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Epidemiology of bacterial meningitis in the North American Arctic, 2000–2010

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KEYWORDS

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Summary Objective: To determine the incidence of meningitis caused by *Haemophilus influenzae*, *Neisseria meningitidis*, and *Streptococcus pneumoniae* in the North American Arctic during 2000–2010.

Methods: Surveillance data were obtained from the International Circumpolar Surveillance network. We defined a case of bacterial meningitis caused by *H. influenzae*, *N. meningitidis*, or *S. pneumoniae* as a culture-positive isolate obtained from a normally sterile site in a resident with a meningitis diagnosis.

Results: The annual incidence/100,000 persons for meningitis caused by *H. influenzae*, *N. meningitidis*, and *S. pneumoniae* among all North American Arctic residents was: 0.6, 0.5, and 1.5, respectively; the meningitis incidence among indigenous persons in Alaska and Canada (indigenous status not recorded in Greenland) for those three bacteria was: 2.1, 0.8, and 2.4, respectively. The percentage of pneumococcal isolates belonging to a 7-valent pneumococcal conjugate vaccine serotype declined from 2000–2004 to 2005–2010 (31%–2%, p-value <0.01). During 2005–2010, serotype a caused 55% of *H. influenzae* meningitis and serogroup B caused 86% of meningococcal meningitis.

Conclusions: Compared with all North American Arctic residents, indigenous people suffer disproportionately from bacterial meningitis. Arctic residents could benefit from the

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development of an *H. influenzae* serotype a vaccine and implementation of a meningococcal serogroup B vaccine.

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Introduction

Historically, populations in the Arctic region of North America, especially indigenous people, have suffered disproportionately from bacterial meningitis compared with non-Arctic populations in the United States and Canada. During 1978–81, the annual incidence of bacterial meningitis in the overall U.S. population was 3/100,000 persons overall and the highest rates were observed among infants aged <1 year (77/100,000 persons).¹ By comparison, the annual incidence of bacterial meningitis among Alaska Native people in southwest Alaska during 1971–74 was 94/100,000 persons overall and 3242/100,000 among infants aged <1 year.² In Northern Canada, the annual bacterial meningitis incidence during 1972–77 was 19/100,000 persons among non-indigenous residents compared with 200/100,000 among indigenous people.³ Conjugate vaccines to protect against certain serotypes/serogroups of *Haemophilus influenzae*, *Neisseria meningitidis*, and *Streptococcus pneumoniae*, three common causes of bacterial meningitis, are now available and part of routine childhood immunization schedules (see Table 1 for the specific years that the North American Arctic regions implemented these vaccines). Since the introduction of those vaccines, however, the incidence of meningitis in Arctic populations has not been reevaluated.

Populations in Alaska, Northern Canada, and Greenland share certain unique social and environmental risk factors for infectious diseases.⁴ The Arctic region is sparsely populated with limited health care/public health infrastructure.⁵ The risk for infectious diseases is not uniform within North American Arctic populations. In particular, indigenous people (e.g., Eskimo people in Alaska and Inuit people of Greenland, Northern Canada, and Alaska), who comprise varying proportions of the population in each region (Table 1), experience a greater burden of infectious

diseases compared with non-indigenous people.^{3,6} Indigenous people are at higher risk for infectious diseases than non-indigenous people because they have greater exposure to conditions that facilitate disease transmission such as household crowding and inadequate access to water/sanitation services.^{7,8} In order to better understand the distinct epidemiology of infectious diseases in the Arctic that result from these risk factors, public health agencies in countries with populations residing in the Arctic collaboratively operate the International Circumpolar Surveillance (ICS) network.⁹ ICS methods allow participating countries to use existing infrastructure to collect and share public health surveillance data.⁵ All three North American countries with Arctic populations – United States, Canada, and Greenland – participate in ICS and have shared surveillance data for certain invasive bacterial diseases since 2000.⁶ This study uses ICS data to describe the epidemiology of meningitis caused by *S. pneumoniae*, *H. influenzae*, and *N. meningitidis* among persons living in the Arctic region of North America during 2000–2010.

Methods

Surveillance methods

ICS defines a case of bacterial meningitis caused by *H. influenzae*, *N. meningitidis*, or *S. pneumoniae* as a culture-positive isolate obtained from a normally sterile site (e.g., blood, cerebrospinal fluid, pleural fluid, peritoneal fluid, synovial fluid) in a resident of the surveillance areas with a diagnosis of meningitis recorded in their medical record. Case-isolates were identified through population-based surveillance by 52 participating laboratories (23 in Alaska, 14 in Northern Canada [Yukon, Northwest Territories and Nunavut], 15 in Greenland).⁵ Laboratories

Table 1 Characteristics of North American Arctic countries.

	Alaska	Northern Canada	Greenland
Population ^a	668,662	136,921	56,550
% Indigenous	19%	60%	Unknown
Region size, km ²	1,518,807	4,506,600	2,131,863
Year vaccine introduced or recommended in region ^b			
7-valent pneumococcal conjugate vaccine	2001	2002–2006	N/A
10-valent pneumococcal conjugate vaccine	N/A	2010–2011	N/A
13-valent pneumococcal conjugate vaccine	2010	2010–2011	2010
23-valent pneumococcal polysaccharide vaccine	1983	1983	1996
Quadrivalent meningococcal conjugate vaccine	2006	2005–2006	N/A
Serogroup C meningococcal conjugate vaccine	N/A	2002–2007	N/A
<i>Haemophilus influenzae</i> serotype b vaccine	1991	1986–1997	1996

Abbreviation: N/A, not available during 2000–2010.

^a Mean population 2000–2010.

^b Northern Canadian territories introduced vaccines over different time periods.

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