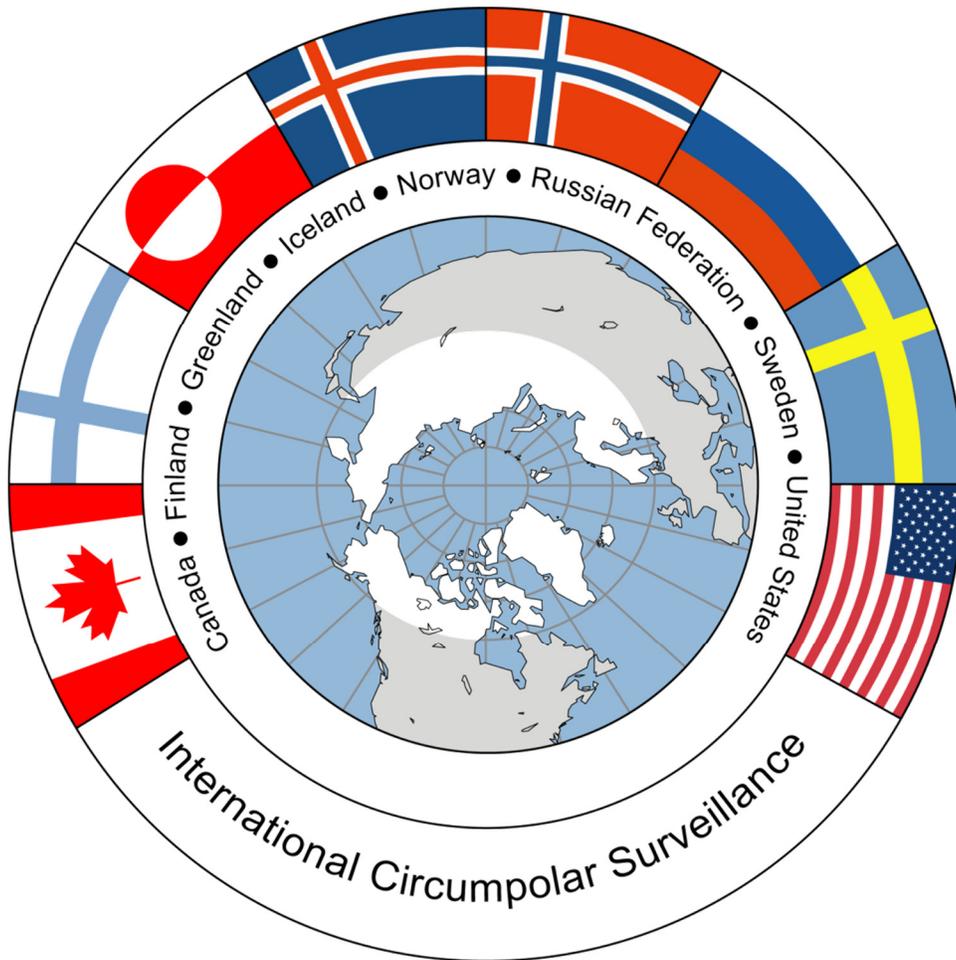


INTERNATIONAL CIRCUMPOLAR SURVEILLANCE (ICS) SUMMARY REPORT



YEAR 2013 DATA

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SUMMARY

International Circumpolar Surveillance (ICS) is a population-based surveillance system for invasive bacterial diseases established in the U.S. Arctic, Northern Canada, Greenland, Iceland, Norway, Finland, and Northern Sweden. Data collection began in 1999 and includes information on disease caused by *Streptococcus pneumoniae*, *Haemophilus influenzae*, *Neisseria meningitidis*, and groups A and B *Streptococcus* (GAS, GBS). This report reviews the data collected for the year 2013.

Data on invasive disease with the organism *S. pneumoniae* are collected from all participating countries. A total of 1,582 cases of invasive pneumococcal disease were identified in 2013. 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 9-16%. Race and ethnicity data are collected only in N. Canada and the U.S. Arctic; rates of invasive pneumococcal disease in Northern Canadian Aboriginal and U.S. Arctic Native populations were 28 and 35 cases per 100,000 population, respectively, which are similar to the 2012 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 19A, in Greenland it was serotypes 4 and 10A, in N. Canada it was serotypes 4 and 7F, in N. Sweden it was 22F and in the U. S. Arctic the most common serotypes were 16F and 22F.

Data on invasive disease due to *H. influenzae*, *N. meningitidis*, and groups A and B *Streptococcus* are currently collected in Greenland, Finland, Northern Canada, Northern Sweden and the U.S. Arctic; Norway also contributes data on cases of *N. meningitidis* and *H. influenzae*. A total of 177 *H. influenzae* cases, 50 *N. meningitidis* cases, 268 GAS cases, and 302 GBS cases were reported in 2013. 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 2013 Data

Country	<i>S. pneumoniae</i> n (rate*)	<i>H. influenzae</i> n (rate*)	<i>N. meningitidis</i> n (rate*)	GAS n (rate*)	GBS n (rate*)
Finland	724 (13.3)	48 (0.9)	20 (0.4)	181 (3.3)	259 (4.8)
Greenland	9 (16)	0 (0)	0 (0)	0 (0)	0 (0)
Iceland	19 (5.9)	N/A	N/A	N/A	N/A
N. Canada	29 (18.4)	19 (12.1)	1 (0.6)	11 (7)	3 (1.9)
N. Sweden	75 (14.7)†	3 (1.2)‡	2 (0.8)‡	23 (9.2)‡	0 (0)‡
Norway	620 (12.3)	86 (1.7)	27 (0.5)	N/A	N/A
U.S. Arctic	106 (14.4)	21 (2.9)	0 (0)	53 (7.2)	40 (5.4)
Total	1,582 (12.9)	177 (1.5)	50 (0.4)	268 (4)	302 (4.5)

*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 2013

Country	<i>S. pneumoniae</i>	<i>H. influenzae</i>	<i>N. meningitidis</i>	GAS	GBS	Serotype	Demographics	Race/Ethnicity	Risk Factors	Outcome	Vaccination Status	Antibiotic Susceptibility
Finland	X	X	X	X	X		X					X
Greenland	X	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	
U.S. Arctic	X	X	X	X	X	X	X	X	X	X	X	X

Finland

- 23 district hospital laboratories participate in ICS.
 - Provide diagnostic microbiology services for all residents of Finland.
 - All invasive isolates of *S. pneumoniae* submitted to the National Public Health Institute (KTL) laboratory in Oulu.
- Antimicrobial susceptibility testing of *S. pneumoniae* isolates was performed by agar dilution method at district hospital laboratories as well as the KTL laboratory.
- Population estimates for 2013 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 2013 were obtained from the website <http://www.stat.gl>

Iceland

- 10 district hospital laboratories and one regional laboratory participate in ICS.
 - Provide diagnostic microbiology services for all residents of Iceland.
 - All invasive isolates of *S. pneumoniae* submitted to the reference hospital in Reykjavik.
- Antimicrobial susceptibility testing of *S. pneumoniae* isolates is performed by disc diffusion method at the Landspítali University Hospital (LUH) in Reykjavik and the laboratory at the regional hospital in Akureyri. All oxacillin resistant isolates are then analyzed by E test.
- Serotyping is performed at the LUH by coagglutination using antisera from Statens Serum Institute.
- Clinical and demographic data for every case of invasive *S. pneumoniae* was collected by public health authorities at the end of the year and entered onto the same collection form (BDSF) used in Greenland, Northern Canada, and the U.S. Arctic.
- Population estimates for 2013 were obtained from the website <http://www.statice.is>

Northern Canada

- 14 Canadian laboratories participate in ICS.
 - Provide diagnostic microbiology services for all residents of the Yukon Territory, Northwest Territories, Nunavut, Northern Quebec, and Northern Labrador.
 - Submit all invasive isolates of *S. pneumoniae*, *H. influenzae*, *N. meningitidis*, GAS, and GBS to one of two reference laboratories in Canada.
 - *S. pneumoniae*, *H. influenzae*, GAS, and GBS isolates are serotyped by the Quellung method using Statens Serum Institute antisera.
- Antimicrobial susceptibility of *S. pneumoniae*, GAS, and GBS isolates was tested by micro-broth dilution (according to NCCLS recommendations).
- Communicable disease consultants located within one of the five regions of Northern Canada provided clinical and demographic information on the same collection form (BDSF) used in Greenland, Iceland, and the U.S. Arctic.
- Population estimates for 2013 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 2013 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 Tromsø.
- Antimicrobial susceptibility testing of *S. pneumoniae* isolates is performed using the disc diffusion method at district hospital laboratories, the reference laboratory in Tromsø or the main national laboratory in Oslo.
- Serotyping is performed at the Statens Serum Institute in Denmark by the Quellung method.
- Population estimates for 2013 were obtained from the website <http://www.ssb.no>

U.S. Arctic

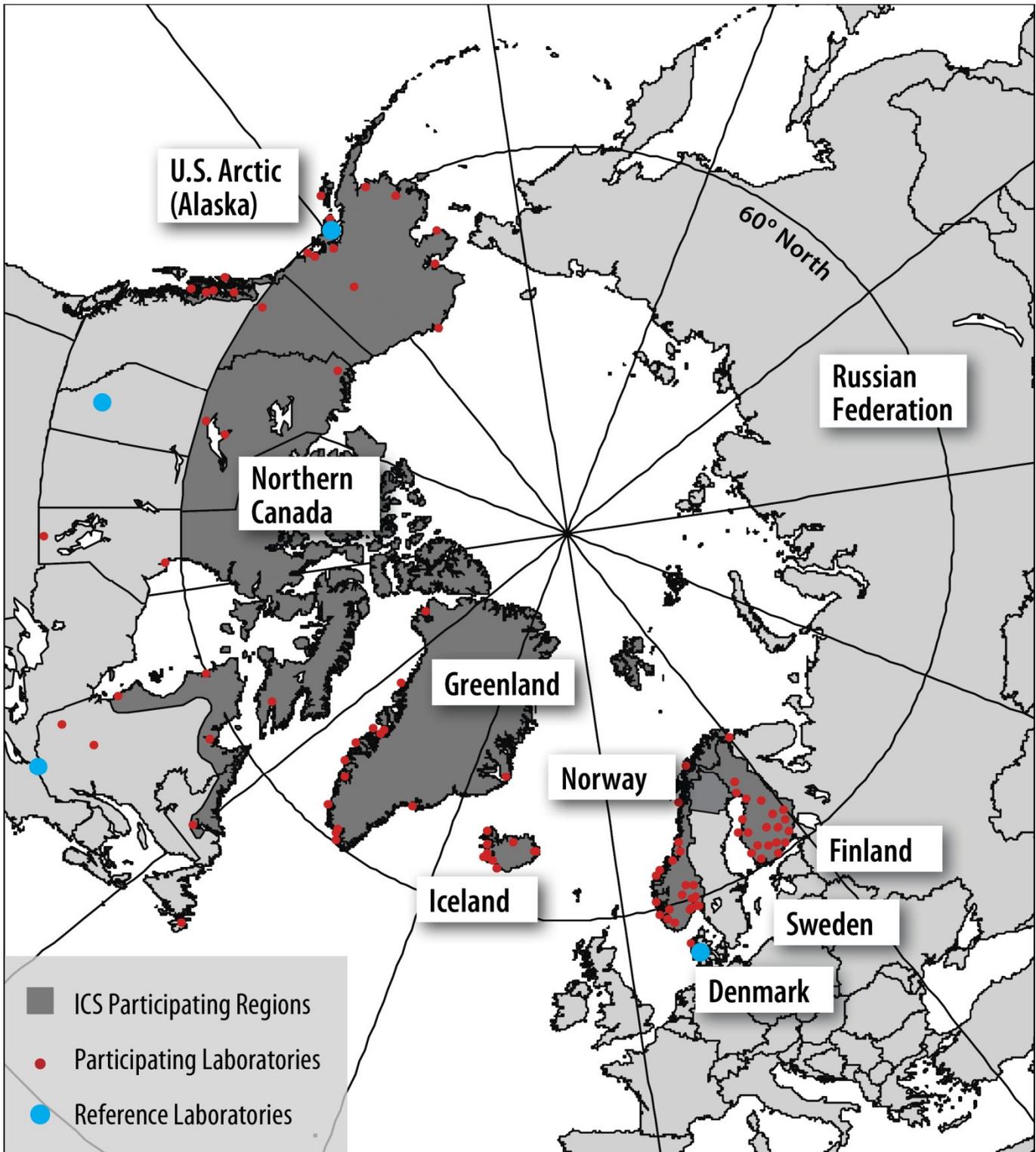
- 23 laboratories providing diagnostic services to residents of Alaska submitted to AIP isolates of *S. pneumoniae*, *H. influenzae*, *N. meningitidis*, GAS, and GBS cultured in blood, cerebrospinal fluid, or from other sterile sites.
 - *S. pneumoniae* and *H. influenzae* isolates are serotyped by the Quellung method using Statens Serum Institute antisera.
 - Serogroup testing of *N. meningitidis* was done using real-time PCR to detect the *ctaA* gene (capsule transport), as well as the genes required for serogroup-specific capsule biosynthesis.
- Antimicrobial susceptibility testing of *S. pneumoniae* isolates is performed at AIP by micro-broth dilution (according to NCCLS recommendations).
- Clinical and demographic information on each case-patient is recorded by AIP research nurses onto the same collection form (BDSF) used in Greenland, Iceland, and Northern Canada.
- Population estimates for 2013 were obtained from the website <http://www.labor.state.ak.us>

Quality Control

Streptococcus pneumoniae: Clinical laboratories forward isolates from patients with invasive pneumococcal disease to reference laboratories in their respective country. 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 2013 [1].

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

Participating Countries, ICS 2013



RESULTS

Streptococcus pneumoniae

Case Demographics

A total of 1,582 cases of invasive disease caused by *S. pneumoniae* were reported to ICS during 2013 by Finland, Greenland, Iceland, N. Canada, N. Sweden, Norway, and the U.S. Arctic. The highest rates of disease (18.4 per 100,000) occurred in N. Canada and the lowest in Iceland (5.9 per 100,000) with an overall rate for the ICS circumpolar region of 12.9 per 100,000; 54% of all cases occurred in males. The median age of cases overall was 63.3 years with the lowest median age in N. Canada (46.8 years) and the highest in N. Sweden (69 years). Case fatality ratios ranged from 9% in Norway to 16% in Iceland and the U.S. Arctic; the overall case fatality ratio was 11%.

Streptococcus pneumoniae Case Demographics, ICS 2013 Data

Country	Population	# Cases	Rate*	Sex M (%)	Median Age (min-max) yrs	Deaths n (CFR**)
Finland	5,451,270	724	13.3	403 (56)	62.7 (0-98.1)	†
Greenland	56,370	9	16	5 (56)	51.6 (1.1-64.6)	†
Iceland	321,857	19	5.9	4 (21)	66 (2-92)	3 (16)
N. Canada	157,602	29	18.4	15 (52)	46.8 (0.4-75.5)	3 (11) ^b
N. Sweden	510,415 ^a	75	14.7	34 (45)	69 (0-93)	†
Norway	5,051,275	620	12.3	330 (53)	64.9 (0-96.9)	38 (9) ^b
U.S. Arctic	736,399	106	14.4	63 (59)	53.9 (0-97)	17 (16)
Total	12,285,188	1,582	12.9	854 (54)	63.3 (0-98.1)	61 (11)

*Number of cases per 100,000 per year

** Case fatality ratio

†Case outcomes not reported from Finland, Greenland, N. Sweden

^a Population for Norbotten and Vasterbotten

^b Case outcomes unknown in 1 case from N. Canada, 204 cases from Norway

Streptococcus pneumoniae by Age Category, ICS 2013 Data

Age	Finland	Greenland	Iceland	N. Canada	N. Sweden	Norway	U.S. Arctic
<2 yrs	Pop	118,503	1,549	9,035	5,566	9,844	121,959
	N (%) [*]	19 (3)	1 (11)	0 (0)	7 (24)	2 (3)	19 (3)
	Rate [†]	16	64.6	0	125.8	20.3	15.6
2-19 yrs	Pop	1,090,064	14,877	80,234	45,619	97,812	1,131,494
	N (%) [*]	34 (5)	0 (0)	1 (5)	1 (3)	3 (4)	16 (3)
	Rate [†]	3.1	0	1.3	2.2	3.1	1.4
20-64 yrs	Pop	3,186,156	35,791	190,911	96,872	293,253	3,007,208
	N (%) [*]	352 (49)	8 (89)	5 (26)	16 (55)	24 (32)	278 (45)
	Rate [†]	11.1	22.4	2.6	16.5	8.2	9.2
65+ yrs	Pop	1,056,547	4,153	41,677	9,545	109,506	790,614
	N (%) [*]	319 (44)	0 (0)	13 (68)	5 (17)	46 (61)	307 (50)
	Rate [†]	30.2	0	31.2	52.4	42	38.8
All ages	Pop	5,451,270	56,370	321,857	157,602	510,415	5,051,275
	N	724	9	19	29	75	620
	Rate [†]	13.3	16	5.9	18.4	14.7	12.3

*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 all countries occurred either in those cases less than two years of age or in cases 65+ years of age.

Seasonality

S. pneumoniae was diagnosed throughout the year in 2013 in each country. For all countries, higher proportions of disease were seen in the first and second quarters with declines in the third quarter. Proportions rose again in the fourth quarter in all countries except Iceland and N. Canada.

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 2013 Data**

Age (yrs)		N. Canada [†]		U.S. Arctic	
		Aboriginal	Non-Aboriginal	AK Native	Non-AK Native
<2	Population	4,028	1,538	5,852	15,201
	Cases (rate [‡])	7 (173.8)	0 (0)	6 (102.5)	4 (26.3)
2-19	Population	33,515	12,104	50,080	137,766
	Cases (rate [‡])	1 (3)	0 (0)	9 (18)	5 (3.6)
20-64	Population	47,331	49,541	77,517	382,220
	Cases (rate [‡])	13 (27.5)	2 (4)	29 (37.4)	25 (6.5)
65+	Population	4,714	4,831	9,449	58,314
	Cases (rate [‡])	4 (84.9)	0 (0)	6 (63.5)	22 (37.7)
All Ages	Population	89,588	68,014	142,898	593,501
	Cases (rate [‡])	25 (27.9)	2 (2.9)	50 (35)	56 (9.4)

[†]Race unknown in 2 cases

[‡]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. Clinical diagnoses were not reported by Finland and N. Sweden. In Greenland, N. Canada, and the U.S. Arctic the clinical presentation reported most often was pneumonia (44%, 52%, and 62%, respectively), in Iceland and Norway it was bacteremia (90% and 53%, respectively).

Clinical Presentation of Reported *Streptococcus pneumoniae* Cases, ICS 2013 Data

	Greenland n (%)	Iceland n (%)	N Canada n (%)	Norway n (%)	US Arctic n (%)
Pneumonia*	4 (44)	0 (0)	15 (52)	201 (32)	66 (62)
Bacteremia	3 (33)	17 (89)	11 (38)	328 (53)	21 (20)
Meningitis	2 (22)	2 (11)	1 (3)	45 (7)	8 (8)
Empyema	0 (0)	0 (0)	0 (0)	0 (0)	3 (3)
Peritonitis	0 (0)	0 (0)	0 (0)	0 (0)	3 (3)
Septic arthritis	0 (0)	0 (0)	0 (0)	3 (0.5)	1 (1)
Endocarditis	0 (0)	0 (0)	1 (3)	0 (0)	1 (1)
Pericarditis	0 (0)	0 (0)	0 (0)	0 (0)	1 (1)
Cellulitis	0 (0)	0 (0)	1 (3)	0 (0)	1 (1)
Other	0 (0)	0 (0)	0 (0)	40 (7)	1 (1)
Unknown	0 (0)	0 (0)	0 (0)	3 (0.5)	0 (0)
Total Cases	9	19	29	620	106

*with bacteremia

Risk Factors

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

Streptococcus pneumoniae Risk Factor/Medical Conditions in Adults*, ICS 2013 Data†

	N. Canada n (%)	U.S. Arctic n (%)
Cigarette Smoking	8 (36)	27 (33)
Alcohol Abuse	6 (27)	25 (31)
Chronic Lung Disease and/or Asthma	5 (23)	24 (29)
Immunosuppressive Therapy	2 (9)	3 (4)
Diabetes	3 (14)	10 (12)
Injection Drug Use	0 (0)	3 (4)
Asplenia	1 (5)	0 (0)
Total Adult* Cases	22	82

*≥ 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 for 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 2013 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

Seventy-four 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 the U.S Arctic is was 80% and, in Greenland and N. Canada, 100% of children with known vaccine status were vaccinated. Only 3% 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 use data were not reported from Finland, Iceland and N. Sweden.

Streptococcus pneumoniae Case Vaccination Status for Pneumococcal Vaccine, ICS 2013 Data

	Greenland	N. Canada	Norway	U.S. Arctic
Total cases eligible for PCV vaccine*	1	7	19	10
Vaccine status known in cases eligible for PCV	1	7	19	10
Cases eligible for PCV vaccinated (%)†	1 (100%)	7 (100%)	14 (74%)	8 (80%)
Total cases eligible for PS23 vaccine‡	0	5	307	28
Vaccine status known in cases eligible for PS23	N/A	4	95	25
Cases eligible for PS23 vaccinated (%)†	N/A	4 (100%)	3 (3%)	14 (56%)

*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 2013 are listed in the following table; yellow highlights the most common serotypes in each country. Finland and Norway did not provide serotype data.

Streptococcus pneumoniae Serotypes by Country, ICS 2013 Data

Serotype	Greenland n (%)	Iceland n (%)	N. Canada (%)	N. Sweden* n (%)	U.S. Arctic n (%)
1‡	1 (11)	-	-	-	-
3‡	1 (11)	-	2 (7)	1 (6)	4 (4)
4‡	2 (22)	1 (5)	3 (11)	-	1 (1)
6A‡	-	1 (5)	-	1 (6)	-
6B‡	-	1 (5)	-	-	-
6C	-	-	-	1 (6)	7 (7)
6D	-	-	1 (4)	-	-
7C	-	-	-	-	2 (2)
7F‡	-	1 (5)	4 (15)	1 (6)	5 (5)

Serotype	Greenland n (%)	Iceland n (%)	N. Canada (%)	N. Sweden* n (%)	U.S. Arctic n (%)
8	-	-	2 (7)	-	4 (4)
9N	-	1 (5)	1 (4)	2 (13)	3 (3)
10A	2 (22)	-	2 (7)	1 (6)	4 (4)
11	-	1 (5)	-	-	-
11A	-	-	-	1 (6)	3 (3)
12F	-	-	1 (4)	-	6 (6)
13	-	-	1 (4)	-	-
14‡	-	-	-	-	1 (1)
15	-	1 (5)	-	-	-
15A	-	-	-	-	3 (3)
15B	-	-	-	1 (6)	3 (3)
15C	1 (11)	-	-	-	3 (3)
16	-	-	1 (4)	-	-
16B	-	-	1 (4)	-	-
16F	-	-	1 (4)	-	10 (10)
17F	-	-	1 (4)	-	3 (3)
19A‡	-	3 (18)	1 (4)	2 (13)	3 (3)
19F‡	-	1 (5)	-	-	1 (1)
21	-	-	1 (4)	-	-
22	-	2 (11)	-	-	-
22F	1 (11)	-	2 (7)	3 (19)	13 (13)
23A	-	2 (11)	-	-	4 (4)
23B	1 (11)	1 (5)	1 (4)	-	4 (4)
23F‡	-	2 (11)	-	-	-
31	-	-	-	-	3 (3)
33F	-	-	2 (7)	1 (6)	3 (3)
34	-	-	1 (4)	-	3 (3)
35	-	1 (5)	-	-	-
35B	-	-	-	1 (6)	3 (3)
Non-viable	-	-	-	-	1 (1)
Total†	9	19	27	16	100

*Serogroup level data from Vasterbotten

†Total isolates serotyped

‡Serotype included in PCV

Cases and Deaths with Vaccine Serotypes

For the countries reporting serotype data, at least 56% of *S. pneumoniae* cases in persons ≥ 2 years of age had a serotype that was included in the 23-valent polysaccharide vaccine. In children < 2 years of age, only the U.S. Arctic had cases with 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 33% to 47%.

Proportion of Cases/Deaths with Invasive Pneumococcal Disease Vaccine Serotypes, ICS 2013 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	7/8 (88)	10/15 (67)	15/21 (71)	13/16 (81)	50/90 (56)
Cases < 2 years old with serotype in the 13-valent pneumococcal conjugate vaccine	0/1 (0)	No cases	0/6 (0)	0/0 (0)	2/10 (20)
Deaths (all ages) for which the serotype was contained in the 23-valent pneumococcal vaccine	0 (0‡)	1 (33‡)	1 (33‡)	†	7 (47‡)

*Number of isolates serotyped by country by age group

‡Percentage of total death

†Outcomes not reported

Outcome

A total of 61 deaths associated with *S. pneumoniae* were reported to ICS in 2013. Overall, the highest case fatality ratio (CFR) occurred in persons 65+ years of age (18%). Finland, Greenland and N. Sweden did not report outcome data.

Streptococcus pneumoniae Age-Specific Case-Fatality Ratios (CFR), ICS 2013 Data

		<2 years	2-19 years	20-64 years	65+ years	All Ages
Iceland	Deaths/Cases*	0/0	0/1	0/5	3/13	3/19
	(CFR)	(0%)	(0%)	(0%)	(23%)	(16%)
N. Canada	Deaths/Cases*	1/7	0/1	0/15†	2/5	3/28
	(CFR)	(14%)	(0%)	(0%)	(40%)	(11%)
Norway	Deaths/Cases*	0/16†	1/13†	6/182†	31/205	38/416
	(CFR)	(0%)	(8%)	(3%)	(15%)	(9%)
U.S. Arctic	Deaths/Cases*	1/10	2/14	7/54	7/28	17/106
	(CFR)	(10%)	(14%)	(13%)	(25%)	(16%)
Total	Deaths/Cases*	2/33	3/28	13/251	43/241	61/553
	(CFR)	(6%)	(11%)	(5%)	(18%)	(11%)

*Cases with known outcome.

†Outcome unknown in (3) Norway cases < 2 years; (3) Norway cases 2-19 years; (1) N Canada, (96) Norway; (153) Norway cases 65+ years

Antimicrobial Susceptibility

In 2013, antimicrobial susceptibility results were reported to ICS from Finland, 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 2013 Data**

Antibiotic	Finland n (NS%)	Iceland n (NS%)	N. Canada n (NS%)	N. Sweden n (NS%)	U.S. Arctic n (NS%)
Ceftriaxone	-	19 (5%)	27 (0%)	-	100 (3%)
Chloramphenicol	-	19 (0%)	25 (0%)	-	100 (2%)
Clindamycin	-	-	26 (4%)	-	100 (4%)
Erythromycin	-	19 (16%)	25 (4%)	38 (0%)	100 (16%)
Levofloxacin	-	-	26 (0%)	-	100 (0%)
Penicillin	724 (1%)	19 (16%)	27 (0%)	38 (5%)	100 (13%)
Tetracycline	-	-	-	-	100 (6%)
TMP Sulfa*	-	19 (26%)	27 (0%)	36 (6%)	100 (8%)
Vancomycin	-	-	24 (0%)	-	100 (0%)

*Trimethoprim-sulfamethoxazole

Of the antibiotics tested, the largest numbers of isolates were resistant to penicillin, TMP-Sulfa and erythromycin. Results by country for each of these antibiotics are shown in the tables below. In the U.S. Arctic, 10 isolates comprised of 9 serotypes (3, 6C, 14, 15A, 15B, 19A, 22F, 23A, 35B) showed multi-drug resistance. In Iceland, 3 isolates including serotypes 15, 19A, and 19F were resistant to more than one antibiotic. N. Canada and N. Sweden did not have any multi-drug resistant isolates. Finland did not report serotype results.

***Streptococcus pneumoniae* Penicillin Susceptibility Results, ICS 2013 Data**

	# Tested	I* (%)	I* Serotypes (n)	R* (%)	R* Serotypes (n)
Iceland	19	2 (11%)	15 (1), 19A (1)	1 (5%)	19F (1)
N. Canada	27	0 (0%)		0 (0%)	
N. Sweden	38	2 (5%)	10A (1), Unk (1)	0 (0%)	
U.S. Arctic	100	11 (11%)	23A (3), 19A (2), 6C (1), 14 (1), 15A (1), 15B (1), 23B (1), 35B (1)	2 (2%)	19A (1), 35B (1)

*I=Intermediate resistance, R=Fully resistant

†Serotypes not reported

***Streptococcus pneumoniae* TMP-Sulfa Susceptibility Results, ICS 2013 Data**

	# Tested	I* (%)	I* Serotypes (n)	R* (%)	R* Serotypes (n)
Iceland	19	1 (5%)	23F (1)	4 (21%)	19A (2), 15 (1), 19F (1)
N. Canada	27	0 (0%)		0 (0%)	
N. Sweden†	36	1 (3%)	Unk (1)	1 (3%)	22F (1)
U.S. Arctic	100	3 (3%)	6C (1), 15B (1), 23B (1)	5 (5%)	33F (3), 14 (1), 19A (1)

*I=Intermediate resistance, R=Fully resistant

†N. Sweden reported serogroups only

***Streptococcus pneumoniae* Erythromycin Susceptibility Results, ICS 2013 Data**

	# Tested	I* (%)	I* Serotypes	R* (%)	R* Serotypes (n)
Iceland	19	0 (0%)		3 (16%)	15 (1), 19A (1), 19F (1)
N. Canada	25	0 (0%)		1 (4%)	19A (1)
N. Sweden	38	0 (0%)		0 (0%)	
U.S. Arctic	100	0 (0%)		16 (16%)	15A (3), 22F (3), 35B (2), 3 (1), 6C (1), 10A (1), 12F (1), 15B (1), 19A (1), 23A (1), 31 (1)

*I=Intermediate resistance, R=Fully resistant

Quality Control

In 2013, 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 log₂ 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 2013-A, overall serotyping correlation was 95.6%. The modal MIC comparison resulted in an overall correlation of 98.8%. Overall category agreement was 96.6% with individual participant agreement ranging from 91.4%-100%. Chloramphenicol differences accounted for 7 out of the 13 categorical errors. This could be due in part to the fact that there is no intermediate range for this antibiotic. 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 97.8% with individual participant agreement ranging from 95.3%-100%.

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

Finland, Greenland, N. Canada, N. Sweden (Norbotten), Norway and the U.S. Arctic reported the occurrence of invasive *H. influenzae* disease during 2013. A total of 177 cases of invasive disease caused by *H. influenzae* were reported to ICS during 2013. The highest rate of disease among regions reporting cases was in N. Canada (12.1 per 100,000) and the lowest in Finland (0.9/100,000). Median age of cases was highest in Norway (65.8 years) and lowest in N. Canada (1.9 years). Greenland reported no cases in 2013.

Haemophilus influenzae Case Demographics, ICS 2013 Data

Country	Population	# Cases	Rate* Rate*	Sex M (%)	Median Age (min-max) yrs	Deaths n (CFR†)
Finland	5,451,270	48	0.9	21 (44)	60.7 (0.5-93.9)	‡
Greenland	56,370	0	0	No cases	No cases	No cases
N. Canada	157,602	19	12.1	13 (68)	1.9 (0.3-80.1)	2 (11%)
N. Sweden	249,465	3	1.2	2 (67)	42 (10-89)	‡
Norway	5,051,275	86	1.7	38 (44)	65.8 (0-98.2)	10 (18%)‡
U.S. Arctic	736,399	21	2.9	11 (52)	34.2 (0-86.3)	2 (10%)
Total	11,702,381	177	1.5	85 (48)	60.5 (0-98.2)	14 (14%)

*Number of cases per 100,000 per year

†Case fatality ratio

‡ Case outcome unknown in (29) Norway cases; Finland and N. Sweden did not report case outcomes

When stratified by age, the highest rates of disease for N. Canada, Norway and the U.S. Arctic were in the <2 years age category; in N. Sweden, the highest rate of disease was in the 2-19 year old category and in Finland, the highest rate of disease was in the 65+ years age category.

Haemophilus influenzae by Age Category, ICS 2013 Data

Age		Finland	N. Canada	N. Sweden	Norway	U.S. Arctic
<2 yrs	Population	118,503	5,566	4,490	121,959	21,053
	Cases (%)*	2 (4)	10 (53)	0 (0)	8 (9)	9 (43)
	Rate†	1.7	179.7	0	6.6	42.8
2-19 yrs	Population	1,090,064	45,619	46,659	1,131,494	187,846
	Cases (%)*	3 (6)	5 (26)	1 (33)	2 (2)	0 (0)
	Rate†	0.3	11	2.1	0.2	0
20-64 yrs	Population	3,186,156	96,872	141,785	3,007,208	459,737
	Cases (%)*	23 (48)	1 (5)	1 (33)	31 (36)	4 (19)
	Rate†	0.7	1	0.7	1	0.9
65+ yrs	Population	1,056,547	9,545	56,531	790,614	67,763
	Cases (%)*	20 (42)	3 (16)	1 (33)	45 (52)	8 (38)
	Rate†	1.9	31.4	1.8	5.7	11.8
All ages	Population	5,451,270	157,602	249,465	5,051,275	736,399
	Cases	48	19	3	86	21
	Rate†	0.9	12.1	1.2	1.7	2.9

*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 (248.1 per 100,000) and U.S. Arctic AK Native (136.7 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 in which cases occurred.

***Haemophilus influenzae* by Race and Age Categories, ICS 2013 Data**

Age (yrs)		N. Canada*		U.S. Arctic	
		Aboriginal	Non-Aboriginal	AK Native	Non-AK Native
<2	Population	4,028	1,538	5,852	15,201
	Cases (rate†)	10 (248.3)	0 (0)	8 (136.7)	1 (6.6)
2-19	Population	33,515	12,104	50,080	137,766
	Cases (rate†)	5 (14.9)	0 (0)	0 (0)	0 (0)
20-64	Population	47,331	49,541	77,517	382,220
	Cases (rate†)	1 (2.1)	0 (0)	2 (2.6)	2 (0.5)
65+	Population	4,714	4,831	9,449	58,314
	Cases (rate†)	3 (63.6)	0 (0)	2 (21.2)	6 (10.3)
All Ages	Population	89,588	68,014	142,898	593,501
	Cases (rate†)	19 (21.2)	0 (0)	12 (8.4)	9 (1.5)

*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, the most common clinical presentation associated with *H. influenzae* was pneumonia (60% of reported cases) followed by meningitis and septic arthritis (21% of cases for each presentation). In Norway and the U.S. Arctic, the most common clinical presentations were bacteremia (49% and 38%, respectively) and pneumonia (30% and 38% respectively). Finland and N. Sweden did not report clinical presentation data.

Clinical Presentation of Reported *Haemophilus influenzae* Cases, ICS 2013 Data

	N. Canada	Norway	U.S. Arctic
	n (%)	n (%)	n (%)
Pneumonia*	7 (37)	26 (30)	8 (38)
Bacteremia	2 (11)	38 (44)	8 (38)
Meningitis	4 (21)	8 (9)	4 (19)
Septic arthritis	4 (21)	0 (0)	0 (0)
Amnionitis	0 (0)	0 (0)	1 (5)
Other/Unknown	2 (11)	14 (16)	0 (0)
Total	19	86	21

*with bacteremia

Risk Factors

Forty-two percent of adult (≥ 18 years) cases of *H. influenzae* reported in the U.S. Arctic indicated chronic lung disease as an associated risk factor; 25% indicated smoking and 8% indicated diabetes and/or alcohol abuse as an associated risk factor. Fifty percent of adult N. Canadian *H. influenzae* cases reported chronic lung disease as a risk factor, 25% reported diabetes, alcohol abuse, and/or immunosuppressive treatment. Finland, 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 three cases of Hib reported in a child under the age of 5 years in N. Canada (n=1) and the U.S. Arctic (n=2). The case in N. Canada and one case in the U.S. Arctic had received at least one dose of vaccine. Data on vaccine status were not provided by Finland, N. Sweden and Norway.

Haemophilus influenzae Case Vaccination Status for Hib Vaccine, ICS 2013 Data

	N. Canada	U.S. Arctic
Total cases* eligible for Hib vaccine†	15	9
Vaccine status known in cases* eligible for Hib vaccine	14	8
Cases* eligible for Hib vaccine vaccinated (%)‡	14 (100%)	6 (75%)

*All serotypes

†Children less than 5 years of age

‡Percent of vaccine status known cases

Serotypes

Serotype data were not provided from Finland and N. Sweden.

Haemophilus influenzae Serotypes by Country, ICS 2012 Data

Serotype	N. Canada	Norway	U.S. Arctic
	n (%)	n (%)	n (%)
a	16 (89)	0 (0)	5 (24)
b	1 (6)	3 (4)	2 (10)
e	0 (0)	1 (1)	0 (0)
f	0 (0)	17 (22)	3 (14)
Non-typeable	1 (6)	58 (73)	11 (52)
Total*	18	79	21

*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

Fourteen deaths were associated with *H. influenzae* cases reported to ICS in 2013; ten from Norway and two each from N. Canada and the U.S. Arctic. Finland and N. Sweden did not provide outcome data.

***Haemophilus influenzae* Deaths by Country, ICS 2013 Data**

	N. Canada	Norway	U.S. Arctic
No. Deaths	2	10	2
Case Fatality Ratio	11%	18%*	10%
Min-max (yrs)	0.9-4.5	0-98.2	0.5-72.7
Serotypes (n)	a (2)	f (1), NT (8), unk (1)	b (1), NT (1)
Clinical Presentation (n)	Meningitis (1), unknown (1)	Bacteremia (5) , pneumonia (3), meningitis (1), other (1)	Meningitis (1), pneumonia (1)

*Case outcome unknown in (29) 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

Finland, Greenland, N. Canada, N. Sweden (Norbotten), Norway and the U.S. Arctic reported the occurrence of *N. meningitidis* during 2013. A total of 50 cases of invasive disease caused by *N. meningitidis* were reported to ICS. Rates were similar in all countries reporting cases ranging from 0.4-0.8 per 100,000. Two deaths associated with *N. meningitidis* were reported from Norway. Greenland and the U.S. Arctic reported no cases in 2013.

Neisseria meningitidis Case Demographics, ICS 2013 Data

Country	Population	# Cases	Rate* Rate*	Sex M (%)	Median Age (min-max) yrs	Deaths n (CFR†)
Finland	5,451,270	20	0.4	8 (40)	17.1 (0.1-87.7)	‡
Greenland	56,370	0	0	No cases	No cases	No cases
N. Canada	157,602	1	0.6	0 (0)	0.4 (1 case)	0 (0%)
N. Sweden	249,465	2	0.8	1 (50)	72 (64-80)	‡
Norway	5,051,275	27	0.5	13 (48)	25.4 (0-82)	2 (7%)
U.S. Arctic	736,399	0	0	No cases	No cases	No cases
Total	11,702,381	50	0.4	22 (44)	25.9 (0-87.7)	2 (7%)

*Number of cases per 100,000 per year

†Case fatality ratio

‡Finland and N. Sweden did not report outcomes

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

Neisseria meningitidis by Age Category, ICS 2013 Data

Age		Finland	N. Canada	N. Sweden	Norway
<2 yrs	Population	118,503	5,566	4,490	121,959
	Cases (%)*	7 (35)	1 (100)	0 (0)	4 (15)
	Rate†	5.9	18	0	3.3
2-19 yrs	Population	1,090,064	45,619	46,659	1,131,494
	Cases (%)*	3 (15)	0 (0)	0 (0)	8 (30)
	Rate†	0.3	0	0	0.7
20-64 yrs	Population	3,186,156	96,872	141,785	3,007,208
	Cases (%)*	6 (30)	0 (0)	1 (50)	12 (44)
	Rate†	0.2	0	0.7	0.4
65+ yrs	Population	1,056,547	9,545	56,531	790,614
	Cases (%)*	4 (20)	0 (0)	1 (50)	3 (11)
	Rate†	0.4	0	1.8	0.4
All ages	Population	5,451,270	157,602	249,465	5,051,275
	Cases	20	1	2	27
	Rate†	0.4	0.6	0.8	0.5

*Proportion of total cases in each country/region

†Number of cases per 100,000 per year

Race

In N. Canada, the one case reported in 2013 occurred 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. Finland and N. Sweden did not report clinical presentations.

Clinical Presentation of Reported *Neisseria meningitidis* Cases, ICS 2013 Data

	N. Canada	Norway
	n (%)	n (%)
Bacteremia	0 (0)	7 (26)
Meningitis	1 (100)	16 (59)
Pneumonia	0 (0)	1 (4)
Other	0 (0)	3 (11)
Total	1	27

*with bacteremia

Serogroups

Twenty-six of 50 cases of invasive *N. meningitidis* reported to ICS in 2013 included serogroup data. The table below lists serogroups by country. Finland and N. Sweden did not report serogroup data.

***Neisseria meningitidis* Serogroups by Country, ICS 2013 Data**

Serogroup	N. Canada	Norway
	n (%)	n (%)
B	-	11 (44)
C	-	6 (24)
W135	1 (100)	1 (4)
Y	-	7 (28)
Total	1	25

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

Finland, Greenland, N. Canada, N. Sweden (Norrbotten) and the U.S. Arctic each reported the occurrence of GAS during 2013. A total of 268 cases of invasive disease caused by GAS were reported to ICS. Among regions reporting cases, the rate of disease was highest in N. Sweden (9.2 per 100,000) compared to the lowest in Finland (3.3 per 100,000). Ten deaths were associated with GAS, seven in the U.S. Arctic and one in N. Canada. Greenland reported no GAS cases in 2013.

Group A *Streptococcus* Case Demographics, ICS 2013 Data

Country	Population	# Cases	Rate*	Sex M (%)	Median Age (min-max) yrs	Deaths n (CFR†)
Finland	5,451,270	181	3.3	95 (53)	56.4 (0-96.3)	‡
Greenland	56,370	0	0	No cases	No cases	No cases
N. Canada	157,602	11	7	8 (73)	41.7 (6.1-85.8)	3 (30%)‡
N. Sweden	249,465	23	9.2	10 (44)	52 (5-87)	‡
U.S. Arctic	736,399	53	7.2	33 (62)	43 (0.2-84.2)	7 (13%)
Total	6,651,106	268	4	146 (55)	51.3 (0-96.3)	10 (16%)

*Number of cases per 100,000 per year

†Case fatality ratio

‡Outcome unknown in (1) N. Canada case; outcomes not reported from Finland and N. Sweden

When stratified by age, the highest rates of disease occurred in children <2 years in the U.S. Arctic (23.8 per 100,000) and in individuals 65+ years of age in Finland, N. Canada and N. Sweden (6.3 per 100,000, 31.4 per 100,000 and 14.2 per 100,000, respectively).

Group A *Streptococcus* by Age Category, ICS 2013 Data

Age		Finland	N. Canada	N. Sweden	U.S. Arctic
<2 yrs	Population	118,503	5,566	4,490	21,053
	Cases (%)*	1 (<1)	0 (0)	0 (0)	5 (9)
	Rate†	0.8	0	0	23.8
2-19 yrs	Population	1,090,064	45,619	46,659	187,846
	Cases (%)*	10 (6)	1 (9)	2 (9)	3 (6)
	Rate†	0.9	2.2	4.3	1.6
20-64 yrs	Population	3,186,156	96,872	141,785	459,737
	Cases (%)*	103 (57)	7 (64)	13 (57)	39 (74)
	Rate†	3.2	7.2	9.2	8.5
65+ yrs	Population	1,056,547	9,545	56,531	67,763
	Cases (%)*	67 (37)	3 (31.4)	8 (35)	6 (11)
	Rate†	6.3	30.1	14.2	8.9
All ages	Population	5,451,270	157,602	249,465	736,399
	Cases	181	11	23	53
	Rate†	3.3	7	9.2	7.2

*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 AK Native children <2 years and N. Canada Aboriginal persons 65 years and older.

Group A *Streptococcus* by Race and Age Categories, ICS 2013 Data

Age (yrs)	N. Canada		U.S. Arctic		
	Aboriginal	Non-Aboriginal	AK Native	Non-AK Native	
<2	Population	4,028	1,538	5,852	15,201
	Cases (rate†)	0 (0)	0 (0)	5 (85.4)	0 (0)
2-19	Population	33,515	12,104	50,080	137,766
	Cases (rate†)	0 (0)	1 (8.3)	2 (4)	1 (0.7)
20-64	Population	47,331	49,541	77,517	382,220
	Cases (rate†)	6 (12.7)	0 (0)	17 (21.9)	22 (5.7)
65+	Population	4,714	4,831	9,449	58,314
	Cases (rate†)	3 (63.6)	0 (0)	0 (0)	6 (10.3)
All Ages	Population	89,588	68,014	142,898	593,501
	Cases (rate†)	9 (10.1)	1 (1.5)	24 (16.8)	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 presentation for GAS cases in N. Canada and the U.S. Arctic was bacteremia. Finland and N. Sweden did not report clinical presentations.

Clinical Presentation of Reported group A *Streptococcus* Cases, ICS 2013 Data

	N. Canada n (%)	U.S. Arctic n (%)
Bacteremia	3 (27)	17 (32)
Cellulitis*	1 (9)	11 (21)
Necrotizing fasciitis	2 (18)	6 (11)
Pneumonia*	0 (0)	9 (17)
Septic arthritis	2 (18)	3 (6)
Empyema	0 (0)	2 (4)
Endocarditis	0 (0)	1 (2)
Strep toxic shock	1 (9)	0 (0)
Peritonitis	0 (0)	1 (2)
Endometritis	0 (0)	1 (2)
Other/Unknown	2 (18)	2 (4)
Total	11	53

*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; in N. Canada alcohol abuse, chronic lung disease and diabetes were most commonly reported. Finland, Greenland and N. Sweden did not report risk factor data.

Group A *Streptococcus* Risk Factor/Medical Conditions in Adults*, ICS 2013 Data†

	N. Canada	U.S. Arctic
	n (%)	n (%)
Cigarette Smoking	1 (10)	14 (26)
Alcohol Abuse	2 (20)	10 (19)
Chronic Lung Disease and/or Asthma	2 (20)	7 (13)
Immunosuppressive Therapy	0 (0)	0 (0)
Diabetes	2 (20)	11 (21)
Injection Drug Use	0 (0)	4 (8)
Asplenia	0 (0)	2 (4)
Total Adult* Cases	10	53

* ≥ 18 years

†Multiple risk factors may be reported per case

Outcome

Seven deaths in cases with GAS were reported from the U.S. Arctic (CFR 13%); one occurred in the 2-19 years old age category, three in the 20-64 age category and three in persons ≥ 65 . One death was reported in Canada in the 20-64 age category and two in persons 65 years of age and older. Finland and 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

Finland, Greenland, N. Canada, N. Sweden and the U.S. Arctic each reported the occurrence of GBS during 2013. A total of 302 cases of invasive disease caused by GBS were reported to ICS. Greenland and N. Sweden reported no cases. One death in the U.S. Arctic was associated with GBS in 2013.

Group B *Streptococcus* Case Demographics, ICS 2013 Data

Country	Population	# Cases	Rate*	Sex M (%)	Median Age (min-max) yrs	Deaths n (CFR†)
Finland	5,451,270	259	4.8	112 (43)	64.8 (0-96.1)	‡
Greenland	56,370	0	0	No cases	No cases	No cases
N. Canada	157,602	3	1.9	1 (33)	0 (0-58.2)	0 (0)
N. Sweden	249,465	0	0	No cases	No cases	No cases
U.S. Arctic	736,399	40	5.4	17 (43)	59.4 (0-84.9)	1 (3)
Total	6,651,106	302	4.5	130 (43)	63.8 (0-96.1)	1 (2)

*Number of cases per 100,000 per year

†Case fatality ratio

‡Outcomes not reported

When stratified by age, the highest rates of disease in all countries reporting cases occurred in children less than two years of age.

Group B *Streptococcus* by Age Category, ICS 2013 Data

Age		Finland	N. Canada	U.S. Arctic
<2 yrs	Population	118,503	5,566	21,053
	Cases (%)*	33 (13)	2 (67)	6 (15)
	Rate†	27.9	35.9	28.5
2-19 yrs	Population	1,090,064	45,619	187,846
	Cases (%)*	0 (0)	0 (0)	0 (0)
	Rate†	0	0	0
20-64 yrs	Population	3,186,156	96,872	459,737
	Cases (%)*	97 (38)	1 (33)	19 (48)
	Rate†	3	1	4.1
65+ yrs	Population	1,056,547	9,545	67,673
	Cases (%)*	129 (50)	0 (0)	15 (38)
	Rate†	12.2	0	22.1
All ages	Population	5,451,270	157,602	736,399
	Cases	259	3	40
	Rate†	4.8	1.9	5.4

*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 and 2 cases in N. Canada (0.3 and 0.7 cases per 1,000 live births respectively).

Race

Race and ethnicity data were collected in N. Canada and the U.S. Arctic. 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 N. Canada Aboriginal and Alaska non-Native children less than 2 years old.

Group B *Streptococcus* by Race and Age Categories, ICS 2013 Data

Age (yrs)	N. Canada		U.S. Arctic		
	Aboriginal	Non-Aboriginal	AK Native	Non-AK Native	
<2	Population	4,028	1,538	5,852	15,201
	Cases (rate†)	2 (49.7)	0 (0)	1 (17.1)	5 (32.9)
2-19	Population	33,515	12,104	50,080	137,766
	Cases (rate†)	0 (0)	0 (0)	0 (0)	0 (0)
20-64	Population	47,331	49,541	77,517	382,220
	Cases (rate†)	1 (2.1)	0 (0)	6 (7.7)	13 (3.4)
65+	Population	4,714	4,831	9,449	58,314
	Cases (rate†)	0 (0)	0 (0)	3 (31.8)	12 (20.6)
All Ages	Population	89,588	68,014	142,898	593,501
	Cases (rate†)	3 (3.4)	0 (0)	10 (7)	30 (5.1)

†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, bacteremia (67% and 40%, respectively) was the most common clinical presentation reported for cases of GBS in 2013. Finland did not report clinical presentations.

Clinical Presentation of Reported group B *Streptococcus* Cases, ICS 2013 Data

	N. Canada n (%)	U.S. Arctic n (%)
Bacteremia	2 (67)	16 (40)
Cellulitis*	0 (0)	11 (28)
Pneumonia*	0 (0)	3 (8)
Septic arthritis	0 (0)	1 (2.5)
Amnionitis	0 (0)	1 (2.5)
Endocarditis	0 (0)	2 (5)
Meningitis	1 (33)	1 (2.5)
Necrotizing fasciitis	0 (0)	1 (2.5)
Peritonitis	0 (0)	1 (2.5)
Other	0 (0)	3 (8)
Total	3	40

*with bacteremia

Risk Factors

Thirty-eight percent of GBS adult (≥ 18 years) cases reviewed in the U.S. Arctic indicated diabetes as a risk factor in 2013; 15% had chronic lung disease and 12% reported alcohol abuse. The one adult case in N. Canada reported no risk factors.

Outcome

One death in cases with GBS was reported in the U.S. Arctic (CFR 3%); the death occurred 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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