International Circumpolar Surveillance for Invasive Bacterial Diseases and collaborative One Health research in the Arctic

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Understanding and Responding to Global Health Security Risks from Microbial Threats in the Arctic

Hanover, Germany

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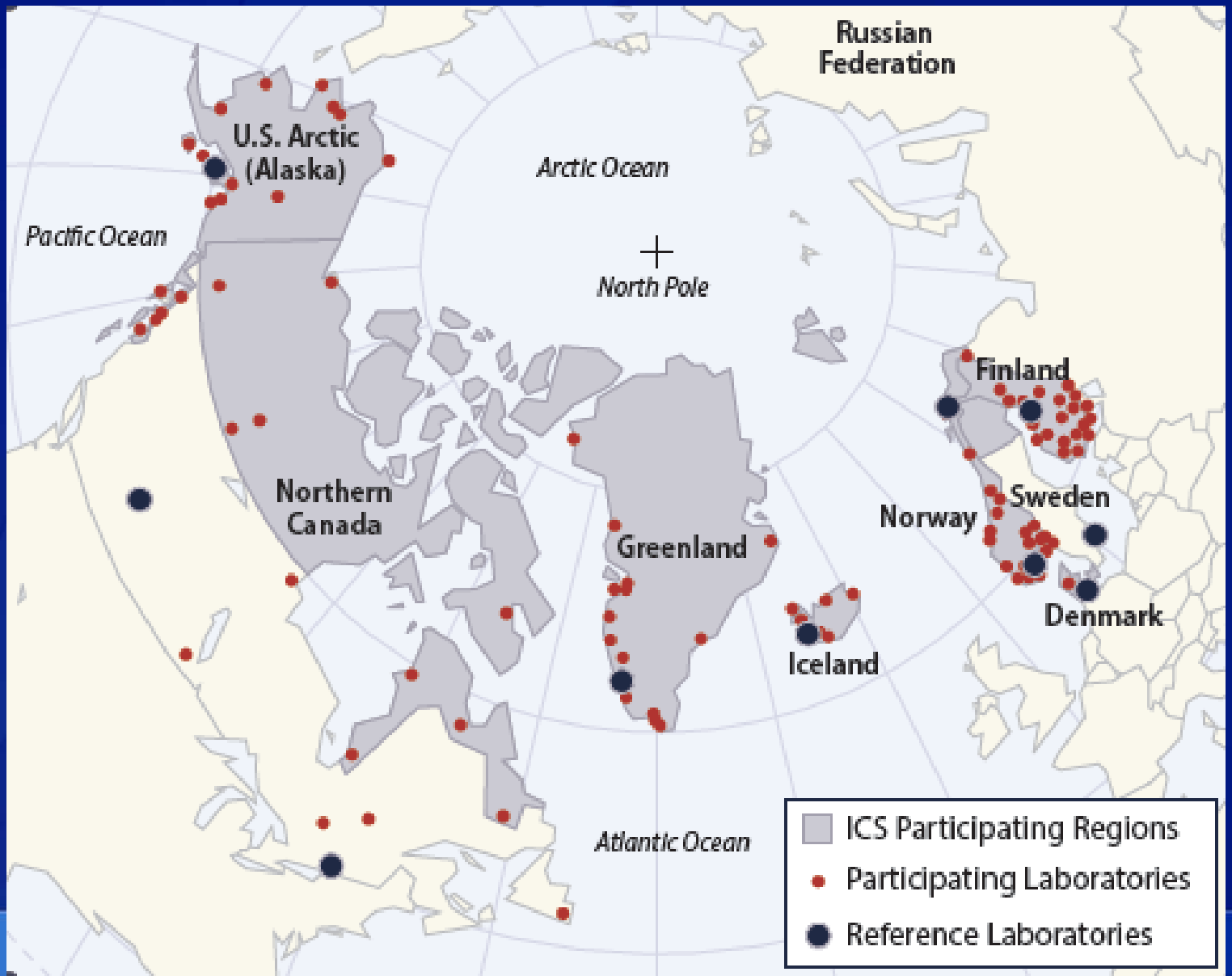
National Center for Emerging and Zoonotic Infectious Diseases
Division of Preparedness and Emerging Infections

International Circumpolar Surveillance (ICS) for Invasive Bacterial Diseases

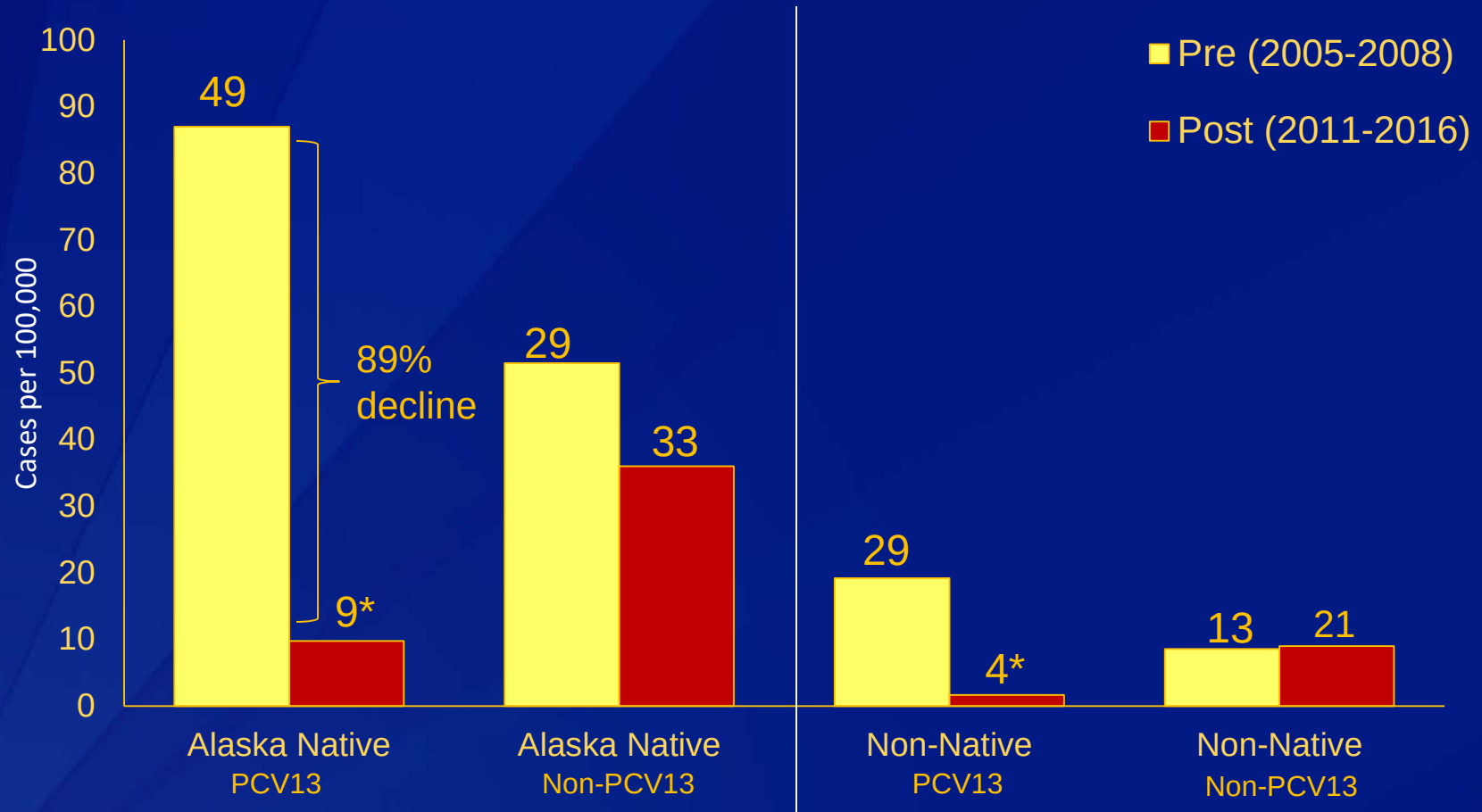


ICS Overview

- ICS is an infectious disease surveillance network of hospitals and public health laboratories throughout the Arctic
- Current members

Current members	Surveillance Organisms
USA (Alaska)	Sp, Hi, Nm, GAS, GBS
Northern Canada	Sp, Hi, Nm, GAS, GBS
Greenland	Sp, Hi, Nm, GAS, GBS
Iceland	Sp
Norway	Sp, Hi, Nm
Northern Sweden	Sp, Hi, Nm, GAS, GBS
Finland	Sp, Hi, Nm, GAS, GBS

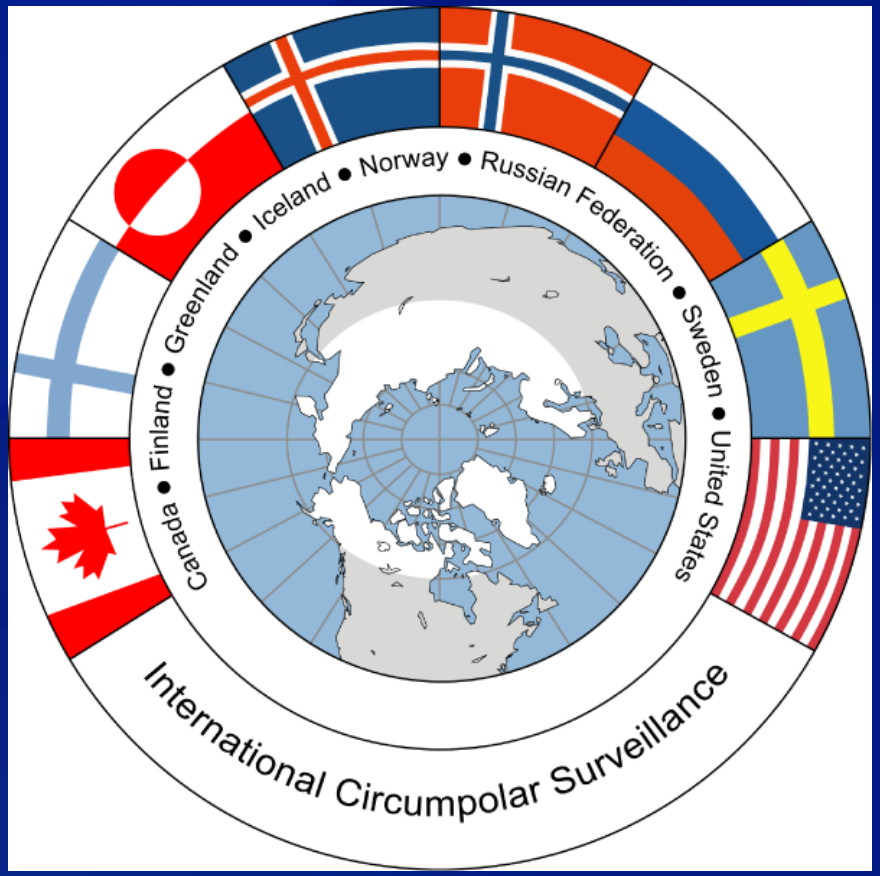
IPD Rates Pre- and Post PCV13 Introduction Children <5 Years, Alaska



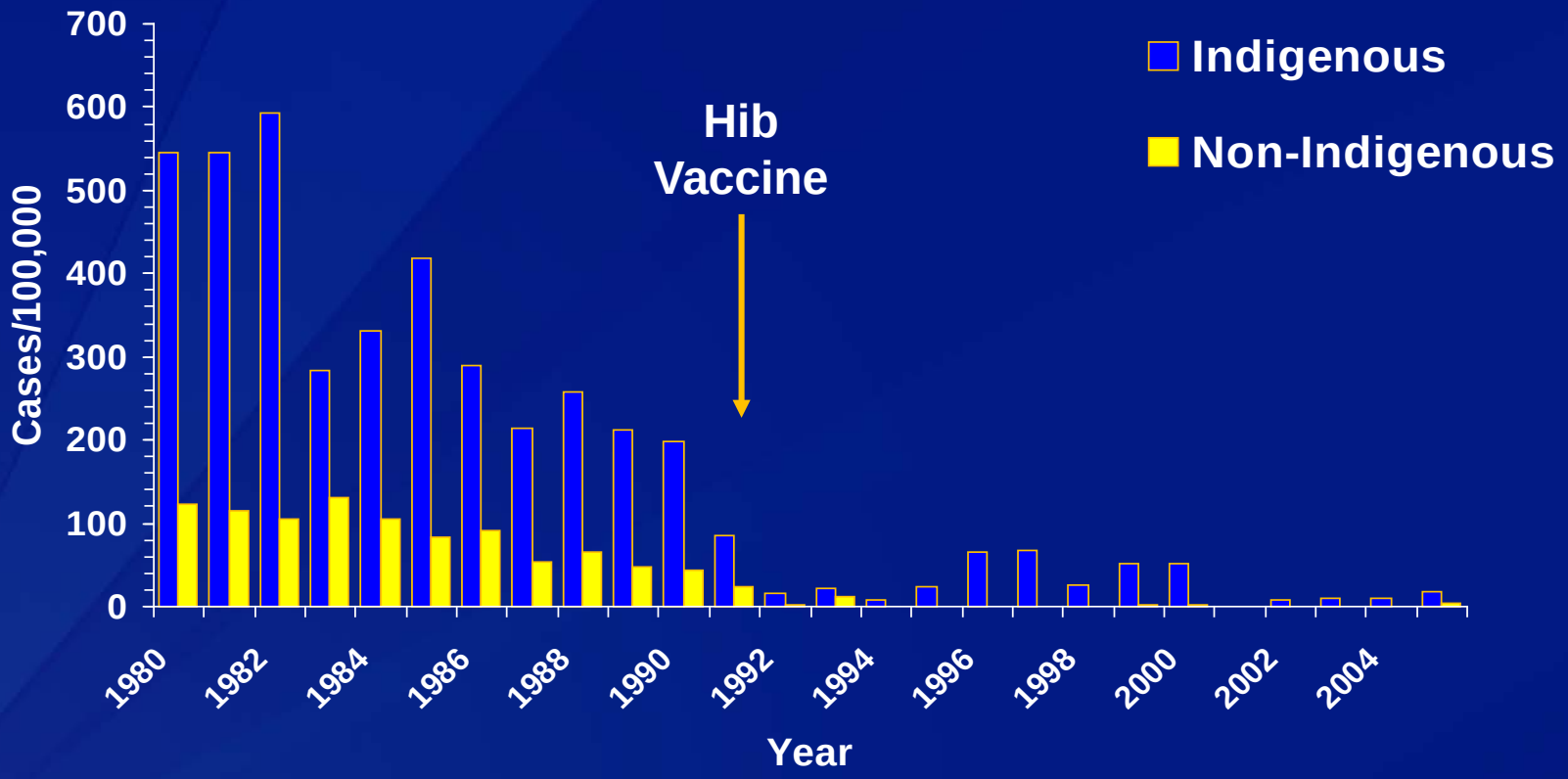
*p<0.05

Number of cases shown on top of bars

Epidemiology of *Haemophilus influenzae* serotype a an emerging pathogen 2000-2018



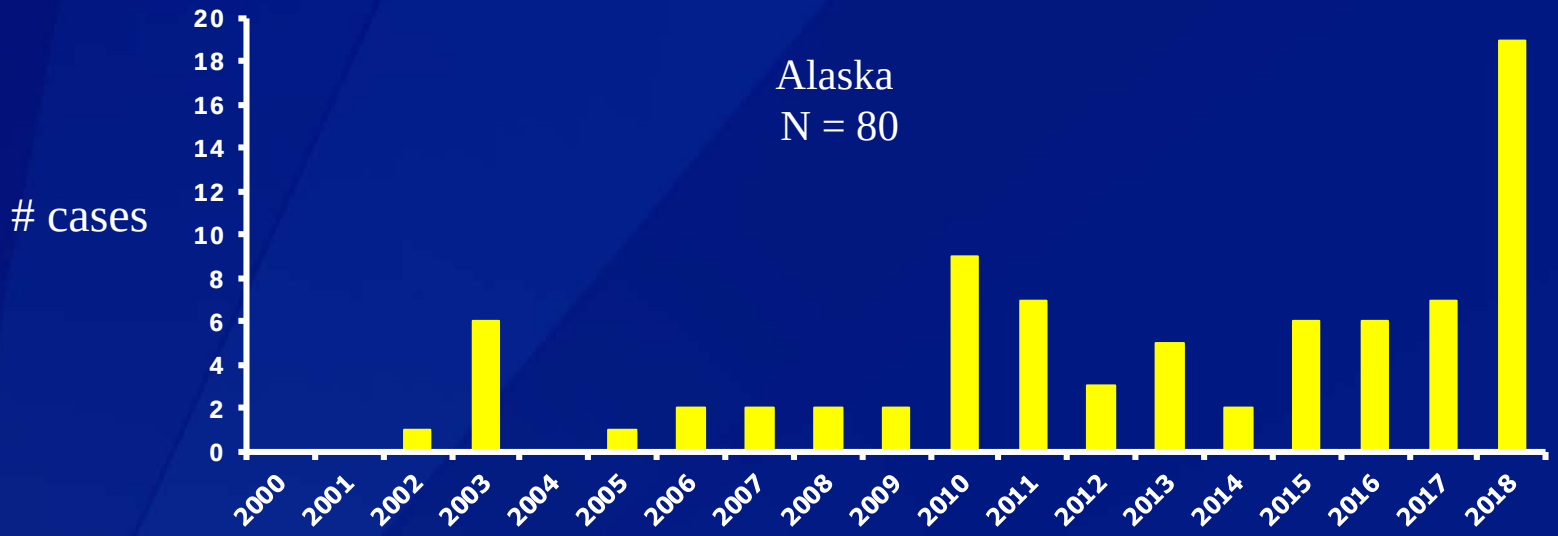
Invasive Hib Disease, Children Aged <5 Years, Alaska, 1980-2005

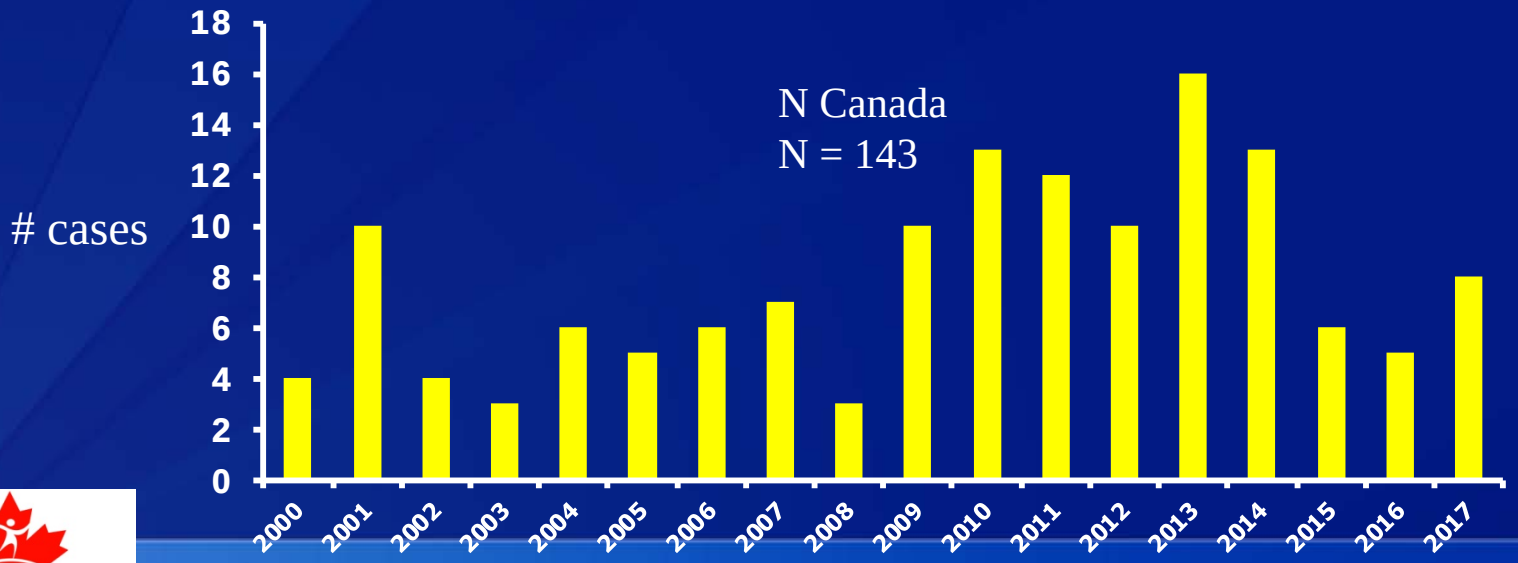


Singleton, et al. J Pediatr 2000; 137:313-20 and CDC, unpublished

CDC
Centers for Disease Control and Prevention

Invasive Disease Caused by Hia 2000-2018





PUBLIC HEALTH AGENCY of CANADA
AGENCE DE SANTÉ PUBLIQUE du CANADA

CDC
CENTERS FOR DISEASE CONTROL AND PREVENTION

Severity of Invasive Hia Disease in Alaska 2002-2014

- Invasive Hia disease frequently led to death or disability
  - 11% Case fatality
- 32% required hospital transfer
- 78% required air transport
- 36% required ICU or died before admission

- 14% had sequelae (disease complications) ≥1 year after the clinical episode: hemiparesis and speech or hearing loss

Hia Outbreak, 2018

- 4 pediatric cases in 1 YK Delta Village
- 1 fatal case
- Close contacts of cases had higher Hia carriage (15%) than the community (2%)
- Children more likely to carry Hia
- MV analysis showed that contacts and children < 10 were at increased risk of carrying Hia
- Rifampin prophylaxis eliminates Hia carriage following treatment course

Hia Conjugate Vaccine Development

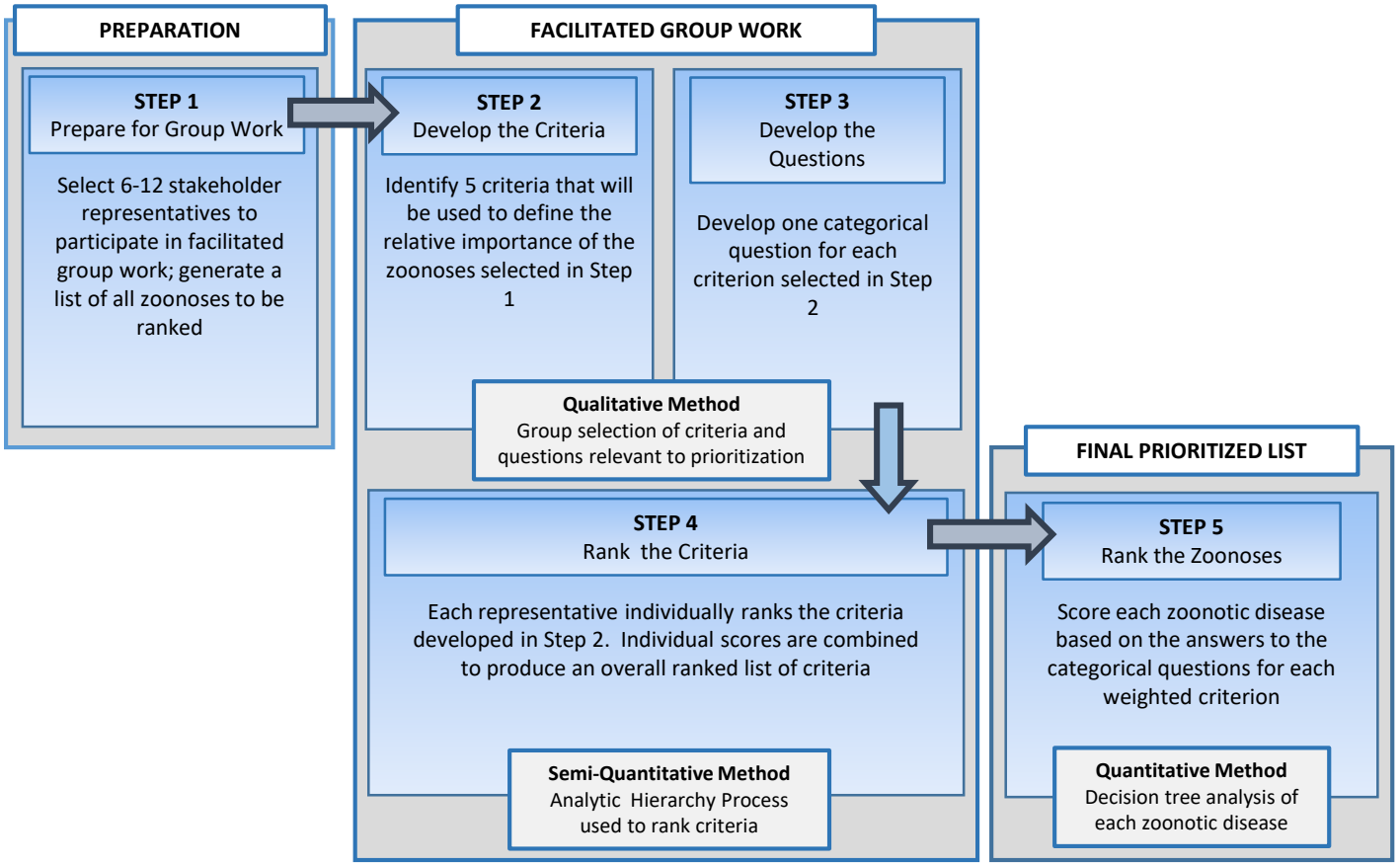
- Colleagues at NRC in Canada have created a vaccine by conjugating Hia polysaccharide to 2 different carrier proteins (CRM-197, protein D)
- Injected into mice and rabbits
- Shown to be immunogenic and bactericidal

- Canadians met with vaccine companies to discuss Hia vaccine development
  - Plan is for small scale production of vaccine within the next year for phase 1 trial in Canada

Collaborative One Health Research in the Arctic

- Circumpolar Climate Change and Infectious Diseases Workgroup
  - Survey of 15 climate-sensitive reportable infectious diseases in the Arctic
    - anthrax, arboviral disease, brucellosis, cryptosporidiosis, echinococcus, giardiasis, leptospirosis, Lyme borreliosis, Puumula virus, rabies, tickborne encephalitis, toxoplasmosis, trichinellosis, tularemia and West Nile virus
- Completed serosurvey in Alaska
  - Cryptosporidium spp., Echinococcus spp., Giardia intestinalis, Toxoplasma gondii, Trichinella spp., Brucella spp., Coxiella burnetii, Francisella tularensis, California serogroup bunyaviruses, and hepatitis E virus (HEV), influenza
- Planned serosurvey in Greenland & Sweden
- Alaska Zoonotic Prioritization Workshop in Fairbanks, Alaska 2019

Overview of 5-Step Prioritization Process



Goal of the Alaska Zoonotic Disease Prioritization Process

To use a multisectoral, One Health approach
to prioritize endemic and emerging zoonotic diseases
of greatest concern in Alaska
that should be jointly addressed by sectors responsible for
human, animal, and environmental health

Zoonotic Diseases

Alaska's Initial List of 35 Zoonotic Diseases for Prioritization

Bacteria
Anthrax
Brucellosis
Campylobacteriosis
E. coli
Glanders
Leptospirosis
Listeriosis
Lyme Disease
Melioidosis
Plague
Psittacosis
Q-fever
Salmonellosis
Shigella
Tularemia

Bacteria (cont.)
Vibriosis
Yersiniosis
Zoonotic Tuberculosis

Viruses
Hantavirus Pulmonary Syndrome
Rabies
SARS
West Nile Virus
Zoonotic Influenzas (Avian and Swine)

Parasites
Cryptosporidiosis
Cysticercosis
Cyclosporosis
Diphyllobothriasis
Echinococcosis
Giardiasis
Metorchiasis
Trichinosis

Prions
Bovine Spongiform Encephalopathy
Chronic Wasting Disease*

Fungi
Cryptococcus gattii

Other
Paralytic Shellfish Poisoning (PSP)

Participating Organizations

- State of Alaska
  - Division of Public Health
  - Department of Environmental Conservation
  - Dept of Fish and Game
- Alaska Native Tribal Health Consortium
- Aleutian Pribilof Islands Association
- North Slope Borough
- University of Alaska
- US Federal Agencies
  - CDC
  - USDA
  - US Dept of Interior
    - National Parks Service, USGS
  - Arctic Research Commission
  - NOAA

5 Criteria

- **Clinical Outcome**
  - Case fatality ratio
  - Number of animal species affected
  - Impact on reproduction, fitness
- **Prevalence and modes of transmission**
  - Has it occurred in Alaska?
  - One mode or many modes of transmission?
- **Food Safety/Security, Social or Economic Effects**
- **Response Capacity**
- **Climate Change**

Priority Zoonotic Diseases for Alaska

- Amnesic Shellfish Poisoning / Paralytic Shellfish Poisoning
- Zoonotic Influenza
- Rabies
- Cryptosporidiosis / Giardiasis
- Toxoplasmosis
- Brucellosis
- Q fever

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Thank you

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