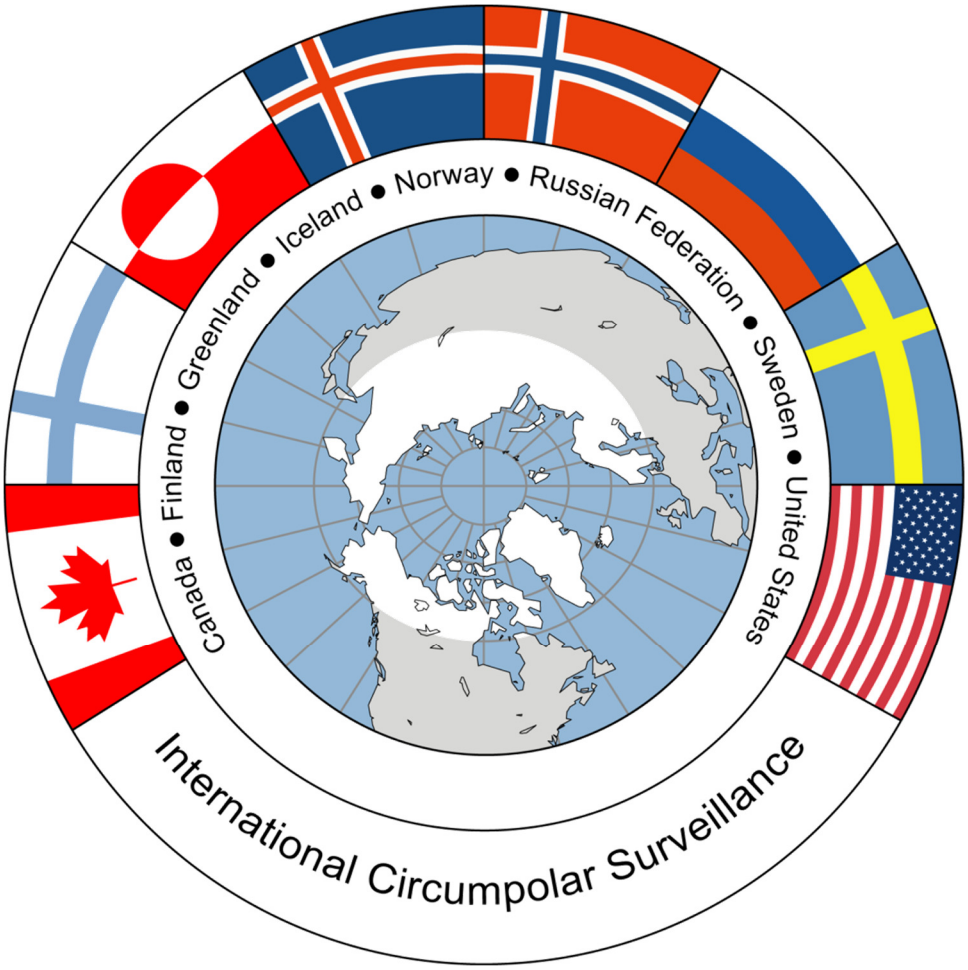
INTERNATIONAL CIRCUMPOLAR SURVEILLANCE (ICS) SUMMARY REPORT



YEAR 2012 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 2012.

Data on invasive disease with the organism *S. pneumoniae* are collected from all participating countries. A total of 1,647 cases of invasive pneumococcal disease were identified in 2012. 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 0-14%. 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 27 and 48 cases per 100,000 population, respectively, which are similar to the 2011 rates in these populations. Pneumonia and bacteremia were the most common clinical presentations; cigarette smoking, alcohol abuse, and chronic lung disease were the most common risk factors. The most common *S. pneumoniae* serotype in Iceland was 22, in Greenland it was serotypes 4 and 22F, in N. Canada and N. Sweden it was 7F and in the U. S. Arctic the most common serotypes were 3 and 22F.

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 112 *H. influenzae* cases, 32 *N. meningitidis* cases, 76 GAS cases, and 33 GBS cases were reported in 2012. In general, the highest rates of disease for 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 2012 Data

Country	*S. pneumoniae* n (rate*)	*H. influenzae* n (rate*)	*N. meningitidis* n (rate*)	GAS n (rate*)	GBS n (rate*)
Finland	751 (13.8)	N/A	N/A	N/A	N/A
Greenland	7 (12.3)	1 (1.2)	0 (0)	0 (0)	0 (0)
Iceland	28 (8.8)	N/A	N/A	N/A	N/A
N. Canada	26 (16.6)	13 (8.3)	2 (1.3)	14 (9)	0 (0)
N. Sweden	79 (15.5)†	5 (2)‡	4 (1.6)‡	14 (5.6)‡	0 (0)‡
Norway	626 (12.6)	78 (1.6)	24 (0.5)	N/A	N/A
U.S. Arctic	130 (17.8)	15 (2.1)	2 (0.3)	48 (6.6)	33 (4.5)
Total	1,647 (13.5)	112 (1.8)	32 (0.5)	76 (6.4)	33 (2.8)

*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, *H. pylori* and stomach cancer), and climate sensitive diseases. 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 (AIP), 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 2012

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

*Serotypes/serogroups reported for Hi/Nm only

Finland

Case level data was not reported from Finland for 2012. Overall numbers of invasive *S. pneumoniae* cases were obtained from the National Institute for Health and Welfare report "Infectious Diseases in Finland 2012" [1].

- 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 2012 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 2012 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 2012 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.

- Population estimates for 2012 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 2012 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 Tromsö.

- Antimicrobial susceptibility testing of *S. pneumoniae* isolates is performed using the disc diffusion method at district hospital laboratories, the reference laboratory in Tromsö or the main national laboratory in Oslo.

- Serotyping is performed at the Statens Serum Institute in Denmark by the Quellung method.

- Population estimates for 2012 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.

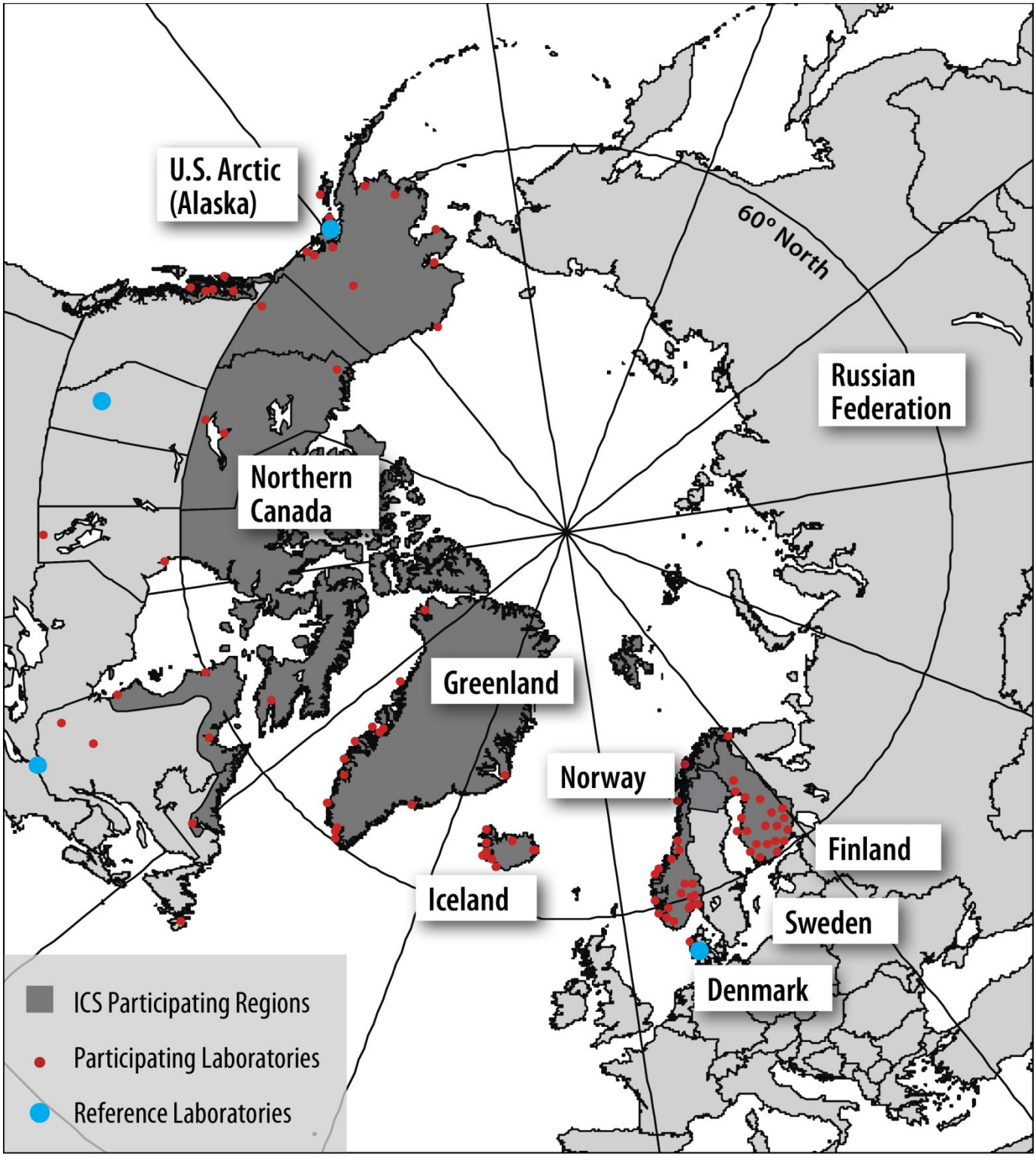
- Population estimates for 2012 were obtained from the website http://www.labor.state.ak.us

Quality Control

Streptococcus pneumoniae: 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 2012 [2].

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 [3].

Participating Countries, ICS 2012



RESULTS

Streptococcus pneumoniae

Case Demographics

A total of 1,647 cases of invasive disease caused by *S. pneumoniae* were reported to ICS during 2012 by Finland, Greenland, Iceland, N. Canada, N. Sweden, Norway, and the U.S. Arctic. The highest rates of disease (17.8 per 100,000) occurred in the U.S. Arctic and the lowest in Iceland (8.8 per 100,000) with an overall rate for the ICS circumpolar region of 13.5 per 100,000; 52% of all cases occurred in males. The median age of cases overall was 63.5 years with the lowest median age in N. Canada (26.4 years) and the highest in N. Sweden (67 years). Case fatality ratios ranged from 0% in Greenland to 14% in Iceland; the overall case fatality ratio was 14%.

***Streptococcus pneumoniae* Case Demographics, ICS 2012 Data**

Country	Population	# Cases	Rate*	Sex M (%)	Median Age (min-max) yrs	Deaths n (CFR**)
Finland	5,426,674	751	13.8	†	†	†
Greenland	56,749	7	12.3	5 (71)	64.4 (1.7-84)	0 (0)
Iceland	319,575	28	8.8	13 (46)	50.5 (22-90)	4 (14)
N. Canada	156,286	26	16.6	6 (23)	26.4 (0.3-79)	3 (13)[b]
N. Sweden	508,592[a]	79	15.5	41 (52)	67 (21-94)	‡
Norway	4,985,870	626	12.6	318 (51)	65.9 (0-99.3)	46 (13)[b]
U.S. Arctic	731,827	130	17.8	81 (62)	57 (0.1-99.5)	17 (13)[b]
Total	12,185,573	1,647	13.5	464 (52)	63.4 (0-99.5)	70 (13)

*Number of cases per 100,000 per year
** Case fatality ratio
†Data not reported from Finland
‡Case outcomes not reported from N. Sweden
[a] Population for Norbotten and Vasterbotten
[b] Case outcomes unknown in 2 cases from N. Canada, 283 cases from Norway, 1 case from U.S. Arctic

***Streptococcus pneumoniae* by Age Category, ICS 2012 Data**

Age		Greenland	Iceland	N. Canada	N. Sweden	Norway	U.S. Arctic
<2 yrs	Pop	1,651	9,345	5,519	9,912	122,987	21,568
	N (%)*	1 (14)	0 (0)	5 (19)	0 (0)	10 (2)	13 (10)
	Rate†	60.6	0	90.6	0	8.1	60.3
2-19 yrs	Pop	15,243	80,125	45,238	98,292	1,125,578	186,994
	N (%)*	1 (14)	0 (0)	7 (27)	0 (0)	18 (3)	10 (8)
	Rate†	6.6	0	15.5	0	1.6	5.4
20-64 yrs	Pop	35,760	189,783	96,064	293,166	2,969,291	459,476
	N (%)*	2 (29)	20 (71)	12 (46)	37 (47)	270 (43)	76 (58)
	Rate†	5.6	10.5	12.5	12.6	9.1	16.5
65+ yrs	Pop	4,095	40,322	9,465	107,222	768,014	63,789
	N (%)*	3 (43)	8 (29)	2 (8)	42 (53)	328 (52)	31 (24)
	Rate†	73.3	19.8	21.1	39.2	42.7	48.6
All ages	Pop	56,749	319,575	156,286	508,592	4,985,870	731,827
	N	7	28	26	79	626	130
	Rate†	12.3	8.8	16.6	15.5	12.6	17.8

*Proportion of total cases in each country/region
†Number of cases per 100,000 per year

When stratified by age, the highest rates of disease in most countries occurred either in those cases less than two years of age or in cases 65+ years of age. In Norway, the highest rates were in the 20-64 years and 65+ years of age categories.

Seasonality

S. pneumoniae was identified throughout the year in 2012 in each country. For all countries except N. Canada, higher proportions of disease were seen in the first quarter with declines in the second quarter and rising again in either the third or fourth quarter of the year. In N Canada, the highest proportion of cases were seen in the third quarter of the year and lowest in 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 overall in Aboriginal and AK Native populations than in non-Aboriginal and non-AK Native populations. The highest rates of disease occurred in Aboriginal and AK Native children less than 2 years of age in N. Canada and the U.S. Arctic.

***Streptococcus pneumoniae* by Race and Age Categories, ICS 2012 Data**

Age (yrs)		N. Canada		U.S. Arctic	
		Aboriginal	**Non-Aboriginal**	**AK Native**	**Non-AK Native**
<2	Population	4,005	1,514	6,196	15,372
	Cases (rate‡)	4 (99.9)	1 (66.1)	11 (177.5)	2 (13)
2-19	Population	33,323	11,915	49,706	137,288
	Cases (rate‡)	7 (21)	0 (0)	6 (12.1)	4 (2.9)
20-64	Population	47,060	49,004	77,546	381,930
	Cases (rate‡)	11 (23.4)	1 (2)	38 (49)	38 (10)
65+	Population	4,687	4,778	8.997	54,792
	Cases (rate‡)	2 (42.7)	0 (0)	13 (144.5)	18 (32.9)
All Ages	Population	89,075	67,210	142,435	589,392
	Cases (rate‡)	24 (26.9)	2 (3)	68 (47.7)	62 (10.5)

‡Number of cases per 100,000 per year

Clinical Presentation

The primary clinical presentation was determined by a review of the discharge diagnoses in each patient's individual medical record associated with the invasive bacterial illness. In cases with multiple discharge diagnoses, the most serious diagnosis related to the pneumococcal infection was recorded as the primary clinical presentation. The most common clinical presentations associated with *S. pneumoniae* were pneumonia, bacteremia, and meningitis. In Greenland, N. Canada, and the U.S. Arctic the clinical presentation reported most often was pneumonia (100%, 65%, and 70%, respectively), in N. Sweden and Norway it was bacteremia (98% and 48%, respectively).

Clinical Presentation of Reported *Streptococcus pneumoniae* Cases, ICS 2012 Data

	Greenland n (%)	Iceland n (%)	N Canada n (%)	N Sweden** n (%)	Norway n (%)	US Arctic n (%)
Pneumonia*	7 (100)	0 (0)	17 (65)	0 (0)	235 (38)	91 (70)
Bacteremia	0 (0)	23 (82)	7 (27)	40 (98)	299 (48)	18 (14)
Meningitis	0 (0)	5 (18)	0 (0)	1 (2)	57 (9)	10 (8)
Empyema	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	4 (3)
Peritonitis	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	2 (1.5)
Septic arthritis	0 (0)	0 (0)	0 (0)	0 (0)	1 (<1)	0 (0)
Endocarditis	0 (0)	0 (0)	1 (4)	0 (0)	0 (0)	2 (1.5)
Pericarditis	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	2 (1.5)
Cellulitis	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (0.5)
Other	0 (0)	0 (0)	0 (0)	0 (0)	31 (5)	0 (0)
Unknown	0 (0)	0 (0)	1 (4)	0 (0)	3 (1)	0 (0)
Total Cases	7	28	26	41	626	130

*with bacteremia
**Clinical presentation data reported from Vasterbotten only

Risk Factors

N. Canada and the U.S. Arctic reported medical conditions or risk factors associated with *S. pneumoniae*. In adults 18 years and older, cigarette smoking and alcohol abuse were the most common associated conditions in the U.S. Arctic; alcohol abuse and diabetes were the most commonly reported in N. Canada.

***Streptococcus pneumoniae* Risk Factor/Medical Conditions in Adults*, ICS 2012 Data†**

	N. Canada n (%)	U.S. Arctic n (%)
Cigarette Smoking	2 (14)	46 (43)
Alcohol Abuse	4 (29)	31 (29)
Chronic Lung Disease and/or Asthma	1 (7)	30 (28)
Immunosuppressive Therapy	0 (0)	3 (3)
Diabetes	3 (21)	18 (17)
Injection Drug Use	0 (0)	1 (1)
Asplenia	1 (7)	1 (1)
Total Adult* Cases	14	108

*≥ 18 years
†Multiple risk factors may be reported per case

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. Three pneumococcal conjugate vaccines (PCV), PCV7, PCV10, and PCV13, for use in children under the age of 2 years have been used in ICS regions since 2001. Vaccines used and years introduced are presented in the table below.

Pneumococcal Vaccines Introduced, ICS 2012 Data

	Finland	Greenland	Iceland	N Canada	N Sweden	Norway	US Arctic
PCV7				2002-2006*	2007	2007	2001
PCV10	2010		2011	2009-2010*			
PCV13		2010		2010-2011*	2010	2011	2010
PS23	†	1996	†	1988	1994	†	1983

*PCV7 – N Quebec and Nunavut (2002), Newfoundland and Yukon (2005), Northwest Territory (2006); PCV10 – Nunavut (2010); PCV13 – N Quebec (2011)
†PS23 used but year of introduction unknown

Vaccination Status

Thirteen percent of *S. pneumoniae* cases in children less than 2 years of age with known vaccination status were vaccinated with a PCV in Norway; in N. Canada and the U.S. Arctic, 100% of children with known vaccine status were vaccinated. Only 4% of cases eligible for PS23 in Norway were vaccinated indicating much less frequent use of this vaccine than in N. Canada and the U.S. Arctic. Vaccine coverage data were not reported from Iceland and N. Sweden.

***Streptococcus pneumoniae* Case Vaccination Status for Pneumococcal Vaccine, ICS 2012 Data**

	N. Canada	Norway	U.S. Arctic
Total cases eligible for PCV vaccine*	5	10	13
Vaccine status known in cases eligible for PCV	3	10	13
Cases eligible for PCV vaccinated (%)†	3 (100%)	7 (70%)	11 (85%)
Total cases eligible for PS23 vaccine‡	2	328	31
Vaccine status known in cases eligible for PS23	1	106	28
Cases eligible for PS23 vaccinated (%)†	1 (100%)	5 (5%)	19 (68%)

*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 2012 are listed in the following table; yellow highlights the most common serotypes in each country.

***Streptococcus pneumoniae* Serotypes by Country, ICS 2012 Data**

Serotype	Greenland n (%†)	Iceland n (%†)	N. Canada (%†)	N. Sweden* n (%†)	U.S. Arctic n (%†)
1‡	1 (14)	3 (11)	0 (0)	1 (3)	0 (0)
3‡	0 (0)	2 (7)	0 (0)	2 (6)	12 (10)
4‡	2 (29)	1 (4)	1 (4)	2 (6)	0 (0)
6A‡	0 (0)	3 (11)	0 (0)	1 (3)	1 (1)
6B‡	1 (14)	1 (4)	0 (0)	2 (6)	0 (0)
6C	0 (0)	0 (0)	0 (0)	0 (0)	4 (3)
7C	0 (0)	0 (0)	0 (0)	0 (0)	1 (1)
7F‡	0 (0)	0 (0)	4 (17)	4 (13)	10 (8)
8	0 (0)	0 (0)	1 (4)	2 (6)	5 (4)
9N	0 (0)	0 (0)	0 (0)	1 (3)	3 (2)

Serotype	Greenland n (%†)	Iceland n (%†)	N. Canada (%†)	N. Sweden* n (%†)	U.S. Arctic n (%†)
9V‡	0 (0)	0 (0)	0 (0)	1 (3)	0 (0)
10A	0 (0)	0 (0)	3 (13)	0 (0)	3 (2)
11	0 (0)	2 (7)	0 (0)	0 (0)	0 (0)
11A	0 (0)	0 (0)	1 (4)	2 (6)	2 (2)
12F	1 (14)	0 (0)	0 (0)	0 (0)	8 (7)
14‡	0 (0)	3 (11)	0 (0)	0 (0)	0 (0)
15	0 (0)	1 (4)	0 (0)	0 (0)	0 (0)
15A	0 (0)	0 (0)	1 (4)	0 (0)	7 (6)
15C	0 (0)	0 (0)	0 (0)	0 (0)	1 (1)
16F	0 (0)	0 (0)	1 (4)	0 (0)	2 (2)
17F	0 (0)	0 (0)	0 (0)	0 (0)	1 (1)
19A‡	0 (0)	0 (0)	3 (13)	3 (9)	8 (7)
19F‡	0 (0)	1 (4)	0 (0)	3 (9)	2 (2)
20	0 (0)	1 (4)	0 (0)	0 (0)	9 (7)
21	0 (0)	0 (0)	0 (0)	0 (0)	1 (1)
22	0 (0)	4 (14)	0 (0)	0 (0)	0 (0)
22A	0 (0)	0 (0)	0 (0)	0 (0)	1 (1)
22F	2 (29)	0 (0)	3 (13)	3 (9)	12 (10)
23A	0 (0)	1 (4)	1 (4)	1 (3)	5 (4)
23B	0 (0)	0 (0)	1 (4)	0 (0)	2 (2)
23F	0 (0)	3 (11)	0 (0)	2 (6)	0 (0)
31	0 (0)	0 (0)	0 (0)	0 (0)	6 (5)
33F	0 (0)	0 (0)	1 (4)	0 (0)	8 (7)
35B	0 (0)	1 (4)	1 (4)	0 (0)	4 (3)
35F	0 (0)	0 (0)	0 (0)	2 (6)	2 (2)
38	0 (0)	0 (0)	1 (4)	0 (0)	2 (2)
Non-viable	0 (0)	0 (0)	0 (0)	0 (0)	1 (1)
# Isolates Serotyped	7	28	23	32	122

*Serogroup level data from Vasterbotten
†Percent of total isolates serotyped
‡Serotype included in PCV

Cases and Deaths with Vaccine Serotypes

For the countries reporting serotype data, at least 71% of *S. pneumoniae* cases in persons ≥ 2 years of age had a serotype that was included in the 23-valent polysaccharide vaccine. Eight percent to 100% of *Strep pneumoniae* cases in children < 2 years of age had a serotype contained in the PCV13 vaccine. The proportion of deaths with serotypes in the 23-valent polysaccharide vaccine related to *S. pneumoniae* ranged from 0% to 100%.

Proportion of Cases/Deaths with Invasive Pneumococcal Disease Vaccine Serotypes, ICS 2012 Data

	Greenland n/Denom* (%)	Iceland n/Denom* (%)	N. Canada n/Denom* (%)	N. Sweden n/Denom* (%)	U.S. Arctic n/Denom* (%)
Cases ≥ 2 years old with serotype in the 23-valent pneumococcal polysaccharide vaccine	6/6 (100)	15/20** (75)	15/19 (79)	28/32 (88)	77/109 (71)
Cases < 2 years old with serotype in the 13-valent pneumococcal conjugate vaccine	1/1 (100)	No cases	2/4 (50)	No cases	1/13 (8)
Deaths (all ages) for which the serotype was contained in the 23-valent pneumococcal vaccine	0 (0‡)	1 (25‡)	3 (100‡)	†	6 (35‡)

*Number of isolates serotyped by country by age group
**7 isolates tested to serogroup level only
‡Percentage of total death
†Outcomes not reported

Outcome

A total of 70 deaths associated with *S. pneumoniae* were reported to ICS in 2012. Overall, the highest case fatality ratio (CFR) occurred in persons 65+ years of age (18%). Finland and N. Sweden did not report outcome data.

***Streptococcus pneumoniae* Age-Specific Case-Fatality Ratios (CFR), ICS 2012 Data**

		<2 years	2-19 years	20-64 years	65+ years	All Ages
Greenland	Deaths/Cases*	0/1	0/1	0/2	0/3	0/7
	(CFR)	(0%)	(0%)	(0%)	(0%)	(0%)
Iceland	Deaths/Cases*	0/0	0/0	2/20	2/8	4/28
	(CFR)	(0%)	(0%)	(10%)	(25%)	(14%)
N. Canada	Deaths/Cases*	0/4†	0/7	3/11†	0/2	3/24
	(CFR)	(0%)	(0%)	(28%)	(0%)	(13%)
Norway	Deaths/Cases*	0/5†	0/14†	11/149†	35/175†	46/343
	(CFR)	(0%)	(0%)	(7%)	(20%)	(13%)
U.S. Arctic	Deaths/Cases*	0/13	0/10	14/75	3/31	17/129
	(CFR)	(0%)	(0%)	(19%)	(10%)	(13%)
Total	Deaths/Cases*	0/23	0/32	30/257	40/219	70/531
	(CFR)	(0%)	(0%)	(12%)	(18%)	(13%)

*Cases with known outcome.
†Outcome unknown in (1) N Canada, (5) Norway cases < 2 years; (4) Norway cases 2-19 years; (1) N Canada, (121) Norway, (1) US Arctic cases 20-64 years; (153) Norway cases 65+ years

Antimicrobial Susceptibility

In 2012, antimicrobial susceptibility results were reported to ICS from 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 2012 Data**

Antibiotic	Iceland n (NS%)	N. Canada n (NS%)	N. Sweden n (NS%)	U.S. Arctic n (NS%)
Ceftriaxone	28 (0%)	24 (4%)	-	121 (8%)
Chloramphenicol	28 (0%)	21 (0%)	-	121 (3%)
Clindamycin	-	21 (4%)	-	121 (11%)
Erythromycin	28 (7%)	21 (12%)	41 (1%)	121 (21%)
Levofloxacin	-	21 (0%)	-	121 (1%)
Penicillin	28 (4%)	24 (4%)	40 (0%)	121 (19%)
Rifampin	-	-	-	121 (1%)
Tetracycline	-	-	-	121 (12%)
TMP Sulfa*	28 (18%)	21 (12%)	38 (4%)	121 (18%)
Vancomycin	-	24 (0%)	-	121 (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, 22 isolates comprised of 9 serotypes (3, 6A, 6C, 15A, 19A, 23A, 23B, 33F, 35B) showed multi-drug resistance. Serotypes 15A and 19A comprised the largest proportion (n = 10 (5 of each serotype), 46%) of the multi-drug resistant isolates and all of isolates with these serotypes were resistant to three or more antibiotics. In N. Canada, one serotype 19A isolate was resistant to four antibiotics. In Iceland, 5 isolates including serotypes 6B, 15, 19F, and 23F were resistant to more than one antibiotic.

***Streptococcus pneumoniae* Penicillin Susceptibility Results, ICS 2012 Data**

	# Tested	I* (%)	I* Serotypes (n)	R* (%)	R* Serotypes (n)
Iceland	28	1 (4%)	19F (1)	0 (0%)	
N. Canada	24	1 (4%)	19A (1)	0 (0%)	
N. Sweden‡	40	0 (0%)		0 (0%)	
U.S. Arctic	121	15 (12%)	15A (5), 23A (4), 6C (2), 19A (2), 6A (1), 23B (1)	8 (7%)	19A (4), 35B (4)

*I=Intermediate resistance, R=Fully resistant
†Serotypes not reported
‡N. Sweden reported serogroups only

***Streptococcus pneumoniae* TMP-Sulfa Susceptibility Results, ICS 2012 Data**

	# Tested	I* (%)	I* Serotypes (n)	R* (%)	R* Serotypes (n)
Iceland	28	2 (7%)	15 (1), 23F (1)	3 (11%)	6B (1), 19F (1), 23F (1)
N. Canada	21	1 (5%)	33F (1)	2 (10%)	19A (2)
N. Sweden†	38	3 (4%)	4 (1), 8 (1), 23F (1)	0 (0%)	
U.S. Arctic	121	12 (10%)	33F (4), 15A (3), 19A (2), 6C (1), 19F (1), 23A (1)	10 (8%)	19A (5), 33F (3), 6C (1), 23B (1)

*I=Intermediate resistance, R=Fully resistant
†N. Sweden reported serogroups only

***Streptococcus pneumoniae* Erythromycin Susceptibility Results, ICS 2012 Data**

	# Tested	I* (%)	I* Serotypes	R* (%)	R* Serotypes (n)
Iceland	28	0 (0%)		2 (7%)	11 (1), 19F (1)
N. Canada	21	0 (0%)		3 (14%)	19A (1), 23A (1), 33F (1)
N. Sweden†	41	0 (0%)		1 (1%)	19A (1)
U.S. Arctic	121	0 (0%)		25 (21%)	15A (5), 31 (5), 19A (4), 6C (3), 33F (3), 3 (2), 22F (1), 23A (1)

*I=Intermediate resistance, R=Fully resistant
†N. Sweden reported serogroups only

Quality Control

In 2012, 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 2012-A, overall serotyping correlation was 100%. The modal MIC comparison resulted in an overall correlation of 99.4% with individual participant correlation ranging from 97.1%-100%. Overall category agreement was 98.0% with individual participant agreement ranging from 97.1%-100%. For Panel 2011-B, overall serotyping correlation was 100%. The modal MIC comparison resulted in an overall correlation of 99.7%. Overall category agreement was 99% with individual participant agreement ranging from 96.8%-100% [1].

Conclusions

Streptococcus pneumoniae remains a major cause of invasive bacterial disease in circumpolar regions. Disease rates are highest in indigenous populations. All ICS regions have introduced either PCV10 or PCV13 into their vaccine schedules. Monitoring the impact of these conjugate vaccines 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 invasive *H. influenzae* disease during 2012. A total of 112 cases of invasive disease caused by *H. influenzae* were reported to ICS during 2012. The highest rate of disease among regions reporting cases was in N. Canada (8.3 per 100,000) and the lowest in Norway (1.6/100,000). Median age of cases was highest in Norway (67.2 years) and lowest in N. Canada (10.2 years).

***Haemophilus influenzae* Case Demographics, ICS 2012 Data**

Country	Population	# Cases	Rate*	Sex M (%)	Median Age (min-max) yrs	Deaths n (CFR†)
Greenland	56,749	1	1.8	1 (100%)	1 case (41.6)	0 (0%)
N. Canada	156,286	13	8.3	5 (39%)	10.2 (0.6-66.3)	0 (0%)‡
N. Sweden	248,548	5	2	1 (20%)	40 (31-97)	‡
Norway	4,985,870	78	1.6	35 (45%)	67.2 (1.1-93.3)	3 (8%)‡
U.S. Arctic	731,827	15	2.1	9 (60%)	51 (0.4-78.9)	1 (7%)
Total	6,179,280	112	1.8	51 (46%)	63.3 (0.4-97)	4 (6.5%)

*Number of cases per 100,000 per year
†Case fatality ratio
‡ Case outcome unknown in (3) N. Canada, (42) Norway cases; N. Sweden did not report case outcomes

When stratified by age, the highest rates of disease for N. Canada and the U.S. Arctic were in the <2 years age category; in Greenland and N. Sweden, the highest rate of disease was in the 20-64 year old category and in Norway, the highest rate of disease was in the 65+ years age category.

***Haemophilus influenzae* by Age Category, ICS 2012 Data**

Age		Greenland	N. Canada	N. Sweden	Norway	U.S. Arctic
<2 yrs	Population	1,651	5,519	4,473	122,987	21,568
	Cases (%)*	0 (0)	5 (38.5)	0 (0)	2 (3)	4 (27)
	Rate†	0	90.6	0	1.6	18.6
2-19 yrs	Population	15,243	45,238	47,031	1,125,578	186,994
	Cases (%)*	0 (0)	2 (15)	0 (0)	3 (4)	1 (7)
	Rate†	0	4.4	0	0.3	0.5
20-64 yrs	Population	35,760	96,064	141,785	2,969,291	459,476
	Cases (%)*	1 (100)	5 (38.5)	4 (80)	26 (33)	8 (53)
	Rate†	2.8	5.2	2.8	0.9	1.7
65+ yrs	Population	4,095	9,465	55,259	768,014	63,789
	Cases (%)*	0 (0)	1 (8)	1 (20)	47 (60)	2 (13)
	Rate†	0	10.6	1.8	6.1	3.1
All ages	Population	56,749	156,286	248,548	4,985,870	731,827
	Cases	1	13	5	78	15
	Rate†	1.8	8.3	2	1.6	2.1

*Proportion of total cases in each country/region
†Number of cases per 100,000 per year

Race

Rates of disease were highest in N. Canada Aboriginal (99.9 per 100,000) and U.S. Arctic AK Native (64.6) per 100,000) cases less than two years of age. In both regions, rates of disease were higher in Aboriginal and AK Native populations than in non-Aboriginal and non-Native populations in all age categories.

***Haemophilus influenzae* by Race and Age Categories, ICS 2012 Data**

Age (yrs)		N. Canada*		U.S. Arctic	
		Aboriginal	Non-Aboriginal	AK Native	Non-AK Native
<2	Population	4,005	1,514	6,196	15,372
	Cases (rate†)	4 (99.9)	0 (0)	4 (64.6)	0 (0)
2-19	Population	33,323	11,915	49,706	137,288
	Cases (rate†)	2 (6)	0 (0)	1 (2)	0 (0)
20-64	Population	47,060	49,004	77,546	381,930
	Cases (rate†)	5 (10.6)	0 (0)	5 (6.5)	3 (0.8)
65+	Population	4,687	4,778	8.997	54,792
	Cases (rate†)	1 (21.3)	0 (0)	1 (11.1)	1 (1.8)
All Ages	Population	89,075	67,210	142,435	589,392
	Cases (rate†)	12 (13.5)	0 (0)	11 (7.7)	4 (0.7)

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

Clinical Presentation

The primary clinical presentation was determined by a review of the discharge diagnoses in each patient's individual medical record associated with the invasive bacterial illness. In cases with multiple discharge diagnoses, the most serious diagnosis related to the infection was recorded as the primary clinical presentation. In N. Canada and the U.S. Arctic, the most common clinical presentation associated with *H. influenzae* was pneumonia (60% and 39% of reported cases, respectively). In Norway, the most common clinical presentation was bacteremia (49%). N. Sweden did not report clinical presentation data.

Clinical Presentation of Reported *Haemophilus influenzae* Cases, ICS 2012 Data

	N. Canada n (%)	Norway n (%)	U.S. Arctic n (%)
Pneumonia*	5 (39)	20 (26)	9 (60)
Bacteremia	1 (8)	38 (49)	2 (13)
Meningitis	3 (23)	4 (5)	2 (13)
Septic arthritis	2 (15)	0 (0)	0 (0)
Epiglottitis	0 (0)	0 (0)	1 (7)
Amnionitis	0 (0)	0 (0)	1 (7)
Other/Unknown	2 (15)	16 (20)	0 (0)
Total	13	78	15

*with bacteremia

Risk Factors

Fifty percent of adult (≥ 18 years) cases of *H. influenzae* reported in the U.S. Arctic indicated smoking as an associated risk factor; 40% indicated alcohol abuse and 20% chronic lung disease as an associated risk factor. Fifty percent of adult N. Canadian *H. influenzae* cases reported chronic lung disease as a risk factor, 33% reported diabetes and 17% reported smoking and/or alcohol abuse. 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 Greenland, N. Canada, N. Sweden, Norway and the U.S. Arctic. There were no cases of Hib reported in a child under the age of 5 years in N. Canada, Norway or the U.S. Arctic. Data on vaccine status were not provided by Greenland, N. Sweden and Norway.

***Haemophilus influenzae* Case Vaccination Status for Hib Vaccine, ICS 2012 Data**

	N. Canada	U.S. Arctic
Total cases* eligible for Hib vaccine†	5	5
Vaccine status known in cases* eligible for Hib vaccine	4	4
Cases* eligible for Hib vaccine vaccinated (%)‡	4 (100%)	4 (100%)

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

Serotypes

***Haemophilus influenzae* Serotypes by Country, ICS 2012 Data**

Serotype	N. Canada n (%)	Norway n (%)	U.S. Arctic n (%)
a	10 (77)	0 (0)	3 (21)
b	1 (8)	6 (8)	1 (7)
e	0 (0)	1 (1)	0 (0)
f	2 (15)	11 (14)	4 (29)
Non-typeable	0 (0)	60 (77)	6 (43)
Total*	13	78	14

*Number of isolates serotyped

The most common *H. influenzae* serotype in N. Canada was type a (77% of cases), in Norway and the US Arctic, it was type f (14% and 29% of cases, respectively). Non-typeable cases made up a large proportion of cases in Norway (77%) and the U.S. Arctic (43%). Greenland and N. Sweden did not provide serotype data.

Outcome

Four deaths were associated with *H. influenzae* cases reported to ICS in 2012; three from Norway and one from the U.S. Arctic. N. Sweden did not provide outcome data.

***Haemophilus influenzae* Deaths by Country, ICS 2012 Data**

	Norway	U.S. Arctic
No. Deaths	3	1
Case Fatality Ratio	8%*	7%
Min-max (yrs)	58.9-85.8	1 case – 0.4
Serotypes (n)	f (1), NT (2)	NT (1)
Clinical Presentation (n)	Bacteremia (3)	Pneumonia (1)

*Case outcome unknown in (42) Norway cases

Quality Control

Two QC panels of five *H. influenzae* and *N. meningitidis* isolates were shipped and serotyped or serogrouped. There was one discrepant result which 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. Although serotype a is causing a large proportion of disease in the N. American Arctic, it has not reached the rates of Hib disease seen prior to vaccine introduction in these regions. 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 2012. A total of 32 cases of invasive disease caused by *N. meningitidis* were reported to ICS. N. Sweden had the highest disease rate (1.6 per 100,000). Three deaths associated with *N. meningitidis* were reported from Norway.

***Neisseria meningitidis* Case Demographics, ICS 2012 Data**

Country	Population	# Cases	Rate*	Sex M (%)	Median Age (min-max) yrs	Deaths n (CFR†)
Greenland	56,749	0	0	No cases	No cases	No cases
N. Canada	156,286	2	1.3	1 (50)	3 (0.3-5.8)	0 (0)
N. Sweden	248,548	4	1.6	2 (50)	54 (51-57)	‡
Norway	4,985,870	24	0.5	11 (46)	19.4(0.3-84.6)	3 (13)
U.S. Arctic	731,827	2	0.3	1 (50)	9.2 (0.3-18)	0 (0)
Total	6,179,280	32	0.5	15 (47)	27.8 (0.4-91.3)	3 (11)

*Number of cases per 100,000 per year
†Case fatality ratio
‡N. Sweden did not report outcomes

The following table shows cases and rates stratified by age category.

***Neisseria meningitidis* by Age Category, ICS 2012 Data**

Age		N. Canada	N. Sweden	Norway	U.S. Arctic
<2 yrs	Population	5,519	4,473	122,987	21,568
	Cases (%)*	1 (50)	0 (0)	4 (17)	1 (50)
	Rate†	18.1	0	3.3	4.6
2-19 yrs	Population	45,238	47,031	1,125,578	186,994
	Cases (%)*	1 (50)	0 (0)	9 (38)	1 (50)
	Rate†	2.2	0	0.8	0.5
20-64 yrs	Population	96,064	141,785	2,969,291	459,476
	Cases (%)*	0 (0)	1 (25)	8 (33)	0 (0)
	Rate†	0	0.7	0.3	0
65+ yrs	Population	9,465	55,259	768,014	63,789
	Cases (%)*	0 (0)	3 (75)	3 (13)	0 (0)
	Rate†	0	5.4	0.4	0
All ages	Population	156,286	248,548	4,985,870	731,827
	Cases	2	4	24	2
	Rate†	1.3	1.6	0.5	0.3

*Proportion of total cases in each country/region
†Number of cases per 100,000 per year

Race

In the U.S. Arctic, one case of *N. meningitidis* occurred in a non-AK Native person (rate 0.2/100,000) and one in an AK Native person (rate 0.7/100,000). In N. Canada, one Nm case occurred in a non-Aboriginal person (rate 1.5/100,000) and one in an Aboriginal person (rate 1.1/100,000).

Clinical Presentation

The primary clinical presentation was determined by a review of the discharge diagnoses in each patient's individual medical record associated with the invasive meningococcal bacterial illness. In cases with multiple discharge diagnoses, the most serious diagnosis related to the infection was recorded as the primary clinical presentation. The most common clinical presentation reported for *N. meningitidis* cases was meningitis. N. Sweden did not report clinical presentations.

Clinical Presentation of Reported *Neisseria meningitidis* Cases, ICS 2012 Data

	N. Canada n (%)	Norway n (%)	U.S. Arctic n (%)
Bacteremia	0 (0)	8 (33)	0 (0))
Meningitis	2 (100)	13 (54)	2 (100)
Other	0 (0)	2 (8)	0 (0)
Unknown	0 (0)	1 (4)	0 (0)
Total	2	24	2

*with bacteremia

Serogroups

Twenty-eight of 32 cases of invasive *N. meningitidis* reported to ICS in 2012 included serogroup data. The table below lists serogroups by country. N. Sweden did not report serogroup data.

***Neisseria meningitidis* Serogroups by Country, ICS 2012 Data**

Serogroup	N. Canada n (%)	Norway n (%)	U.S. Arctic n (%)
B	0 (0)	9 (37.5)	2 (100)
C	0 (0)	9 (37.5)	0 (50)
W135	2 (100)	0 (0)	0 (0)
Y	0 (0)	6 (25)	0 (0)
Total	2	24	2

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 (Norbotten) and the U.S. Arctic each reported the occurrence of GAS during 2012. A total of 76 cases of invasive disease caused by GAS were reported to ICS. Among regions reporting cases, the rate of disease was highest in N. Canada (9 per 100,000) compared to the lowest in N. Sweden (5.6 per 100,000). Five deaths were associated with GAS, four in the U.S. Arctic and one in N. Canada.

Group A *Streptococcus* Case Demographics, ICS 2012 Data

Country	Population	# Cases	Rate*	Sex M (%)	Median Age (min-max) yrs	Deaths n (CFR†)
Greenland	56,749	0	0	No cases	No cases	No cases
N. Canada	156,286	14	9	7 (50)	55.4 (0.5-75.7)	1 (7)
N. Sweden	248,548	14	5.6	3 (21)	66.5 (19-91)	‡
U.S. Arctic	731,827	48	6.6	19 (40)	49.7 (0.3-87.5)	4 (8)
Total	1,193,410	76	6.4	29 (38)	53.7 (0.3-91)	5 (8.1)

*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 in N. Canada (72.5 per 100,000) and in individuals 65+ years of age in N. Canada (63.4 per 100,000).

Group A *Streptococcus* by Age Category, ICS 2012 Data

Age		N. Canada	N. Sweden	U.S. Arctic
<2 yrs	Population	5,519	4,473	21,568
	Cases (%)*	4 (29)	0 (0)	3 (6)
	Rate†	72.5	0	13.9
2-19 yrs	Population	45,238	47,031	186,994
	Cases (%)*	1 (7)	1 (7)	3 (6)
	Rate†	2.2	2.1	1.6
20-64 yrs	Population	96,064	141,785	459,476
	Cases (%)*	3 (21)	4 (29)	33 (69)
	Rate†	3.1	2.8	7.2
65+ yrs	Population	9,465	55,259	63,789
	Cases (%)*	6 (43)	9 (64)	9 (19)
	Rate†	63,4	15.3	14.1
All ages	Population	156,286	248,548	731,827
	Cases	14	14	48
	Rate†	9	5.6	6.6

*Proportion of total cases in each country/region
†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 Aboriginal children <2 years and persons 65 years and older.

Group A *Streptococcus* by Race and Age Categories, ICS 2012 Data

Age (yrs)		N. Canada		U.S. Arctic	
		Aboriginal	Non-Aboriginal	AK Native	Non-AK Native
<2	Population	4,005	1,514	6,196	15,372
	Cases (rate†)	4 (99.9)	0 (0)	3 (48.4)	0 (0)
2-19	Population	33,323	11,915	49,706	137,288
	Cases (rate†)	1 (3)	0 (0)	1 (2)	2 (1.5)
20-64	Population	47,060	49,004	77,546	381,930
	Cases (rate†)	3 (6.4)	0 (0)	12 (15.5)	21 (5.5)
65+	Population	4,687	4,778	8.997	54,792
	Cases (rate†)	6 (128)	0 (0)	3 (33.3)	6 (11)
All Ages	Population	89,075	67,210	142,435	589,392
	Cases (rate†)	14 (15.7)	0 (0)	19 (13.3)	29 (4.9)

†Number of cases per 100,000 per year

Clinical Presentation

The primary clinical presentation was determined by a review of the discharge diagnoses in each patient's individual medical record associated with the invasive bacterial illness. In cases with multiple discharge diagnoses, the most serious diagnosis related to the infection was recorded as the primary clinical presentation. The most common clinical presentations for GAS cases in N. Canada and the U.S. Arctic were bacteremia and cellulitis. N. Sweden did not report clinical presentations.

Clinical Presentation of Reported group A *Streptococcus* Cases, ICS 2012 Data

	N. Canada n (%)	U.S. Arctic n (%)
Bacteremia	2 (14)	13 (27)
Cellulitis*	5 (36)	11 (23)
Necrotizing fasciitis	1 (7)	6 (13)
Pneumonia*	1 (7)	4 (8)
Septic arthritis	3 (21)	3 (6)
Empyema	0 (0)	2 (4)
Endocarditis	0 (0)	2 (4)
Strep toxic shock	1 (7)	1 (2)
Pericarditis	0 (0)	1 (2)
Osteomyelitis	0 (0)	1 (2)
Endometritis	0 (0)	1 (2)
Bursitis	0 (0)	1 (2)
Amnionitis	0 (0)	1 (2)
Other	0 (0)	1 (2)
Unknown	1 (7)	0 (0)
Total	14	48

*with bacteremia

Risk Factors

Cigarette smoking, alcohol abuse and diabetes were the most common risk factors associated with adult (≥18 years) GAS cases in the U.S. Arctic. Greenland and N. Sweden did not report risk factor data.

Group A *Streptococcus* Risk Factor/Medical Conditions in Adults*, ICS 2012 Data†

	N. Canada n (%)	U.S. Arctic n (%)
Cigarette Smoking	0 (0)	12 (29)
Alcohol Abuse	1 (11)	11 (26)
Chronic Lung Disease and/or Asthma	1 (11)	6 (14)
Immunosuppressive Therapy	1 (11)	4 (10)
Diabetes	1 (11)	13 (31)
Injection Drug Use	0 (0)	0 (0)
Asplenia	0 (0)	0 (0)
Total Adult* Cases	9	42

*≥ 18 years
†Multiple risk factors may be reported per case

Outcome

Four deaths in cases with GAS were reported from the U.S. Arctic (CFR 8%); two occurred in the 20-64 years old age category and two in persons ≥ 65. One death was reported in Canada in a child <2 years of age. N. Sweden did not report case outcome data.

Conclusions

These data suggest higher rates in indigenous populations, particularly in young children and older adults. 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 2012. A total of 33 cases of invasive disease caused by GBS were reported to ICS. Greenland, N. Canada and N. Sweden reported no cases. Four deaths in the U.S. Arctic were associated with GBS in 2012.

Group B *Streptococcus* Case Demographics, ICS 2012 Data

Country	Population	# Cases	Rate*	Sex M (%)	Median Age (min-max) yrs	Deaths n (CFR†)
Greenland	56,749	0	0	No cases	No cases	No cases
N. Canada	156,286	0	0	No cases	No cases	No cases
N. Sweden	248,548	0	0	No cases	No cases	No cases
U.S. Arctic	731,827	33	4.5	20 (61)	54.6 (0-80.9)	4 (12)
Total	1,193,410	33	2.8	20 (61)	54.6 (0-80.9)	4 (12)

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

When stratified by age, the highest rates of disease in the U.S. Arctic occurred in cases less than two years of age.

Group B *Streptococcus* by Age Category, ICS 2012 Data

Age		U.S. Arctic
<2 yrs	Population	21,568
	Cases (%)*	5 (15)
	Rate†	23.2
2-19 yrs	Population	186,994
	Cases (%)*	0 (0)
	Rate†	0
20-64 yrs	Population	459,476
	Cases (%)*	17 (52)
	Rate†	3.7
65+ yrs	Population	63,789
	Cases (%)*	11 (33)
	Rate†	17.2
All ages	Population	731,827
	Cases	33
	Rate†	4.5

*Proportion of total cases in each country/region
†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 live births).

Race

Race and ethnicity data were collected in N. Canada and the U.S. Arctic. No cases were reported in 2012 in N. Canada. The overall rates of disease caused by GBS were higher in AK Native people compared to non-Native people. The highest rates of disease occurred in AK Native children less than 2 years old.

Group B *Streptococcus* by Race and Age Categories, ICS 2012 Data

Age (yrs)		U.S. Arctic	
		Native	**Non-Native**
<2	Population	6,196	15,372
	Cases (rate*)	2 (32.3)	3 (19.5)
2-19	Population	49,706	137,288
	Cases (rate*)	0 (0)	0 (0)
20-64	Population	77,546	381,930
	Cases (rate*)	7 (9)	10 (2.6)
65+	Population	8,997	54,792
	Cases (rate*)	2 (22.2)	9 (16.4)
All Ages	Population	142,435	589,392
	Cases (rate*)	11 (7.7)	22 (3.7)

*Number of cases per 100,000 per year

Clinical Presentation

The primary clinical presentation was determined by a review of the discharge diagnoses in each patient's individual medical record associated with the invasive bacterial illness. In cases with multiple discharge diagnoses, the most serious diagnosis related to the infection was recorded as the primary clinical presentation. In the U.S. Arctic, bacteremia (30%) was the most common clinical presentation reported for cases of GBS in 2012 followed by cellulitis (27%) and pneumonia (12%).

Clinical Presentation of Reported group B *Streptococcus* Cases, ICS 2012 Data

	U.S. Arctic n (%)
Bacteremia	10 (30)
Cellulitis*	9 (27)
Pneumonia*	4 (12)
Septic arthritis	3 (9)
Amnionitis	3 (9)
Endocarditis	1 (3)
Empyema	1 (3)
Osteomyelitis	1 (3)
Other	1 (2.5)
Total	33

*with bacteremia

Risk Factors

Forty-six percent of GBS adult (≥ 18 years) cases reviewed in the U.S. Arctic indicated diabetes as a risk factor in 2012; 18% were smokers, 14% had chronic lung disease and/or reported alcohol abuse.

Outcome

Four deaths in cases with GBS were reported in the U.S. Arctic (CFR 12%); 1 occurred in the <2 year old age group, 2 in the 20-65 years age category and 1 in the 65+ years age category.

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

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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