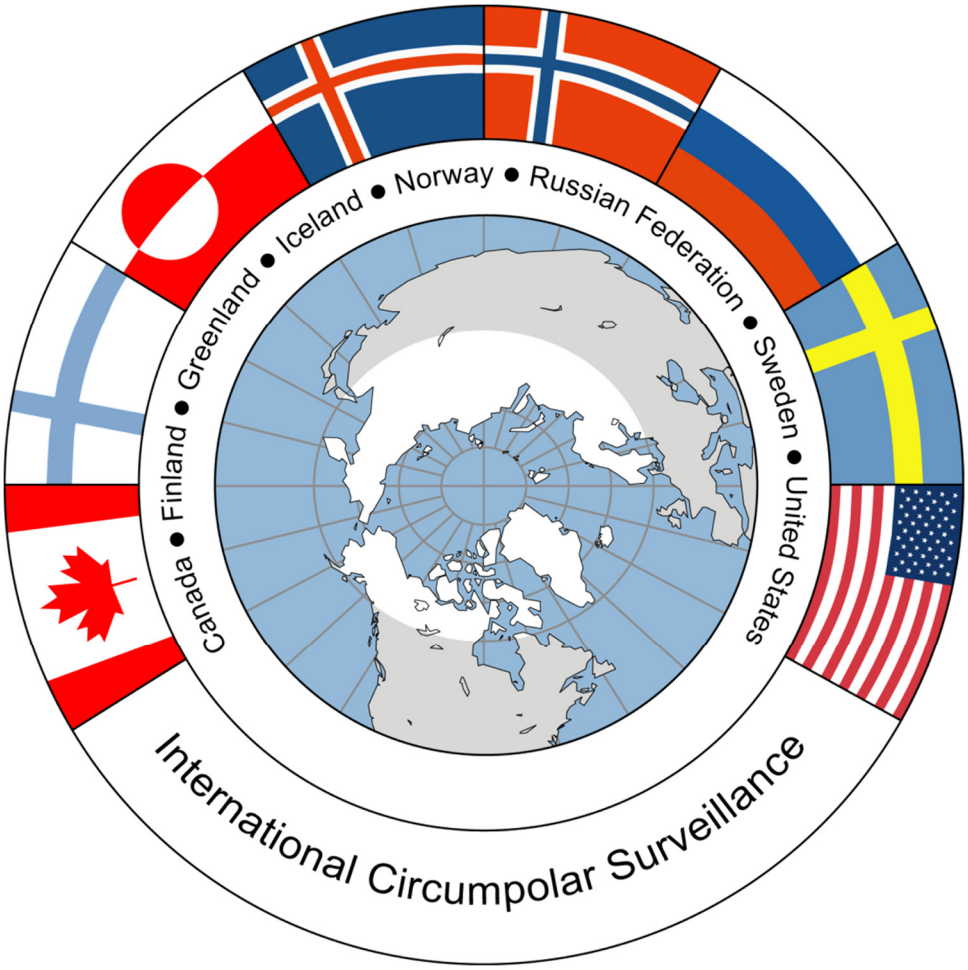
INTERNATIONAL CIRCUMPOLAR SURVEILLANCE (ICS) SUMMARY REPORT



YEAR 2010 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 2010.

Data on invasive disease with the organism *S. pneumoniae* are collected from all participating countries. A total of 1,874 cases of invasive pneumococcal disease were identified in 2010. 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 7-14%. 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 36 and 31 cases per 100,000 population, respectively, which represents a slight decrease in disease from 2009 in these populations. Pneumonia, bacteremia and meningitis 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 14; in Greenland, N. Canada and the U.S. Arctic the most common serotype was 7F.

Data on invasive disease due to *H. influenzae*, *N. meningitidis*, and groups A and B *Streptococcus* are currently collected in Greenland, Northern Canada, Northern Sweden and the U.S. Arctic; Norway also contributes data on cases of *N. meningitidis* and *H. influenzae*. A total of 137 *H. influenzae* cases, 42 *N. meningitidis* cases, 63 GAS cases, and 68 GBS cases were reported in 2010. 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 2010 Data

Country	*S. pneumoniae* n (rate*)	*H. influenzae* n (rate*)	*N. meningitidis* n (rate*)	GAS n (rate*)	GBS n (rate*)
Finland	850 (15.8)	N/A	N/A	N/A	N/A
Greenland	10 (17.7)	0 (0)	0 (0)	0 (0)	0 (0)
Iceland	37 (11.6)	N/A	N/A	N/A	N/A
N. Canada	30 (19.8)	17 (11.2)	1 (0.7)	12 (7.9)	3 (2)
N. Sweden	84 (16.5)†	2 (0.8)‡	1 (0.4)‡	9 (3.6)‡	12 (4.8)‡
Norway	748 (15.4)	89 (1.8)	39 (0.8)	N/A	N/A
U.S. Arctic	115 (16.2)	29 (4.1)	1 (0.1)	42 (5.9)	53 (7.5)
Total	1,874 (15.6)	137 (2.3)	42 (0.7)	63 (5.4)	68 (5.4)

*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, 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 2010

Country	*S. pneumoniae*	*H. influenzae*	*N. meningitidis*	GAS	GBS	Serotype	Demographics	Race/Ethnicity	Risk Factors	Outcome	Vaccination Status	Antibiotic Susceptibility
Finland	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 2010 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 2010 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 2010 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 2010 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 2010 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 2010 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.

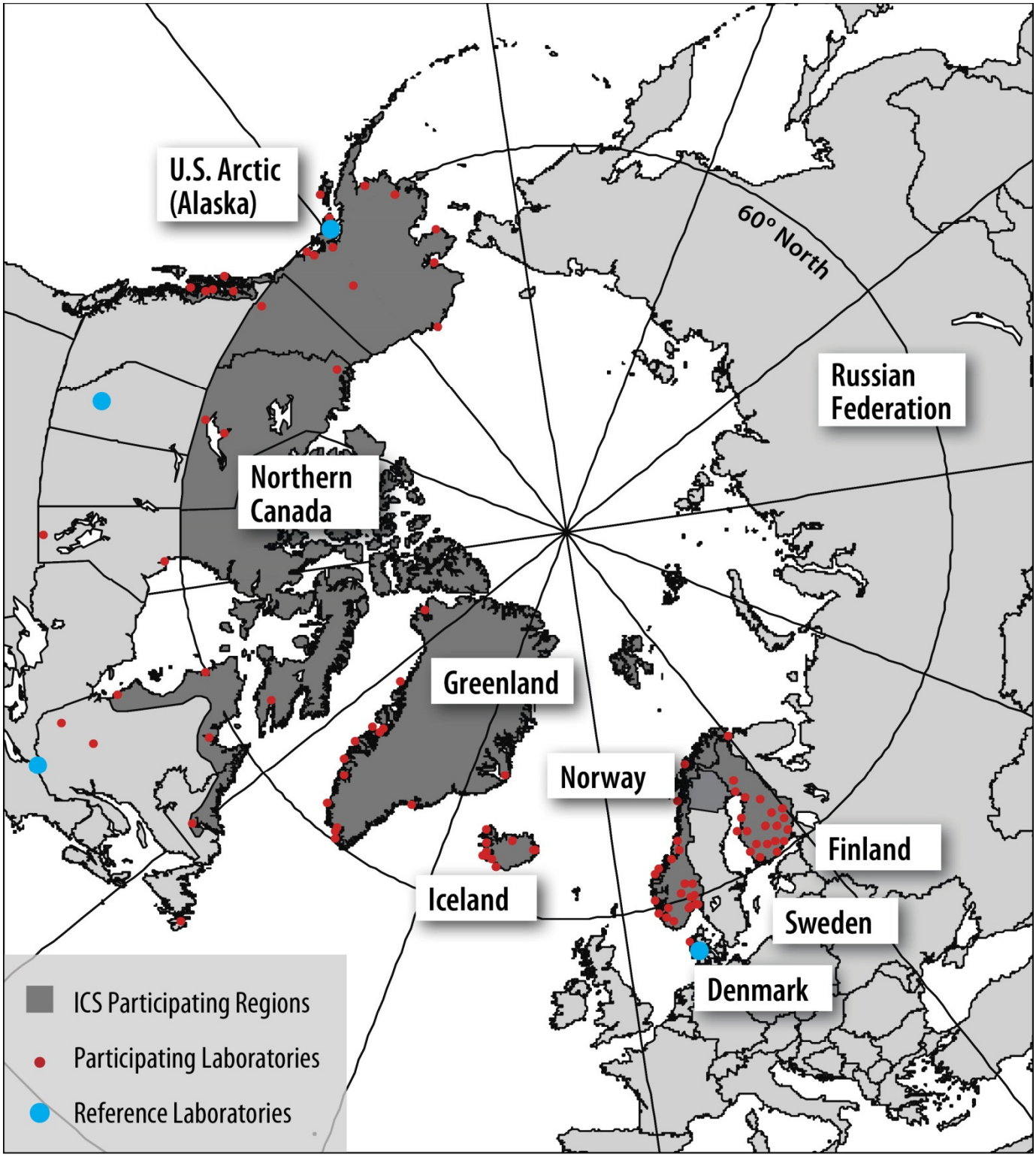
- Population estimates for 2010 were obtained from the website http://www.labor.state.ak.us

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 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 [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 2010



RESULTS

Streptococcus pneumoniae

Case Demographics

A total of 1,874 cases of invasive disease caused by *S. pneumoniae* were reported to ICS during 2010 by Finland, Greenland, Iceland, N. Canada, N. Sweden, Norway, and the U.S. Arctic. The highest rates of disease (17.7 per 100,000) occurred in N. Canada and the lowest in Iceland (11.6 per 100,000) with an overall rate for the ICS circumpolar region of 15.6 per 100,000; 54% of all cases occurred in males. The median age of cases overall was 62.3 years with the lowest median age in N. Canada (54 years) and the highest in Norway (65.6 years). Case fatality ratios ranged from 6.7% in N. Canada to 13.5% in Iceland; the overall case fatality ratio was 11.4%.

***Streptococcus pneumoniae* Case Demographics, ICS 2010 Data**

Country	Population	# Cases	Rate*	Sex M (%)	Median Age (min-max) yrs	Deaths n (CFR†)
Finland	5,375,276	850	15.8	470 (55)	59.5 (0-97.4)	‡
Greenland	56,452	10	17.7	7 (70)	57.8 (1.2-82.6)	1 (11.1%)[b]
Iceland	317,630	37	11.6	21 (57)	61.4 (0.6-95.9)	5 (13.5%)
N. Canada	151,578	30	19.8	18 (60)	54 (0.8-89.8)	2 (6.7%)
N. Sweden	507,826[a]	84	16.5	39 (46)	65.2 (0.1-95.6)	‡
Norway	4,858,199	748	15.4	385 (51)	65.6 (0.1-101.2)	44 (11.8%)[b]
U.S. Arctic	710,231	115	16.2	69 (60)	55.2 (0.3-95.4)	12 (10.6%)[b]
Total	11,977,192	1,874	15.6	1,009 (54)	62.3 (0-101.2)	64 (11.4%)

*Number of cases per 100,000 per year
†Case fatality ratio
‡Case outcomes not reported from Finland, N. Sweden
[a] Population for Norbotten and Vasterbotten
[b] Case outcomes unknown in 1 case from Greenland, 374 cases from Norway, 2 cases from U.S. Arctic

***Streptococcus pneumoniae* by Age Category, ICS 2010 Data**

Age		Finland	Greenland	Iceland	N. Canada	N. Sweden	Norway	U.S. Arctic
<2 yrs	Pop	121,919	1,695	9,778	5,651	9,986	123,626	21,834
	N (%)*	71 (8)	1 (10)	4 (11)	2 (7)	1 (1)	25 (3)	10 (9)
	Rate†	58.2	59	40.9	35.4	10	20.2	45.8
2-19 yrs	Pop	1,097,842	15,749	80,515	44,672	101,420	1,116,131	186,006
	N (%)*	63 (7)	0 (0)	2 (5)	1 (3)	2 (2)	22 (3)	14 (12)
	Rate†	5.7	0	2.5	2.2	2	2	7.5
20-64 yrs	Pop	3,214,474	35,161	189,268	92,854	293,628	2,895,769	447,453
	N (%)*	405 (48)	6 (60)	15 (41)	19 (63)	35 (42)	309 (41)	61 (54)
	Rate†	12.6	17.1	7.9	20.5	11.9	10.7	13.6
65+ yrs	Pop	941,041	3,847	38,069	8,401	102,792	722,673	54,938
	N (%)*	311 (37)	3 (30)	16 (43)	8 (27)	46 (55)	392 (52)	30 (26)
	Rate†	33.1	78	42	95.2	44.8	54.2	54.6
All ages	Pop	5,375,276	56,452	317,630	151,578	507,826	4,858,199	710,231
	N	850	10	37	30	84	748	115
	Rate†	15.8	17.7	11.6	19.8	16.5	15.4	16.2

*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 2010 in each country. For all countries except Greenland, higher proportions of disease were seen in the first and second quarters of the year with declines during the third quarter and rising again during the fourth quarter. In Greenland, the highest proportion of cases was seen in the third quarter and the lowest in the second quarter of the year, however, due to the small number of cases, seasonality cannot be described.

Race

Race and ethnicity data were collected in N. Canada and the U.S. Arctic. Rates of invasive pneumococcal disease were higher in Aboriginal and Native populations than in non-Aboriginal and non-Native populations. The highest rates of disease occurred in children less than 2 years of age and adults 65+ in both countries.

***Streptococcus pneumoniae* by Race and Age Categories, ICS 2010 Data**

Age (yrs)		N. Canada*		U.S. Arctic	
		Aboriginal	**Non-Aboriginal**	**Native**	**Non-Native**
<2	Population	3,834	1,817	6,191	15,643
	Cases (rate‡)	2 (52.2)	0 (0)	8 (129.2)	2 (12.8)
2-19	Population	34,594	10,078	49,754	136.252
	Cases (rate‡)	1 (2.9)	0 (0)	10 (20.1)	4 (2.9)
20-64	Population	44,126	48,728	75,228	372,225
	Cases (rate‡)	17 (38.5)	1 (2.1)	23 (30.6)	38 (10.2)
65+	Population	3,610	4,791	8,551	46,387
	Cases (rate‡)	7 (193.9)	1 (20.9)	10 (117)	20 (43.1)
All Ages	Population	86,164	65,414	139,724	570,507
	Cases (rate‡)	27 (31.3)	2 (3.1)	51 (36.5)	64 (11.2)

*Race unknown in 1 case 20-64 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 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 (80%, 60%, and 66%, respectively), in Norway it was bacteremia (53%).

Clinical Presentation of Reported *Streptococcus pneumoniae* Cases, ICS 2010 Data

	Finland n (%)	Greenland n (%)	Iceland n (%)	N Canada n (%)	N Sweden n (%)	Norway n (%)	US Arctic n (%)
Pneumonia*	0 (0)	8 (80)	0 (0)	18 (60)	0 (0)	254 (34)	76 (66)
Bacteremia	801 (94)	1 (10)	34 (92)	6 (20)	80 (95)	393 (53)	17 (15)
Meningitis	49 (6)	0 (0)	3 (8)	3 (10)	4 (5)	47 (6)	7 (6)
Empyema	0 (0)	0 (0)	0 (0)	1 (3)	0 (0)	0 (0)	11 (10)
Septic arthritis	0 (0)	1 (10)	0 (0)	1 (3)	0 (0)	0 (0)	1 (1)
Endocarditis	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (1)
Cellulitis	0 (0)	0 (0)	0 (0)	1 (3)	0 (0)	0 (0)	0 (0)
Other	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	49 (7)	2 (2)
Unknown	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	5 (<1)	0 (0)
Total Cases	850	10	37	30	84	748	115

*with bacteremia

Risk Factors

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

***Streptococcus pneumoniae* Risk Factor/Medical Conditions in Adults*, ICS 2010 Data†**

	Greenland n (%)	N. Canada n (%)	U.S. Arctic n (%)
Cigarette Smoking	4 (44)	7 (26)	44 (48)
Alcohol Abuse	2 (22)	8 (30)	31 (34)
Chronic Lung Disease and/or Asthma	1 (11)	3 (11)	34 (37)
Immunosuppressive Therapy	1 (11)	2 (7)	7 (8)
Diabetes	0 (0)	6 (22)	23 (25)
Injection Drug Use	0 (0)	0 (0)	1 (1)
Asplenia	0 (0)	0 (0)	2 (2)
Total Adult* Cases	9	27	92

*≥ 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 2010 Data

	Finland	Greenland	Iceland	N Canada	N Sweden	Norway	US Arctic
PCV7				2002-2006*	2007	2007	2001
PCV10	2010			2009-2010*			
PCV13		2010		2010*	2010		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 did not introduce PCV13 in 2010
†PS23 used but year of introduction unknown

Vaccination Status

Fifty-six 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 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 coverage data were not reported from Finland and Iceland.

***Streptococcus pneumoniae* Case Vaccination Status for Pneumococcal Vaccine, ICS 2010 Data**

	N. Canada	Norway	U.S. Arctic
Total cases eligible for PCV7 vaccine*	2	25	10
Vaccine status known in cases eligible for PCV7	1	18	9
Cases eligible for PCV7 vaccinated (%)†	1 (100%)	10 (56%)	9 (100%)
Total cases eligible for PS23 vaccine‡	8	392	30
Vaccine status known in cases eligible for PS23	7	74	17
Cases eligible for PS23 vaccinated (%)†	5 (71%)	2 (3%)	14 (82%)

*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 2010 are listed in the following table; yellow highlights the most common serotypes in each country. Serotypes included in the conjugate vaccines were the most prevalent in Iceland; PCV was not included in their universal vaccine program in 2010.

***Streptococcus pneumoniae* Serotypes by Country, ICS 2010 Data**

Serotype	Greenland† n (%)	Iceland n (%)	N. Canada† (%)	N. Sweden*† n (%)	U.S. Arctic† n (%)
1‡	0 (0)	1 (3)	0 (0)	0 (0)	0 (0)
3‡	1 (10)	4 (11)	3 (11)	4 (10)	11 (11)
4‡	3 (30)	2 (5)	0 (0)	1 (2)	1 (1)
6	0 (0)	0 (0)	0 (0)	4 (10)	0 (0)
6A‡	0 (0)	1 (3)	0 (0)	0 (0)	0 (0)
6B‡	1 (10)	2 (5)	0 (0)	0 (0)	0 (0)
6C	0 (0)	0 (0)	0 (0)	0 (0)	2 (2)
7	0 (0)	0 (0)	0 (0)	3 (7)	0 (0)
7F‡	4 (40)	4 (11)	4 (15)	0 (0)	20 (20)

Serotype	Greenland† n (%)	Iceland n (%)	N. Canada† (%)	N. Sweden*† n (%)	U.S. Arctic† n (%)
8	0 (0)	0 (0)	4 (15)	2 (5)	4 (4)
9N	0 (0)	1 (3)	1 (4)	0 (0)	6 (6)
9V‡	0 (0)	2 (5)	0 (0)	0 (0)	0 (0)
10	0 (0)	0 (0)	0 (0)	1 (2)	0 (0)
10A	0 (0)	0 (0)	3 (11)	0 (0)	2 (2)
11	0 (0)	0 (0)	0 (0)	1 (2)	0 (0)
11A	0 (0)	0 (0)	0 (0)	0 (0)	4 (4)
11B	0 (0)	1 (3)	0 (0)	0 (0)	0 (0)
12	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
12F	0 (0)	0 (0)	1 (4)	0 (0)	4 (4)
14‡	0 (0)	5 (14)	0 (0)	1 (2)	0 (0)
15	0 (0)	0 (0)	0 (0)	2 (5)	0 (0)
15A	0 (0)	0 (0)	1 (4)	0 (0)	2 (2)
15B	0 (0)	0 (0)	0 (0)	0 (0)	2 (2)
15C	0 (0)	0 (0)	0 (0)	0 (0)	2 (2)
16F	0 (0)	0 (0)	0 (0)	0 (0)	6 (6)
18	0 (0)	0 (0)	0 (0)	7 (17)	0 (0)
18C‡	0 (0)	2 (5)	1 (4)	0 (0)	0 (0)
19	0 (0)	0 (0)	0 (0)	4 (10)	0 (0)
19A‡	0 (0)	3 (8)	2 (7)	0 (0)	18 (18)
19C	0 (0)	1 (3)	0 (0)	0 (0)	0 (0)
19F‡	0 (0)	3 (8)	1 (4)	0 (0)	1 (1)
20	0 (0)	0 (0)	0 (0)	0 (0)	4 (4)
22	0 (0)	1 (3)	0 (0)	6 (14)	0 (0)
22A	0 (0)	0 (0)	1 (4)	0 (0)	0 (0)
22F	0 (0)	0 (0)	4 (15)	0 (0)	2 (2)
23	0 (0)	0 (0)	0 (0)	4 (10)	0 (0)
23A	0 (0)	0 (0)	0 (0)	0 (0)	6 (6)
23B	0 (0)	0 (0)	0 (0)	0 (0)	1 (1)
23F‡	0 (0)	2 (5)	0 (0)	0 (0)	0 (0)
29	0 (0)	1 (3)	0 (0)	0 (0)	1 (1)
31	0 (0)	0 (0)	0 (0)	1 (2)	1 (1)
33	0 (0)	1 (3)	0 (0)	0 (0)	0 (0)
33F	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
35	0 (0)	0 (0)	0 (0)	1 (2)	0 (0)
35B	0 (0)	0 (0)	1 (4)	0 (0)	0 (0)
35F	1 (10)	0 (0)	0 (0)	0 (0)	1 (1)
38	0 (0)	0 (0)	0 (0)	0 (0)	1 (1)
# Isolates Serotyped	10	37	27	42	102

*Serogroup level data from Vasterbotten
†PCV included in universal vaccine program
‡Serotype included in PCV

Cases and Deaths with Vaccine Serotypes

For the countries reporting serotype data, more than 77% of *S. pneumoniae* cases in persons ≥ 2 years of age had a serotype that was included in the 23-valent polysaccharide vaccine. Fifty percent to 100% of *Strep pneumoniae* cases in children < 2 years of age had a serotype contained in the PCV13 vaccine. With the introduction of PCV13 in Greenland, N. Canada and the U.S. Arctic, the number of cases caused by vaccine serotypes should decline over time. The proportion of deaths with serotypes in the 23-valent polysaccharide vaccine related to *S. pneumoniae* ranged from 50% to 100%.

Proportion of Cases/Deaths with Invasive Pneumococcal Disease Vaccine Serotypes, ICS 2010 Data

	Greenland n/Denom* (%)	Iceland n/Denom* (%)	N. Canada n/Denom* (%)	U.S. Arctic n/Denom* (%)
Cases ≥ 2 years old with serotype in the 23-valent pneumococcal polysaccharide vaccine	9/9 (100)	28/33 (85)	22/25 (88)	71/92 (77)
Cases < 2 years old with serotype in the 13-valent pneumococcal conjugate vaccine	1/1 (100)	3/4 (75)	1/2 (50)	8/10 (80)
Deaths (all ages) for which the serotype was contained in the 23-valent pneumococcal vaccine	1 (100‡)	5 (100‡)	1 (50‡)	8 (67‡)

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

Outcome

A total of 64 deaths associated with *S. pneumoniae* were reported to ICS in 2010. Overall, the highest case fatality ratio (CFR) occurred in persons 65+ years of age (19%). Finland and N. Sweden did not report outcome data.

***Streptococcus pneumoniae* Age-Specific Case-Fatality Ratios (CFR), ICS 2010 Data**

		<2 years	2-19 years	20-64 years	65+ years	All Ages
Greenland	Deaths/Cases* (CFR)	0/1 (0%)	0/0 (0%)	0/5† (0%)	1/3 (33%)	1/9 (11%)
Iceland	Deaths/Cases* (CFR)	0/4 (0%)	0/2 (0%)	1/15 (7%)	4/16 (25%)	5/37 (13.5%)
N. Canada	Deaths/Cases* (CFR)	0/2 (0%)	0/1 (0%)	1/19† (5%)	1/8 (13%)	2/30 (6.7%)
Norway	Deaths/Cases* (CFR)	1/16† (6%)	0/15† (0%)	9/154† (6%)	34/189† (18%)	44/374 (11.8%)
U.S. Arctic	Deaths/Cases* (CFR)	0/10 (0%)	1/14 (7%)	4/59† (7%)	7/30 (23%)	12/113 (10.6%)
Total	Deaths/Cases* (CFR)	1/33 (3%)	1/32 (3%)	15/252 (6%)	47/246 (19%)	64/563 (11.4%)

*Cases with known outcome.
†Outcome unknown in (9) Norway cases < 2 years; (7) Norway cases 2-19 years; (1) Greenland, (1) N. Canada, (155) Norway, and 2 US Arctic cases 20-64 years; (203) Norway cases 65+ years

Antimicrobial Susceptibility

In 2010, antimicrobial susceptibility results were reported to ICS from Finland, Greenland, Iceland, N. Canada, N. Sweden and the U.S. Arctic. The following table outlines for each country the antibiotics tested, the number of isolates reported tested for each antibiotic and the proportion (NS%) of isolates tested that showed any level of non-susceptibility.

***Streptococcus pneumoniae* Antibiotic Susceptibility Testing, ICS 2010 Data**

Antibiotic	Finland n (NS%)	Greenland n (NS%)	Iceland n (NS%)	N. Canada n (NS%)	N. Sweden n (NS%)	U.S. Arctic n (NS%)
Ceftriaxone	-	-	37 (0%)	16 (0%)	5 (0%)	101 (5%)
Chloramphenicol	-	-	37 (0%)	21 (0%)	-	101 (0%)
Clindamycin	-	-	-	21 (0%)	42 (0%)	101 (8%)
Erythromycin	-	10 (0%)	37 (11%)	21 (5%)	84 (2%)	101 (14%)
Levofloxacin	-	-	-	22 (0%)	-	101 (0%)
Penicillin	850 (3%)	10 (0%)	37 (5%)	22 (0%)	83 (0%)	101 (21%)
Rifampin	-	-	-	-	-	101 (21%)
TMP Sulfa*	-	-	37 (11%)	23 (0%)	44 (18%)	101 (16%)
Vancomycin	-	-	-	23 (0%)	-	101 (0%)

*Trimethoprimsulfamethoxizole

Of the antibiotics tested, the largest numbers of isolates were resistant to penicillin, TMP-Sulfa and erythromycin. Results by country for each of these antibiotics are shown in the tables below. In the U.S. Arctic, 36 isolates comprised of 8 serotypes (3, 6A, 6C, 14, 15A, 19A, 19F, 33F) showed multi-drug resistance. The largest proportion (n = 23, 64%) of the multi-drug resistant isolates was serotype 19A and 21% of isolates with this serotype were resistant to more than three antibiotics. In N. Canada, one of two serotype 15A isolates was resistant to two antibiotics. In Iceland, none of the isolates tested were resistant to more than one antibiotic. Finland and N. Sweden did not report serotypes.

***Streptococcus pneumoniae* Penicillin Susceptibility Results, ICS 2010 Data**

	# Tested	I* (%)	I* Serotypes (n)	R* (%)	R* Serotypes (n)
Finland	850	3 (<1%)	†	19 (2%)	†
Greenland	10	0 (0%)		0 (0%)	
Iceland	37	1 (3%)	19F (1)	1 (3%)	19F (1)
N. Canada	22	0 (0%)		0 (0%)	
N. Sweden	83	0 (0%)		0 (0%)	
U.S. Arctic	101	16 (16%)	19A (8), 23A (6), 15A (1), 29 (1)	5 (5%)	19A (5)

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

***Streptococcus pneumoniae* TMP-Sulfa Susceptibility Results, ICS 2010 Data**

	# Tested	I* (%)	I* Serotypes (n)	R* (%)	R* Serotypes (n)
Iceland	37	0 (0%)		4 (11%)	19F (2), 23F (1), 33 (1)
N. Canada	23	0 (0%)		0 (0%)	
N. Sweden†	44	4 (9%)	7 (1), 18 (1), 23 (1), 31 (1)	4 (9%)	6 (2), 3 (1), 18 (1)
U.S. Arctic	101	3 (3%)	19A (1), 19F (1), 29 (1)	13 (13%)	19A (13)

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

***Streptococcus pneumoniae* Erythromycin Susceptibility Results, ICS 2010 Data**

	# Tested	I* (%)	I* Serotypes	R* (%)	R* Serotypes (n)
Greenland	10	0 (0%)		0 (0%)	
Iceland	37	0 (0%)		4 (11%)	14 (2), 19F (2)
N. Canada	21	0 (0%)		0 (0%)	
N. Sweden†	84	0 (0%)		2 (2%)	8 (1), 19 (1)
U.S. Arctic	101	0 (0%)		14 (14%)	19A (8), 23A (2), 7F (1), 9N (1), 10A (1), 15A (1)

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

Quality Control

In 2010, 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 2010-A, overall serotyping correlation was 100%. The modal MIC comparison resulted in an overall correlation of 95.7% with individual participant correlation ranging from 82%-100%. Overall category agreement was 97.8% with individual participant agreement ranging from 96.3%-100%. For Panel 2010-B, six of seven isolates were reported correctly by all labs; one isolate was not typeable by three labs. The modal MIC correlation ranged from 75%-100%.

Conclusions

Streptococcus pneumoniae remains a major cause of invasive bacterial disease in circumpolar regions. Disease rates are highest in indigenous populations. The impact of pneumococcal conjugate vaccines is clear in the U.S. Arctic and is beginning to be seen in N. Canada. Surveillance for evidence of impact in other circumpolar countries will be important to confirm effectiveness and provide support for continuing immunization programs.

Haemophilus influenzae

Case Demographics

Greenland, N. Canada, N. Sweden (Norbotten), Norway and the U.S. Arctic reported the occurrence of invasive *H. influenzae* disease during 2010. Greenland reported no cases. A total of 137 cases of invasive disease caused by *H. influenzae* were reported to ICS during 2010 by N. Canada, N. Sweden (Norbotten), Norway and the U.S. Arctic. The highest rate of disease among regions reporting cases was in N. Canada (11.2 per 100,000) and the lowest in N. Sweden (0.8/100,000). Median age of cases was highest in Norway (67.4 years) and lowest in N. Canada (0.9 year).

***Haemophilus influenzae* Case Demographics, ICS 2010 Data**

Country	Population	# Cases	Rate*	Sex M (%)	Median Age (min-max) yrs	Deaths n (CFR†)
Greenland	56,452	0	0	No cases	No cases	No cases
N. Canada	151,578	17	11.2	11 (65%)	0.9 (0.1-59)	1 (9%)‡
N. Sweden	248,635	2	0.8	1 (50%)	40 (7-73)	‡
Norway	4,858,199	89	1.8	34 (38%)	67.4 (0-97.6)	13 (24%)‡
U.S. Arctic	710,231	29	4.1	17 (59%)	48.3 (0.3-89.7)	4 (14%)‡
Total	6,025,095	137	2.3	63 (46%)	57.4 (0-97.6)	18 (19%)

*Number of cases per 100,000 per year
†Case fatality ratio
‡ Case outcome unknown in (6) N. Canada, (35) 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 N. Sweden the highest rate was in the 2-19 years age category, and in Norway the highest rate of disease was in the 65+ years age category.

***Haemophilus influenzae* by Age Category, ICS 2010 Data**

Age		N. Canada	N. Sweden	Norway	U.S. Arctic
<2 yrs	Population	5,651	4,463	123,626	21,834
	Cases (%)*	10 (59)	0 (0)	4 (4.5)	10 (34)
	Rate†	177	0	3.2	45.8
2-19 yrs	Population	44,672	48,763	1,116,131	186,006
	Cases (%)*	3 (18)	1 (50)	4 (4.5)	2 (7)
	Rate†	6.7	2.1	0.4	1.1
20-64 yrs	Population	92,854	142,546	2,895,769	447,453
	Cases (%)*	4 (23)	0 (0)	34 (38)	9 (31)
	Rate†	4.3	0	1.2	2
65+ yrs	Population	8,401	52,863	722,673	54,938
	Cases (%)*	0 (0)	1 (50)	47 (53)	8 (28)
	Rate†	0	1.9	6.5	14.6
All ages	Population	151,578	248,635	4,858,199	710,231
	Cases	17	2	89	29
	Rate†	11.2	0.8	1.8	4.1

*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 (156.5 per 100,000) and U.S. Arctic (161.5 per 100,000) cases less than two years of age. In the U.S. Arctic, rates of disease were higher in Native populations than in non-Native populations in all age categories.

***Haemophilus influenzae* by Race and Age Categories, ICS 2010 Data**

Age (yrs)		N. Canada		U.S. Arctic	
		Aboriginal	Non-Aboriginal	Native	Non-Native
<2‡	Population	3,834	1,817	6,191	15,643
	Cases (rate†)	6 (156.5)	0 (0)	10 (161.5)	0 (0)
2-19	Population	34,594	10,079	49,754	136,252
	Cases (rate†)	3 (8.7)	0 (0)	1 (2)	1 (0.7)
20-64‡	Population	44,126	48,728	75,228	372,225
	Cases (rate†)	3 (6.8)	0 (0)	3 (4)	6 (1.6)
65+	Population	3,610	4,791	8,551	46,387
	Cases (rate†)	0 (0)	0 (0)	4 (46.8)	4 (8.6)
All Ages	Population	86,164	65,414	139,724	570,507
	Cases (rate†)	12 (13.9)	0 (0)	18 (12.9)	11 (1.9)

†Number of cases per 100,000 per year
‡Race unknown in (4) N. Canada cases < 2 years, (1) N. Canada case 20-64 years

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, N. Sweden and Norway, the most common clinical presentation associated with *H. influenzae* was bacteremia (35%, 100% and 54% of reported cases, respectively). In the U.S. Arctic, the most common clinical presentation was pneumonia (45%).

Clinical Presentation of Reported *Haemophilus influenzae* Cases, ICS 2010 Data

	N. Canada n (%)	N. Sweden n (%)	Norway n (%)	U.S. Arctic n (%)
Pneumonia*	4 (23.5)	0 (0)	27 (30)	13 (45)
Bacteremia	6 (35)	2 (100)	48 (54)	5 (17)
Meningitis	4 (23.5)	0 (0)	6 (7)	4 (14)
Cellulitis	0 (0)	0 (0)	0 (0)	1 (3)
Septic arthritis	0 (0)	0 (0)	0 (0)	4 (14)
Empyema	0 (0)	0 (0)	0 (0)	2 (7)
Osteomyelitis	1 (6)	0 (0)	0 (0)	0 (0)
Other/Unknown	2 (12)	0 (0)	8 (9)	0 (0)
Total	17	2	89	29

*with bacteremia

Risk Factors

Thirty-five percent of adult (≥ 18 years) cases of *H. influenzae* reported in the U.S. Arctic indicated chronic lung disease as an associated risk factor; 29% indicated smoking, 24% diabetes or alcohol abuse and 12% immune suppressive treatment as an associated risk factor. Twenty-five percent of adult N. Canadian *H. influenzae* cases reported smoking as a risk factor. N. Sweden and Norway did not report risk factor data.

Vaccination Status

The *H. influenzae* type b (Hib) conjugate vaccine is required as part of routine childhood vaccination in N. Canada, N. Sweden, Norway and the U.S. Arctic. Two cases of Hib were reported in the U.S. Arctic in children less than five years. One case had received Hib vaccine and one had not. Data on vaccine status were not provided by N. Sweden and Norway.

***Haemophilus influenzae* Case Vaccination Status for Hib Vaccine, ICS 2010 Data**

	N. Canada	U.S. Arctic
Total cases* eligible for Hib vaccine†	13	12
Vaccine status known in cases* eligible for Hib vaccine	8	12
Cases* eligible for Hib vaccine vaccinated (%)‡	7 (88%)	11 (92%)

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

Serotypes

***Haemophilus influenzae* Serotypes by Country, ICS 2010 Data**

Serotype	N. Canada n (%)	Norway n (%)	U.S. Arctic n (%)
a	13 (76)	3 (3)	9 (33)
b	0 (0)	2 (2)	3 (11)
c	0 (0)	0 (0)	0 (0)
d	0 (0)	0 (0)	0 (0)
e	0 (0)	2 (2)	0 (0)
f	1 (6)	13 (15)	3 (11)
Non-typeable	3 (18)	69 (78)	12 (44)
Total	17	89	27

The most common *H. influenzae* serotype in N. Canada was type a (76% of cases), in Norway, type f (15% of cases) and in the U.S. Arctic it was serotype a (33% of cases each). Non-typeable cases also made up a large proportion of cases in Norway (78%) and the U.S. Arctic (44%). N. Sweden did not provide serotype data.

Outcome

Eighteen deaths were associated with *H. influenzae* cases reported to ICS in 2010; one from N. Canada, four from the U.S. Arctic and 13 from Norway. N. Sweden did not provide outcome data.

***Haemophilus influenzae* Deaths by Country, ICS 2010 Data**

	N. Canada	Norway	U.S. Arctic
No. Deaths	1	13	4
Case Fatality Ratio	9%*	24%*	14%
Min-max (yrs)	59 (1 case)	0-94.2	0.7-89.7
Serotypes (n)	a (1)	a (1), e (2), f (2), NT (8)	a (1), NT (2), unknown (1)
Clinical Presentations (n)	Bacteremia (1)	Bacteremia (9), pneumonia (3), other (1)	Bacteremia (3), pneumonia (1)

*Case outcome unknown in (6) N. Canada, (35) Norway cases

Quality Control

Two QC panels of five *H. influenzae* and *N. meningitidis* isolates were shipped and serogrouped or serotyped. The single discrepant result was due to the primer set available that did not include all possible serogroups [2].

Conclusions

Widespread use of Hib conjugate vaccines has led to the virtual disappearance of Hib disease in these populations. Substantial replacement with other serotypes has not occurred. The proportion of disease caused by non-typeable organisms continues to be substantial.

Neisseria meningitidis

Case Demographics

Greenland, N. Canada, N. Sweden (Norbotten), Norway and the U.S. Arctic reported the occurrence of *N. meningitidis* during 2010. A total of 42 cases of invasive disease caused by *N. meningitidis* were reported to ICS. Norway had the highest disease rate (0.8 per 100,000). Two deaths associated with *N. meningitidis* were reported from Norway.

***Neisseria meningitidis* Case Demographics, ICS 2010 Data**

Country	Population	# Cases	Rate*	Sex M (%)	Median Age (min-max) yrs	Deaths n (CFR†)
Greenland	56,452	0	0	No cases	No cases	No cases
N. Canada	151,578	1	0.7	1 (100)	56.1 (1 case)	0 (0)
N. Sweden	248,635	1	0.4	0 (0)	79 (1 case)	‡
Norway	4,858,199	39	0.8	19 (49)	19 (0.5-81)	2 (6) ‡
U.S. Arctic	710,231	1	0.1	0 (0)	1.8 (1 case)	0 (0)
Total	6,025,095	42	0.7	20 (48)	19 (0.5-81)	2 (6)

*Number of cases per 100,000 per year
†Case fatality ratio
‡Outcome unknown in 7 Norway cases; N. Sweden did not report outcomes

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

***Neisseria meningitidis* by Age Category, ICS 2010 Data**

Age		N. Canada	N. Sweden	Norway	U.S. Arctic
<2 yrs	Population	5,651	4,463	123,626	21,834
	Cases (%)*	0 (0)	0 (0)	4 (10)	1 (100)
	Rate†	0	0	3.2	4.6
2-19 yrs	Population	44,672	48,763	1,116,131	186,006
	Cases (%)*	0 (0)	0 (0)	22 (56)	0 (0)
	Rate†	0	0	2	0
20-64 yrs	Population	92,854	142,546	2,895,769	447,453
	Cases (%)*	1 (100)	0 (0)	9 (23)	0 (0)
	Rate†	1.1	0	0.3	0
65+ yrs	Population	8,401	52,863	722,673	54,938
	Cases (%)*	0 (0)	1 (100)	4 (10)	0 (0)
	Rate†	0	1.9	0.6	0
All ages	Population	151,578	248,635	4,858,199	710,231
	Cases	1	1	39	1
	Rate†	0.7	0.4	0.8	0.1

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

Race

In the U.S. Arctic, the single case of *N. meningitidis* occurred in a non-AK Native person (rate 0.2/100,000. In N. Canada, the single Nm case occurred in an Aboriginal person (rate 1.2/100,000).

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 bacterial illness. In cases with multiple discharge diagnoses, the most serious diagnosis related to the meningococcal infection was recorded as the primary clinical presentation. The most common clinical presentation in N. Sweden and Norway for *N. meningitidis* cases was meningitis in 100% and 62% of cases, respectively. In N. Canada, the one case presented with pneumonia and in the U.S. Arctic, septic arthritis was reported as the clinical presentation for the single case.

Clinical Presentation of Reported *Neisseria meningitidis* Cases, ICS 2010 Data

	N. Canada n (%)	N. Sweden n (%)	Norway n (%)	U.S. Arctic n (%)
Pneumonia*	1 (100)	0 (0)	1 (2.5)	0 (0)
Bacteremia	0 (0)	1 (100)	13 (33)	0 (0)
Meningitis	0 (0)	0 (0)	24 (62)	0 (0)
Septic arthritis	0 (0)	0 (0)	0 (0)	1 (100)
Other	0 (0)	0 (0)	1 (2.5)	0 (0)
Total	1	1	39	1

*with bacteremia

Serogroups

Forty of 42 cases of invasive *N. meningitidis* reported to ICS in 2010 included serogroup data. The table below lists serogroups by country. N. Sweden did not report serogroup data.

***Neisseria meningitidis* Serogroups by Country, ICS 2010 Data**

Serogroup	N. Canada n (%)	Norway n (%)	U.S. Arctic n (%)
B	0 (0)	13 (33)	0 (0)
C	1 (100)	10 (26)	0 (0)
W135	0 (0)	2 (5)	1 (100%)
Y	0 (0)	13 (33)	0 (0)
Unknown	0 (0)	1 (3)	0 (0)
Total	1	39	1

Conclusions

Neisseria meningitidis is a relatively uncommon cause of invasive bacterial disease in the circumpolar area under surveillance, however, continued surveillance is warranted due to high morbidity and mortality associated with outbreaks.

Group A *Streptococcus*

Case Demographics

Greenland, N. Canada, N. Sweden and the U.S. Arctic each reported the occurrence of GAS during 2010. A total of 63 cases of invasive disease caused by GAS were reported to ICS; no cases occurred in Greenland in 2010. Among regions reporting cases, the rate of disease was highest in N. Canada (7.9 per 100,000) compared to the lowest in N. Sweden (3.6 per 100,000). Seven deaths were associated with GAS, all occurred in the U.S. Arctic.

Group A *Streptococcus* Case Demographics, ICS 2010 Data

Country	Population	# Cases	Rate*	Sex M (%)	Median Age (min-max) yrs	Deaths n (CFR†)
Greenland	56,452	0	0	No cases	No cases	No cases
N. Canada	151,578	12	7.9	8 (67)	49.4 (0.9-78.6)	0 (0)[a]
N. Sweden	248,635	9	3.6	1 (11)	76 (52-91)	‡
U.S. Arctic	710,231	42	5.9	20 (48)	54.6 (0.9-85)	7 (16.7)
Total	1,166,896	63	5.4	29 (46)	57.3 (0.9-91)	7 (13.2)

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

When stratified by age, the highest rates of disease occurred in children <2 years and in individuals 65+ years of age in N. Canada (17.7 per 100,000 and 47.6 per 100,000, respectively).

Group A *Streptococcus* by Age Category, ICS 2010 Data

Age		N. Canada	N. Sweden	U.S. Arctic
<2 yrs	Population	5,651	4,463	21,834
	Cases (%)*	1	0	2
	Rate†	17.7	0	9.2
2-19 yrs	Population	44,672	48,763	186,006
	Cases (%)*	0	0	5
	Rate†	0	0	2.7
20-64 yrs	Population	92,854	142,546	447,453
	Cases (%)*	7	4	26
	Rate†	7.5	2.8	5.8
65+ yrs	Population	8,401	52,863	54,938
	Cases (%)*	4	5	9
	Rate†	47.6	9.5	16.4
All ages	Population	151,578	248,635	710,231
	Cases	12	9	42
	Rate†	7.9	3.6	5.9

*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 and U.S. Arctic Native people 65 years and older.

Group A *Streptococcus* by Race and Age Categories, ICS 2010 Data

Age (yrs)		N. Canada		U.S. Arctic	
		Aboriginal	Non-Aboriginal	Native	Non-Native
<2	Population	3,834	1,817	6,191	15,643
	Cases (rate†)	1 (26.1)	0 (0)	2 (32.3)	0 (0)
2-19	Population	34,594	10,078	49,754	136,252
	Cases (rate†)	0 (0)	0 (0)	3 (6)	2 (1.5)
20-64	Population	44,126	48,728	75,228	372,225
	Cases (rate†)	6 (13.6)	1 (2.1)	4 (5.3)	22 (5.9)
65+	Population	3,610	4,791	8,551	46,387
	Cases (rate†)	3 (83.1)	1 (20.9)	3 (35.1)	6 (12.9)
All Ages	Population	86,164	65,414	139,724	570,507
	Cases (rate†)	10 (11.6)	2 (3.1)	12 (8.6)	30 (5.3)

†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. Sweden and N. Canada (100%) was bacteremia, 100% and 33%, respectively. In the U.S. Arctic the most common clinical presentation was cellulitis (40%).

Clinical Presentation of Reported group A *Streptococcus* Cases, ICS 2010 Data

	N. Canada n (%)	N. Sweden n (%)	U.S. Arctic n (%)
Bacteremia	4 (33)	9 (100)	6 (14)
Pneumonia*	1 (8)	0 (0)	6 (14)
Empyema	1 (8)	0 (0)	1 (2)
Cellulitis*	2 (17)	0 (0)	17 (40)
Necrotizing fasciitis	1 (8)	0 (0)	2 (5)
Septic arthritis	2 (17)	0 (0)	2 (5)
Meningitis	0 (0)	0 (0)	2 (5)
Strep toxic shock	1 (8)	0 (0)	3 (7)
Endocarditis	0 (0)	0 (0)	2 (5)
Bursitis	0 (0)	0 (0)	1 (2)
Total	12	9	42

*with bacteremia

Risk Factors

Chronic lung disease was the most common risk factor associated with adult (≥18 years) GAS cases in the U.S. Arctic; it was reported in 35% of cases. In N. Canada, the most common risk factor reported was diabetes which occurred in 36% of the adult cases. N. Sweden did not report risk factor data.

Group A *Streptococcus* Risk Factor/Medical Conditions in Adults*, ICS 2010 Data†

	N. Canada n (%)	U.S. Arctic n (%)
Cigarette Smoking	2 (18)	6 (16)
Alcohol Abuse	3 (27)	4 (11)
Chronic Lung Disease and/or Asthma	1 (9)	13 (35)
Immunosuppressive Therapy	0 (0)	3 (8)
Diabetes	4 (36)	8 (22)
Injection Drug Use	0 (0)	2 (5)
Asplenia	0 (0)	0 (0)
Total Adult* Cases	11	37

*≥ 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 16.7%); five occurred in the 20-64 years old age category and two in persons ≥ 65. No deaths were reported in N. Canada. N. Sweden did not report case outcome data.

Conclusions

These data suggest 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 2010. A total of 68 cases of invasive disease caused by GBS were reported to ICS. Greenland reported no cases. Among regions reporting cases, the rate of disease was highest in the U.S. Arctic (7.5 per 100,000) compared to N. Canada (2 per 100,000). Four deaths were associated with GBS in 2010.

Group B *Streptococcus* Case Demographics, ICS 2010 Data

Country	Population	# Cases	Rate*	Sex M (%)	Median Age (min-max) yrs	Deaths n (CFR†)
Greenland	56,452	0	0	No cases	No cases	No cases
N. Canada	151,578	3	2	1 (33)	55.2 (0-89)	0 (0)
N. Sweden	248,635	12	4.8	4 (33)	63 (0-93)	‡
U.S. Arctic	710,231	53	7.5	27 (51)	55.5 (0-94.2)	4 (7.6)
Total	1,166,896	68	5.8	32 (47)	56.4 (0-94.2)	4 (7.1)

*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 cases less than two years of age in all regions.

Group B *Streptococcus* by Age Category, ICS 2010 Data

Age		N. Canada	N. Sweden	U.S. Arctic
<2 yrs	Population	5,651	4,463	21,834
	Cases (%)*	1 (33)	2 (17)	14 (26)
	Rate†	17.7	44.8	64.1
2-19 yrs	Population	44,672	48,763	186,006
	Cases (%)*	0 (0)	0 (0)	0 (0)
	Rate†	0	0	0
20-64 yrs	Population	92,854	142,546	447,453
	Cases (%)*	1 (33)	5 (42)	23 (43)
	Rate†	1.1	3.5	5.1
65+ yrs	Population	8,401	52,863	54,938
	Cases (%)*	1 (33)	5 (42)	16 (30)
	Rate†	11.9	9.5	29.1
All ages	Population	151,578	248,635	710,231
	Cases	3	12	53
	Rate†	2	4.8	7.5

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

There were six cases of early-onset disease (cases less than 7 days old) in the U.S. Arctic (0.6 cases per 1,000 births) one case in N. Canada (0.4 cases per 1,000 births) and one case in N. Sweden (0.4 cases per 1,000 births).

Race

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

Group B *Streptococcus* by Race and Age Categories, ICS 2010 Data

Age (yrs)		N. Canada		U.S. Arctic	
		Aboriginal	Non-Aboriginal	Native	Non-Native
<2	Population	3,834	1,817	6,191	15,643
	Cases (rate*)	1 (26.1)	0 (0)	4 (64.6)	10 (63.9)
2-19	Population	34,594	10,078	49,754	136,252
	Cases (rate*)	0 (0)	0 (0)	0 (0)	0 (0)
20-64	Population	44,126	48,728	75,228	372,225
	Cases (rate*)	1 (2.3)	0 (0)	6 (8)	17 (4.6)
65+	Population	3,610	4,791	8,551	46,387
	Cases (rate*)	0 (0)	1 (20.9)	1 (11.7)	15 (32.3)
All Ages	Population	86,164	65,414	139,724	570,507
	Cases (rate*)	2 (2.3)	1 (1.5)	11 (7.9)	42 (7.4)

*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 (53%) was the most common clinical presentation reported for cases of GBS in 2010 followed by cellulitis (13%) and septic arthritis (9%). Two cases in N. Canada presented with pneumonia, the third with bacteremia. Ten of twelve cases in N. Sweden were reported as bacteremia which may reflect a difference in reporting practices; two cases presented with meningitis.

Clinical Presentation of Reported group B *Streptococcus* Cases, ICS 2010 Data

	N. Canada n (%)	N. Sweden n (%)	U.S. Arctic n (%)
Bacteremia	1 (33)	10 (83)	28 (53)
Pneumonia*	2 (67)	0 (0)	4 (8)
Meningitis	0 (0)	2 (17)	3 (6)
Septic arthritis	0 (0)	0 (0)	5 (9)
Cellulitis*	0 (0)	0 (0)	7 (13)
Osteomyelitis	0 (0)	0 (0)	1 (2)
Endocarditis	0 (0)	0 (0)	3 (6)
Peritonitis	0 (0)	0 (0)	2 (4)
Total	3	12	53

*with bacteremia

Risk Factors

Thirty-six percent of GBS adult (≥ 18 years) cases reviewed in the U.S. Arctic indicated diabetes as a risk factor in 2010; 23% were smokers, 15% had chronic lung disease, 8% were receiving immune suppressive treatment and 5% abused alcohol. In N. Canada, 50% of adult cases reported chronic lung disease and/or alcohol abuse. N. Sweden does not report risk factor data.

Outcome

Four deaths in cases with GBS were reported in the U.S. Arctic (CFR 7.6%); one death occurred in the less than 2 years age category, one death occurred in the 20-65 years age category and two deaths occurred in the 65+ age category. N. Sweden did not report case outcome data.

Conclusions

Guidelines for universal screening of pregnant women for GBS carriage were established in 2002 which have resulted in decreases in early onset disease. Cases continue to occur in older age groups which warrants continued surveillance.

CONCLUSIONS

The ICS program continued to expand in 2010. 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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