446	67,520	337,642
	Cases (rate‡)	5 (13.4)	1 (2.5)	35 (51.8)	32 (9.5)
65+	Population	3,036	2,403	7,350	36,026
	Cases (rate‡)	3 (98.8)	1 (41.6)	5 (68)	16 (44.4)
All Ages	Population	75,850	57,106	129,594	534,067
	Cases (rate‡)	15 (19.8)	5 (8.8)	61 (47.1)	61 (11.4)

*Race unknown in 2 cases < 2 years, 1 case 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 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 (59%, 48%, 59% and 57%, respectively); in Finland, Iceland and N. Sweden it was bacteremia (96%, 97% and 96%, respectively).

Clinical Presentation of Reported *Streptococcus pneumoniae* Cases, ICS 2005 Data

	Finland n (%)	Greenland n (%)	Iceland n (%)	N Canada n (%)	N Sweden n (%)	Norway n (%)	US Arctic n (%)
Pneumonia*	0 (0)	10 (59)	0 (0)	11 (48)	0 (0)	604 (59)	70 (57)
Bacteremia	708 (96)	4 (24)	37 (97)	8 (35)	22 (96)	310 (30)	31 (25)
Meningitis	27 (4)	3 (17)	1 (3)	3 (13)	1 (4)	72 (7)	6 (5)
Empyema	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	12 (10)
Septic arthritis	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (<1)	2 (2)
Pericarditis	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (1)
Other	0 (0)	0 (0)	0 (0)	1 (4)	0 (0)	42 (4)	0 (0)
Total Cases	735	17	38	23	23	1,029	122

*with bacteremia

Risk Factors

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 18 to 46% of patients.

***Streptococcus pneumoniae* Risk Factor/Medical Conditions in Adults*, ICS 2005 Data**

	N. Canada n (%)	U.S. Arctic n (%)
Cigarette Smoking	2 (18)	41 (46)
Alcohol Abuse	4 (36)	36 (40)
Chronic Lung Disease and/or Asthma	0 (0)	18 (20)
Immunosuppressive Therapy	1 (9)	5 (6)
Diabetes	0 (0)	13 (15)
Injection Drug Use	0 (0)	3 (3)
Asplenia	0 (0)	0 (0)
Total Adult* Cases	11	89

*≥ 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 has been used in some populations in N. Canada and Norway.

Vaccination Status

Forty and 94 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 2% 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 2005 Data**

	N. Canada	Norway	U.S. Arctic
Total cases eligible for PCV7 vaccine*	8	[a]	18
Vaccine status known in cases eligible for PCV7	5	[a]	18
Cases eligible for PCV7 vaccinated (%)†	2 (40)	[a]	17 (94)
Total cases eligible for PS23 vaccine‡	4	477	38
Vaccine status known in cases eligible for PS23	4	187	17
Cases eligible for PS23 vaccinated (%)†	2 (50)	4 (2)	12 (71)

*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 most prevalent *S. pneumoniae* serotypes reported by ICS countries in 2005 were 4 and 14; both are included in the 23-valent pneumococcal polysaccharide vaccine and the 7-valent conjugate vaccine. In the following table, yellow highlights the most common serotypes in each country.

***Streptococcus pneumoniae* Serotypes by Country, ICS 2005 Data**

Serotype	Finland n (%)	Greenland n (%)	Iceland n (%)	Norway n (%)	N. Canada n (%)	U.S. Arctic n (%)
1	3 (<1)	2 (13)	3 (8)	16 (6)	3 (14)	3 (3)
3	47 (6)	2 (13)	3 (8)	8 (2)	3 (14)	10 (9)
4	72 (10)	3 (20)	4 (11)	53 (18)	0 (0)	3 (3)
6	0 (0)	0 (0)	0 (0)	25 (9)	0 (0)	0 (0)
6A	24 (3)	0 (0)	2 (5)	0 (0)	1 (5)	2 (2)
6B	55 (7)	1 (7)	1 (3)	0 (0)	2 (9)	1 (1)
7	0 (0)	0 (0)	0 (0)	21 (7)	0 (0)	0 (0)
7C	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (1)
7F	48 (7)	0 (0)	2 (5)	0 (0)	1 (5)	16 (14)
8	10 (1)	0 (0)	0 (0)	4 (1)	1 (5)	11 (10)
9	0 (0)	0 (0)	0 (0)	32 (11)	0 (0)	0 (0)
9A	1 (<1)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
9N	27 (4)	0 (0)	0 (0)	0 (0)	0 (0)	1 (1)
9V	60 (8)	0 (0)	1 (3)	0 (0)	0 (0)	2 (2)
10	7 (1)	0 (0)	0 (0)	2 (<1)	0 (0)	0 (0)
10A	0 (0)	0 (0)	0 (0)	0 (0)	1 (5)	5 (4)
11	0 (0)	0 (0)	0 (0)	2 (<1)	0 (0)	0 (0)
11A	13 (2)	0 (0)	0 (0)	0 (0)	0 (0)	3 (3)
12	0 (0)	0 (0)	0 (0)	1 (<1)	0 (0)	0 (0)
12F	22 (3)	1 (7)	0 (0)	0 (0)	0 (0)	10 (9)
14	109 (15)	0 (0)	7 (19)	53 (18)	0 (0)	2 (2)
15	0 (0)	0 (0)	0 (0)	2 (<1)	0 (0)	0 (0)
15A	1 (<1)	0 (0)	0 (0)	0 (0)	1 (5)	2 (2)
15B	4 (<1)	0 (0)	0 (0)	0 (0)	0 (0)	2 (2)
15C	3 (<1)	0 (0)	0 (0)	0 (0)	0 (0)	2 (2)
16	2 (<1)	0 (0)	1 (3)	3 (1)	0 (0)	0 (0)

Serotype	Finland n (%)	Greenland n (%)	Iceland n (%)	Norway n (%)	N. Canada n (%)	U.S. Arctic n (%)
16F	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (1)
17	2 (<1)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
17F	0 (0)	0 (0)	0 (0)	0 (0)	1 (5)	2 (2)
18	0 (0)	0 (0)	0 (0)	5 (2)	0 (0)	0 (0)
18B	1 (<1)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
18C	39 (5)	2 (13)	1 (3)	0 (0)	2 (9)	2 (2)
19	0 (0)	0 (0)	0 (0)	17 (6)	0 (0)	0 (0)
19A	31 (4)	1 (7)	1 (3)	0 (0)	1 (5)	17 (15)
19B	1 (<1)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
19C	0 (0)	0 (0)	1 (3)	0 (0)	0 (0)	0 (0)
19F	36 (5)	0 (0)	3 (8)	0 (0)	0 (0)	1 (1)
20	3 (<1)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
22	0 (0)	0 (0)	1 (3)	12 (4)	0 (0)	0 (0)
22F	21 (3)	3 (20)	0 (0)	0 (0)	1 (5)	6 (5)
23	0 (0)	0 (0)	0 (0)	22 (8)	0 (0)	0 (0)
23A	4 (<1)	0 (0)	0 (0)	0 (0)	0 (0)	1 (1)
23B	0 (0)	0 (0)	0 (0)	0 (0)	1 (5)	0 (0)
23F	0 (0)	0 (0)	6 (16)	0 (0)	2 (9)	1 (1)
28	0 (0)	0 (0)	0 (0)	1 (<1)	0 (0)	0 (0)
29	0 (0)	0 (0)	0 (0)	1 (<1)	0 (0)	0 (0)
31	0 (0)	0 (0)	0 (0)	1 (<1)	0 (0)	0 (0)
33	2 (<1)	0 (0)	0 (0)	8 (3)	0 (0)	0 (0)
33F	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	2 (2)
34	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	2 (2)
35	0 (0)	0 (0)	0 (0)	2 (<1)	0 (0)	0 (0)
35B	5 (<1)	0 (0)	0 (0)	0 (0)	1 (5)	1 (1)
35F	6 (1)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
38	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (1)

Vaccine-Preventable Cases and Deaths

For the countries reporting serotype data, more than 80% 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 *S. pneumoniae* cases in children < 2 years of age in Iceland and 75% of cases < 2 years of age in Finland. Eleven percent of remaining disease in U.S. Arctic children less than 2 was vaccine preventable reflecting widespread introduction of this vaccine four years earlier and near elimination of vaccine preventable disease in this population. The proportion of deaths among *S. pneumoniae* cases potentially preventable with use of the 23-valent polysaccharide vaccine ranged from 67% to 75%.

Proportion of Vaccine Preventable Cases/Deaths from Invasive Pneumococcal Disease, ICS 2005 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	628/683 (92)	15/17 (88)	24/30 (80)	13/15 (87)	84/104 (81)
Cases < 2 years old with serotype in the 7-valent pneumococcal conjugate vaccine	39/52 (75)	0	7/8 (88)	3/8 (38)	2/18 (11)
Deaths (all ages) for which the serotype was contained in the 23-valent pneumococcal vaccine	†	3 (75‡)	†	0 (0‡)	8 (67‡)

*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 87 deaths associated with *S. pneumoniae* were reported to ICS in 2005. Overall, the highest case fatality ratio (CFR) occurred in persons 65+ years of age (24%). Finland, Iceland and N. Sweden did not report outcome data.

***Streptococcus pneumoniae* Age-Specific Case-Fatality Ratios (CFR), ICS 2005 Data**

		<2 years	2-19 years	20-64 years	65+ years	All Ages
Greenland	Deaths/Cases* (CFR)	0/0 (0)	0/0 (0)	2/13 (15)†	2/3 (67)	4/16 (25)†
N. Canada	Deaths/Cases* (CFR)	0/7 (0)†	0/4 (0)	1/7 (14)	0/3 (0)†	1/21 (5)†
Norway	Deaths/Cases* (CFR)	2/55 (4)†	2/32 (6)†	17/188 (9)†	49/219 (22)†	70/494 (14)†
U.S. Arctic	Deaths/Cases* (CFR)	0/18 (0)	0/16 (0)	7/66 (11)†	5/21 (24)	12/121 (10)†
Total	Deaths/Cases* (CFR)	2/80 (3)†	2/52 (4)†	27/274 (10)†	56/246 (23)†	87/652 (13)†

*Cases with known outcome.
†Outcome unknown in (1) N. Canada and (30) Norway cases < 2 years, (27) Norway cases 2-19 years, 1 Greenland (220) Norway and (1) U.S. Arctic cases 20-64 years, (1) N. Canada and (258) Norway cases 65+ years

Antimicrobial Susceptibility

In 2005, 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, three (3%) were fully resistant to penicillin (serotypes 9V, 19A, 23F), and 12% had intermediate resistance (serotypes 6A (7%), 9V (7%), 19A (71%), 23A (7%) and 35B (7%)). Finland submitted results from 735 isolates; 2% were fully resistant to penicillin and 5% had intermediate resistance. The Finnish serotype data is not linked to the antimicrobial susceptibility data, so no comparisons can be made. In Iceland, 8% of isolates tested had intermediate resistance to penicillin and consisted of serotypes 14 (33%), 19C (33%) and 19F (33%). In N. Canada, one isolate had intermediate resistance (serotype 19A) and one was fully resistant (serotype 6A). N. Sweden did not report serotype data, however, 21 isolates were tested and all were sensitive to penicillin.

***Streptococcus pneumoniae* Penicillin Susceptibility Results, ICS 2005 Data**

	# Tested	I* (%)	I* Serotypes	R* (%)	R* Serotypes
Finland	735	37 (5)	†	12 (2)	†
Greenland	8	0 (0)		0 (0)	
Iceland	36	3 (8)	14 (1), 19C (1), 19F (1)	0 (0)	
N. Canada	22	1 (5)	19A	1 (5)	6A
N. Sweden	21	0 (0)		0 (0)	
U.S. Arctic	113	14 (12)	6A (1), 9V (1), 19A (10), 23A (1), 35B (1)	3 (3)	9V (1), 19A (1), 23F (1)

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

Full resistance to trimethoprimsulfamethoxizole (TMP-Sulfa) was found in 19% of tested isolates from Iceland and 10% from the U.S. Arctic. Isolates from Iceland that were fully resistant to TMP-Sulfa were serotypes 6A (29%), 23F (29%), and one each of serotypes 14, 19C and 19F. The isolates that were fully resistant in the U.S. Arctic were serotypes 19A (45%), 9V (18%) and one each 6B, 11A, 23F and 33F. Intermediate resistance to TMP-Sulfa was found in 15% of tested isolates from Iceland, 10% from the U.S. Arctic, and 3% from N. Canada.

***Streptococcus pneumoniae* TMP-Sulfa Susceptibility Results, ICS 2005 Data**

	# Tested	I* (%)	I* Serotypes	R* (%)	R* Serotypes
Iceland	36	1 (3)	23F	7 (19)	6A (2), 14 (1), 19C (1), 19F (1), 23F (2)
N. Canada	20	3 (15)	6A (1), 6B (1), 23B (1)	0 (0)	
U.S. Arctic	113	11 (10)	12F (3), 18C (1), 19A (6), 33F (1)	11 (10)	6B (1), 9V (2), 11A (1), 19A (5), 23F (1), 33F (1)

*I=Intermediate resistance, R=Fully resistant

In Iceland, 14% of tested isolates were fully resistant to erythromycin, 10% from N. Canada, and 9% from the U.S. Arctic. In Iceland, the isolates that were fully resistant to erythromycin were serotypes 14 (60%), 19C (20%) and 19F (20%). In N. Canada, resistant isolates were one each 6A and 6B. In the U.S. Arctic, isolates that were fully resistant were serotypes 19A (30%), 9V (20%) and one each 6A, 6B, 14, 23F and 35B.

***Streptococcus pneumoniae* Erythromycin Susceptibility Results, ICS 2005 Data**

	# Tested	I* (%)	I* Serotypes	R* (%)	R* Serotypes
Iceland	36	0 (0)		5 (14)	14 (3), 19C (1), 19F (1)
N. Canada	21	0 (0)		2 (10)	6A (1), 6B (1)
N. Sweden	23	0 (0)		0 (0)	
U.S. Arctic	113	0 (0)		10 (9)	6A (1), 6B (1), 9V (2), 14 (1), 19A (3), 23F (1), 35B (1)

*I=Intermediate resistance, R=Fully resistant

Antimicrobial testing was also done for ceftriaxone, ofloxacin/levofloxacin, chloramphenicol, vancomycin, clindamycin, and rifampin. One of 112 (1%) isolates tested in the U.S. Arctic was fully resistant to chloramphenicol (serotype 23F) and one (1%) was fully resistant to rifampin (serotype 14). In N. Canada, two isolates of 20 tested (10%) were fully resistant to clindamycin (serotypes 6A, 6B). All isolates tested in N. Canada, N. Sweden and the U.S. Arctic were sensitive to ceftriaxone, ofloxacin/levofloxacin, and vancomycin.

Quality Control

In 2005, two QC panels of seven *S. pneumoniae* isolates plus a control strain each were shipped and tested. 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 2005-A, overall serotyping performance ranged between 80%-90%. The modal MIC comparison resulted in an overall correlation of 96.6% with individual participant correlation ranging from 85%-100%. For Panel 2005-B, overall serotyping correlation was 100%. The overall modal MIC correlation was 97.6% with individual correlation ranging from 91.1%-100%.

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. 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 and the U.S. Arctic reported the occurrence of *H. influenzae* in each country during 2005. Greenland reported no cases and therefore will not be included in the results. A total of 22 cases of invasive disease caused by *H. influenzae* were reported to ICS during 2005 by N. Canada, N. Sweden and the U.S. Arctic. The rate of disease was higher in N. Canada (8.3 per 100,000) than it was in the U.S. Arctic (1.4 per 100,000) or N. Sweden (0.8 per 100,000). Median age of cases was higher in N. Sweden (80.4 years) than in N. Canada and the U.S. Arctic (1 year and 3.6 years, respectively), however, only 2 cases were reported in N. Sweden.

***Haemophilus influenzae* Case Demographics, ICS 2005 Data**

Country	Population	# Cases	Rate*	Sex M (%)	Median Age (min-max) yrs	Deaths n (CFR†)
N. Canada	132,956	11	8.3	7 (64)	1 (0.2-66.1)	1 (11)†
N. Sweden	251,740	2	0.8	0 (0)	80.4 (75-85)	†
U.S. Arctic	663,661	9	1.4	7 (78)	3.6 (0.5-73)	1 (11)
Total	1,048,357	22	2.1	14 (64)	1.4 (0.2-85)	2 (11)

*Number of cases per 100,000 per year
†Case fatality ratio
‡ Case outcome unknown in (2) N. Canada 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.

***Haemophilus influenzae* by Age Category, ICS 2005 Data**

Age		N. Canada	N. Sweden	U.S. Arctic
<2 yrs	Population	4,849	4,789	21,121
	Cases (%)	10 (91)	0 (0)	3 (33)
	Rate*	206.2	0	14.2
2-19 yrs	Population	44,845	53,227	194,002
	Cases (%)	0 (0)	0 (0)	2 (22)
	Rate*	0	0	1
20-64 yrs	Population	77,823	145,638	405,162
	Cases (%)	0 (0)	0 (0)	3 (33)
	Rate*	0	0	0.7
65+ yrs	Population	5,439	48,077	43,376
	Cases (%)	1 (9)	2 (100)	1 (11)
	Rate*	18.4	4.2	2.3
All ages	Population	132,956	251,740	663,661
	Cases	11	2	9
	Rate*	8.3	0.8	1.4

*Number of cases per 100,000 per year

Race

Race and ethnicity data was unknown in 2 of the 11 *H. influenzae* cases from N. Canada. Rates of disease were highest (194.6 per 100,000) in N. Canada Aboriginal cases less than two years of age. In the U.S. Arctic, rates of disease were higher in Native populations than in non-Native populations in children less than 2 years old and persons 2-19 years old. There were no cases reported in Native people older than 19 years.

***Haemophilus influenzae* by Race and Age Categories, ICS 2005 Data**

Age (yrs)		N. Canada*		U.S. Arctic	
		Aboriginal	Non-Aboriginal	Native	Non-Native
<2	Population	3,597	1,252	6,156	14,965
	Cases (rate†)	7 (194.6)	1 (79.9)	2 (32.5)	1 (6.7)
2-19	Population	31,840	13,005	48,568	145,434
	Cases (rate†)	0 (0)	0 (0)	1 (2.1)	1 (0.7)
20-64	Population	37,377	40,446	67,520	337,642
	Cases (rate†)	0 (0)	0 (0)	0 (0)	3 (0.9)
65+	Population	3,036	2,403	7,350	36,026
	Cases (rate†)	0 (0)	1 (41.6)	0 (0)	1 (2.8)
All Ages	Population	75,850	57,106	129,594	534,067
	Cases (rate†)	7 (9.2)	2 (3.5)	3 (2.3)	6 (1.1)

*Race unknown in 2 cases <2 years
†Number of cases per 100,000 per year

Clinical Presentation

In N. Canada and N. Sweden, the most common clinical presentation associated with *H. influenzae* was bacteremia (55% and 100% of reported cases, respectively). In the U.S. Arctic, the most common clinical presentation was pneumonia (67%) followed by meningitis (33%).

Clinical Presentation of Reported *Haemophilus influenzae* Cases, ICS 2005 Data

	N. Canada n (%)	N. Sweden n (%)	U.S. Arctic n (%)
Pneumonia*	3 (27)	0 (0)	6 (67)
Bacteremia	6 (55)	2 (100)	0 (0)
Meningitis	1 (9)	0 (0)	3 (33)
Septic arthritis	1 (9)	0 (0)	0 (0)
Total	11	2	9

*with bacteremia

Risk Factors

Fifty percent of adult (≥ 18 years) cases of *H. influenzae* reported in the U.S. Arctic indicated smoking or chronic lung disease as an associated risk factor; 25% indicated alcohol abuse, immune suppressive treatment or diabetes as an associated risk factor. No risk factors were reported in the one Canadian adult case of *H. influenzae*. N. Sweden 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 and the U.S. Arctic. Two cases of Hib were reported in N. Canada and 3 cases in the U.S. Arctic in children less than five years. One Hib case in N. Canada had received one dose of Hib vaccine; vaccine history was unknown in the second case. In the U.S. Arctic, one Hib case was unvaccinated and two others had received three doses of Hib vaccine.

***Haemophilus influenzae* Case Vaccination Status for Hib Vaccine, ICS 2005 Data**

	N. Canada	U.S. Arctic
Total cases* eligible for Hib vaccine†	10	5
Vaccine status known in cases* eligible for Hib vaccine	9	5
Cases* eligible for Hib vaccine vaccinated (%)‡	7 (78%)	4 (80%)

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

Serotypes

***Haemophilus influenzae* Serotypes by Country, ICS 2005 Data**

Serotype	N. Canada n (%)	U.S. Arctic n (%)
a	5 (46)	1 (11)
b	2 (18)	4 (44)
f	0 (0)	2 (22)
Non-typeable	4 (36)	2 (22)
Total	11	9

The most common *H. influenzae* serotype in N. Canada was type a (46% of cases); in the U.S. Arctic it was type b (44% of cases). Non-typeable cases also made up a large proportion of cases in each country; 36% in N. Canada and 22% in the U.S. Arctic. N. Sweden did not provide serotype data.

Outcome

Two deaths were associated with *H. influenzae* cases reported to ICS in 2005; one from the U.S. Arctic and one from N. Canada. N. Sweden did not provide outcome data. Both deaths were in children less than one year old who had received Hib vaccine and the primary clinical presentation was pneumonia. The N. Canada case was a serotype a and the U.S. Arctic case was a serotype f.

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.

Neisseria meningitidis

Case Demographics

Greenland, N. Canada, Norway and the U.S. Arctic reported the occurrence of *N. meningitidis* during 2005. A total of 42 cases of invasive disease caused by *N. meningitidis* were reported to ICS. Greenland had the highest disease rate (1.8 per 100,000). Six deaths associated with *N. meningitidis* were reported.

***Neisseria meningitidis* Case Demographics, ICS 2005 Data**

Country	Population	# Cases	Rate*	Sex M (%)	Median Age (min-max) yrs	Deaths n (CFR†)
Greenland	56,969	1	1.8	1 (100)	1 case – 40.5	0 (0)
N. Canada	132,956	1	0.8	1 (100)	1 case – 51.7	0 (0)
Norway	4,606,363	37	0.8	18 (49)	23 (0-98)	5 (14)
U.S. Arctic	663,661	3	0.5	1 (33)	5.2 (3.1-39.8)	1 (33)
Total	5,459,949	42	0.8	21 (50)	26 (0-98)	6 (14)

*Number of cases per 100,000 per year
†Case fatality ratio

When stratified by age, the highest rates of disease in each country occurred in different age categories. In Greenland and N. Canada, one case was reported in each country and both occurred in 20-64 year old age category. Cases occurred in all age categories in Norway; the highest rate was in the less than 2 years category (2.6/100,000). In the U.S. Arctic, the highest rates of disease occurred in the 2-19 year old age category (1/100,000).

***Neisseria meningitidis* by Age Category, ICS 2005 Data**

Age		Greenland	N. Canada	Norway	U.S. Arctic
<2 yrs	Pop	1,670	4,849	114,499	21,121
	N (%)	0 (0)	0 (0)	3 (8)	0 (0)
	Rate*	0	0	2.6	0
2-19 yrs	Pop	17,133	44,845	1,083,862	194,002
	N (%)	0 (0)	0 (0)	13 (35)	2 (67)
	Rate*	0	0	1.2	1
20-64 yrs	Pop	35,023	77,823	2,730,282	405,162
	N (%)	1 (100)	1 (100)	13 (35)	1 (33)
	Rate*	2.9	1.3	0.5	0.2
65+ yrs	Pop	3,143	5,439	677,720	43,376
	N (%)	0 (0)	0 (0)	8 (22)	0 (0)
	Rate*	0	0	1.2	0
All ages	Pop	56,969	132,956	4,606,363	663,661
	N	1	1	37	3
	Rate*	1.8	0.8	0.8	0.5

*Number of cases per 100,000 per year

Race

In the U.S. Arctic, all three cases of *N. meningitidis* occurred in AK Native people (rate 2.3/100,000). In N. Canada, the single case occurred in a non-Aboriginal person (rate 1.8/100,000).

Clinical Presentation

The most common clinical presentation in all countries reporting invasive *N. meningitis* in 2005 was meningitis ranging from 62% to 100% of cases.

Clinical Presentation of Reported *Neisseria meningitidis* Cases, ICS 2005 Data

	Greenland n (%)	N. Canada n (%)	Norway n (%)	U.S. Arctic n (%)
Pneumonia*	0 (0)	0 (0)	4 (11)	0 (0)
Bacteremia	0 (0)	0 (0)	10 (27)	0 (0)
Meningitis	1 (100)	1 (100)	23 (62)	2 (67)
Septic arthritis	0 (0)	0 (0)	0 (0)	1 (33)
Total	1	1	37	3

*with bacteremia

Risk Factors

Risk factor data was reported by N. Canada and the U.S. Arctic; no adult cases (n=2) in either country indicated the occurrence of a risk factor.

Serogroups

All cases of invasive *N. meningitidis* reported to ICS in 2005 included serogroup data. With the exception of N. Canada, the most common serogroup was B which occurred in 68% to 100% of cases. In N. Canada, the one reported case was a serogroup Y.

***Neisseria meningitidis* Serogroups by Country, ICS 2005 Data**

Serogroup	Greenland n (%)	N. Canada n (%)	Norway n (%)	U.S. Arctic n (%)
B	1 (100)	0 (0)	25 (68)	3 (100)
C	0 (0)	0 (0)	5 (13)	0 (0)
W	0 (0)	0 (0)	1 (3)	0 (0)
W135	0 (0)	0 (0)	3 (8)	0 (0)
Y	0 (0)	1 (100)	3 (8)	0 (0)
Total	1	1	37	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 2005. A total of 55 cases of invasive disease caused by GAS were reported to ICS. The rate of disease was highest in N. Canada (10.5 per 100,000) compared to the lowest in N. Sweden (1.6 per 100,000). Three deaths were associated with GAS, one in N. Canada and two in the U.S. Arctic.

Group A *Streptococcus* Case Demographics, ICS 2005 Data

Country	Population	# Cases	Rate*	Sex M (%)	Median Age (min-max) yrs	Deaths n (CFR†)
Greenland	56,969	1	1.8	0 (0)	1 case – 53.3	0 (0)
N. Canada	132,956	14	10.5	8 (57)	46.2 (0.3-88.9)	1 (7)
N. Sweden	251,740	4	1.6	3 (75)	70.7 (64.8-84.6)	‡
U.S. Arctic	663,661	36	5.4	14 (39)	42.6 (1.2-76.8)	2 (6)
Total	1,105,326	55	5	25 (45)	46.6 (0.3-88.9)	3 (6)

*Number of cases per 100,000 per year
†Case fatality ratio
‡Outcomes not reported from N. Sweden

When stratified by age, the highest rates of disease occurred in children <2 years and in individuals 65+ years of age in N. Canada (62 per 100,000 and 55 per 100,000, respectively).

Group A *Streptococcus* by Age Category, ICS 2005 Data

Age		Greenland	N. Canada	N. Sweden	U.S. Arctic
<2 yrs	Population	1,670	4,849	4,789	21,121
	Cases (%)	0 (0)	3 (22)	0 (0)	2 (6)
	Rate*	0	61.9	0	9.5
2-19 yrs	Population	17,133	44,845	53,227	194,002
	Cases (%)	0 (0)	0 (0)	0 (0)	4 (11)
	Rate*	0	0	0	2.1
20-64 yrs	Population	35,023	77,823	145,638	405,162
	Cases (%)	1 (100)	8 (57)	1 (25)	27 (75)
	Rate*	2.9	10.3	0.7	6.7
65+ yrs	Population	3,143	5,439	48,077	43,376
	Cases (%)	0 (0)	3 (22)	3 (75)	3 (8)
	Rate*	0	55.2	6.2	6.9
All ages	Population	56,969	132,956	251,740	663,661
	Total Cases	1	14	4	36
	Rate*	1.8	10.5	1.6	5.4

*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 2005 Data

Age (yrs)		N. Canada*		U.S. Arctic	
		Aboriginal	Non-Aboriginal	Native	Non-Native
<2	Population	3,597	1,252	6,156	14,965
	Cases (rate†)	3 (83.4)	0 (0)	1 (16.2)	1 (6.7)
2-19	Population	31,840	13,005	48,568	145,434
	Cases (rate†)	0 (0)	0 (0)	3 (6.2)	1 (0.7)
20-64	Population	37,377	40,446	67,520	337,642
	Cases (rate†)	7 (18.7)	1 (2.5)	12 (17.8)	15 (4.4)
65+	Population	3,036	2,403	7,350	36,026
	Cases (rate†)	2 (65.9)	1 (41.6)	3 (40.8)	0 (0)
All Ages	Population	75,850	57,106	129,594	534,067
	Cases (rate†)	12 (15.8)	2 (3.5)	19 (14.7)	17 (3.2)

†Number of cases per 100,000 per year

Clinical Presentation

The most common clinical presentation for GAS cases in N. Sweden (100%) and the U.S. Arctic (28%) was bacteremia, in N. Canada it was cellulitis (29%), and the single case in Greenland presented with pericarditis.

Clinical Presentation of Reported group A *Streptococcus* Cases, ICS 2005 Data

	Greenland n (%)	N. Canada n (%)	N. Sweden n (%)	U.S. Arctic n (%)
Bacteremia	0 (0)	3 (21)	4 (100)	10 (28)
Pneumonia*	0 (0)	1 (7)	0 (0)	7 (25)
Empyema	0 (0)	0 (0)	0 (0)	3 (8)
Cellulitis*	0 (0)	4 (29)	0 (0)	5 (14)
Necrotizing fasciitis	0 (0)	1 (7)	0 (0)	2 (6)
Septic arthritis	0 (0)	2 (14)	0 (0)	4 (11)
Osteomylitis	0 (0)	1 (7)	0 (0)	0 (0)
Pericarditis	1 (100)	0 (0)	0 (0)	0 (0)
Endometritis	0 (0)	0 (0)	0 (0)	1 (3)
Peritonitis	0 (0)	0 (0)	0 (0)	1 (3)
Amnionitis	0 (0)	1 (7)	0 (0)	1 (3)
Other	0 (0)	1 (7)	0 (0)	3 (8)
Total	1	14	4	36

*with bacteremia

Risk Factors

Cigarette smoking was associated with 37% and 18% of adult (≥18 years) GAS cases in the U.S. Arctic and, N. Canada respectively. Thirty percent of U.S. Arctic and 27% of N. Canada case reviews indicated alcohol abuse as a risk factor. In the U.S. Arctic, 17% of case reviews indicated diabetes or chronic lung disease and 3% indicated immune suppressive therapy or injection drug use. N. Sweden did not report risk factor data.

Outcome

Two deaths in cases with GAS were reported from the U.S. Arctic (CFR 6%); both occurred in the 20-64 years old age category. One death was reported in N. Canada (CFR 7%); the death occurred in the 20-64 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 2005. Greenland reported no cases and therefore will not be included in the results. A total of 36 cases of invasive disease caused by GBS were reported to ICS. The rate of disease was highest in N. Sweden (4.4 per 100,000) compared to N. Canada (0.8 per 100,000). Four deaths were reported in the U.S. Arctic associated with GBS in 2005.

Group B *Streptococcus* Case Demographics, ICS 2005 Data

Country	Population	# Cases	Rate*	Sex M (%)	Median Age (min-max) yrs	Deaths n (CFR†)
N. Canada	132,956	1	0.8	1 (100)	1 case – 23.1	0 (0)
N. Sweden	251,740	11	4.4	9 (82)	74.9 (51.4-90.7)	‡
U.S. Arctic	663,661	24	3.6	11 (46)	53.3 (0-89.7)	4 (17)
Total	1,048,357	36	3.4	21 (58)	64.2 (0-90.7)	4 (16)

*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 the U.S. Arctic (28 per 100,000) and in cases 65+ years in N. Sweden (19 per 100,000).

Group B *Streptococcus* by Age Category, ICS 2005 Data

Age		N. Canada	N. Sweden	U.S. Arctic
<2 yrs	Population	4,849	4,789	21,121
	Cases (%)	0 (0)	0 (0)	6 (25)
	Rate*	0	0	28.4
2-19 yrs	Population	44,845	53,227	194,002
	Cases (%)	0 (0)	0 (0)	0 (0)
	Rate*	0	0	0
20-64 yrs	Population	77,823	145,638	405,162
	Cases (%)	1 (100)	2 (18)	11 (46)
	Rate*	1.3	1.4	2.7
65+ yrs	Population	5,439	48,077	43,376
	Cases (%)	0 (0)	9 (82)	7 (29)
	Rate*	0	18.7	16.1
All ages	Population	132,956	251,740	663,661
	Total Cases	1	11	24
	Rate*	0.8	4.4	3.6

*Number of cases per 100,000 per year

Five of six cases that occurred in the U.S. Arctic in the less than 2 years age category were early onset (less than 7 days old) for a rate of 0.5 cases per 1,000 births.

Race

Race and ethnicity data were collected in N. Canada and the U.S. Arctic. The overall rate of disease caused by GBS in AK Natives was almost three times that in non-Natives. One case of GBS was reported in N. Canada Aboriginals.

Group B *Streptococcus* by Race and Age Categories, ICS 2005 Data

Age (yrs)		N. Canada		U.S. Arctic	
		Aboriginal	Non-Aboriginal	Native	Non-Native
<2	Population	3,597	1,252	6,156	14,965
	Cases (rate*)	0 (0)	0 (0)	3 (48.7)	3 (20)
2-19	Population	31,840	13,005	48,568	145,434
	Cases (rate*)	0 (0)	0 (0)	0 (0)	0 (0)
20-64	Population	37,377	40,446	67,520	337,642
	Cases (rate*)	1 (2.7)	0 (0)	5 (7.4)	6 (1.8)
65+	Population	3,036	2,403	7,350	36,026
	Cases (rate*)	0 (0)	0 (0)	2 (27.2)	5 (13.9)
All Ages	Population	75,850	57,106	129,594	534,067
	Cases (rate*)	1 (1.3)	0 (0)	10 (7.7)	14 (2.6)

*Number of cases per 100,000 per year

Clinical Presentation

In the U.S. Arctic, bacteremia (46%) was the most common clinical presentation reported for cases of GBS in 2005 followed by cellulitis (17%), osteomyelitis (17%), pneumonia (13%), meningitis (4%) and amnionitis (4%). The single case in N. Canada presented with bacteremia. All cases in N. Sweden were reported as bacteremia which may reflect a difference in reporting practices.

Clinical Presentation of Reported group B *Streptococcus* Cases, ICS 2005 Data

	N. Canada n (%)	N. Sweden n (%)	U.S. Arctic n (%)
Bacteremia	1 (100)	11 (100)	11 (46)
Pneumonia*	0 (0)	0 (0)	3 (13)
Meningitis	0 (0)	0 (0)	1 (4)
Cellulitis*	0 (0)	0 (0)	4 (17)
Osteomyelitis	0 (0)	0 (0)	4 (17)
Amnionitis	0 (0)	0 (0)	1 (4)
Total	1	11	24

*with bacteremia

Risk Factors

Twenty-two percent of GBS adult (≥ 18 years) cases reviewed in the U.S. Arctic indicated diabetes or chronic lung disease as risk factors in 2005. In 17% of cases, smoking or immune suppressive treatment were indicated and alcohol abuse was indicated in 11% of cases. The single N. Canada case had no risk factors on review.

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 2005. An Interlaboratory Quality Control program was established to provide external proficiency testing of *N. meningitidis* and *H. influenzae*. 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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