

# Climate change and the Impact on Infectious Diseases in the Arctic: The Public Health Response

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# The Arctic Region

compiled by:  
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# Indigenous peoples of the Arctic Live in Small Remote Communities

- Dependent on the land for livelihood
- Little economic Infrastructure
- Hunt, fish and gather for food
- Marginal Public Health or acute care systems



# Health Concerns of Indigenous Arctic populations

- Life expectancy lower
- Higher infant mortality
- Rising rates of cancer and heart disease
- High mortality for unintentional injury & suicide
- High prevalence of certain infectious diseases
- Health impacts of:
  - Environmental pollutants
  - Rapid economic change
  - Climate change

At highest risk for health impacts of climate change

# Climate Change in the Arctic



- Rapid warming results in melting of permafrost
  - Erosion of riverbanks
  - Sinking of ground surface
  - Damage to buildings
  - Disruption to sanitation infrastructure

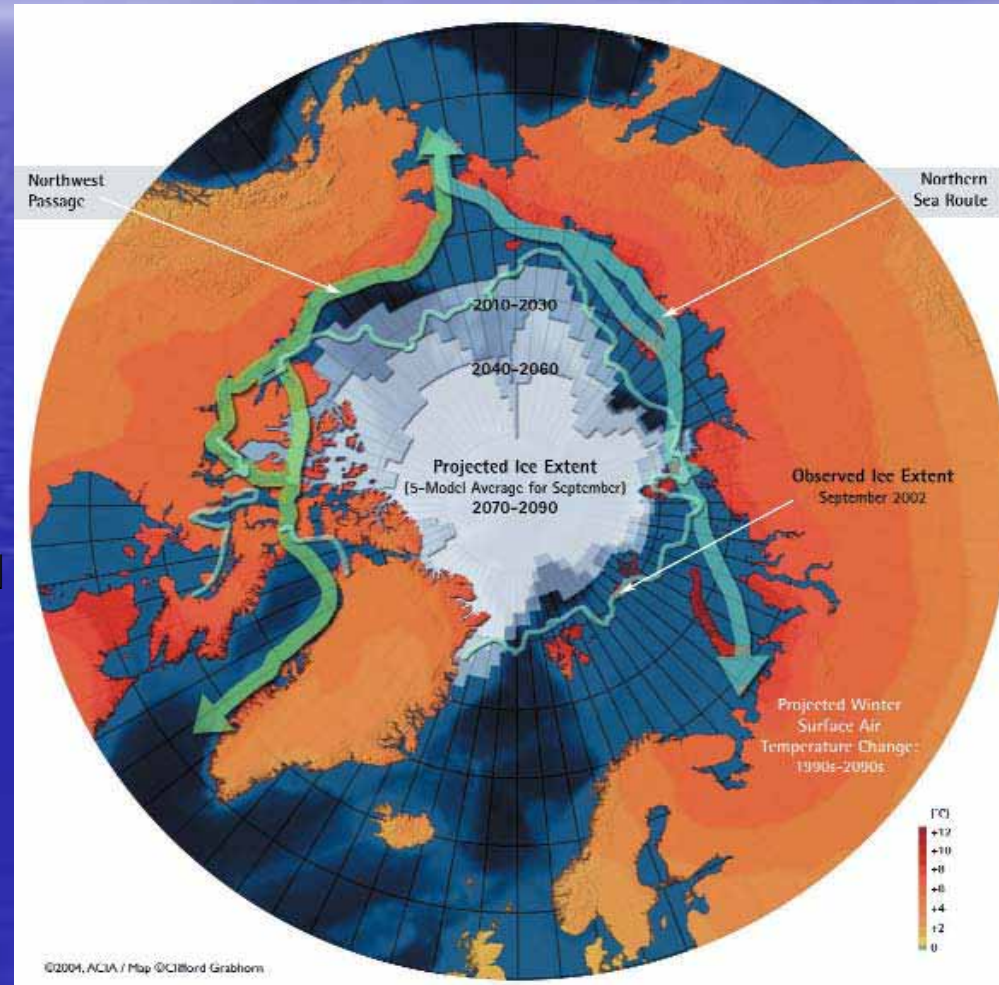
The villages of Shishmaref and Kivalina face relocation

# Health Impacts of Climate Change in the Arctic

- Increase in unintentional injury
- Impact on mental and behavioral health
- Impact food security
  - Reduced access to marine, land animals and bird populations
    - Displacement of wildlife
    - Change in migration patterns
    - Infectious diseases of subsistence species
  - Increase in environmental contaminants
  - Move to non traditional processed “western” food
    - Increase in “modern” diseases
      - Obesity, diabetes, cardiovascular diseases
    - Importation of food borne infections
      - Processed foods, fresh fruit vegetables

# Opening of the Arctic to Shipping

- Benefits
  - Fuel-saving short-cuts
  - Access to oil gas minerals
  - Tourism
  - Employment
  - Access to acute care and Public Health
- Risks
  - Change in population
  - Loss of culture and traditional way of life
  - Health impacts of modernization
  - Importation of infectious diseases



# Infectious Diseases of Concern In Arctic Regions

- Invasive bacterial diseases (pneumonia; meningitis)
  - *Streptococcus pneumoniae*
  - *Haemophilus influenzae*
- Tuberculosis
- Gastrointestinal infections
- Influenza and other respiratory viruses
- Methicillin resistant staph aureus (MRSA)
  - Antimicrobial resistance
- Sexually transmitted infections
  - Chlamydia, gonorrhea, HIV
- Botulism
- Tick Borne Encephalitis
- Parasitic diseases
  - *Echinococcus multilocularis*; *Echinococcus granulosus*



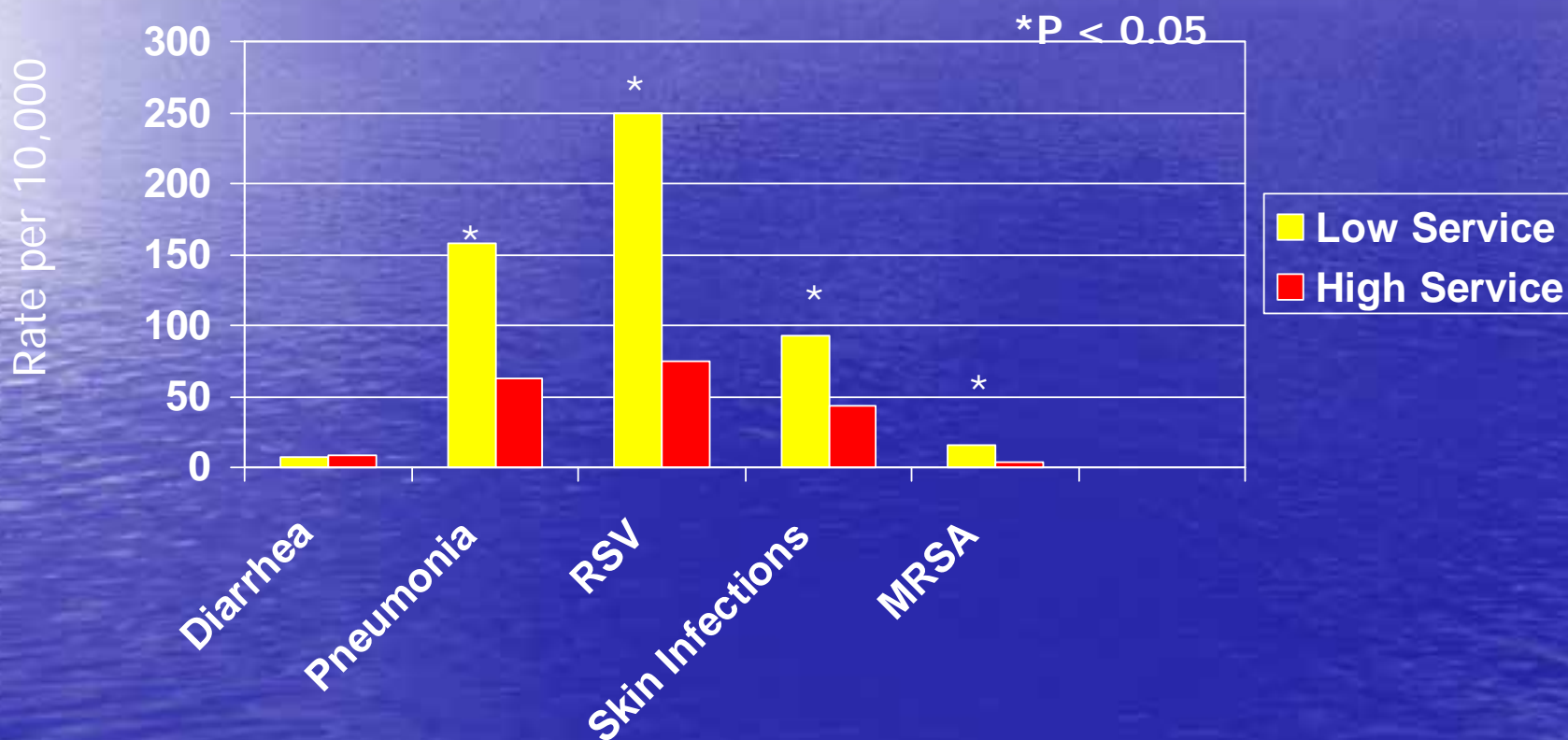


# Potential Impact of Climate Change on Infectious Diseases in the Arctic

- Inadequate housing and sanitation
  - Indoor crowding, smoking
- Inadequate water supply-Damage to the water supply infrastructure-flooding, loss of permafrost foundation
  - Invasive bacterial diseases (pneumonia; meningitis)
    - *Streptococcus pneumoniae*
    - *Haemophilus influenzae*
  - Tuberculosis
  - Gastrointestinal infections
    - *Giardia sp*
    - *Cryptosporidium*
    - Hepatitis A
  - Influenza and other respiratory viruses
  - Methicillin resistant staph aureus (MRSA)



# Hospitalization Rates for "High" and "Low" Water Service Regions, Alaska, 2000-2004



# Potential Impact of Climate Change on Infectious Diseases in the Arctic

- Food Storage
  - Above ground drying and smoking
  - Below ground storage
  - Fermentation
    - *Clostridium botulinum*

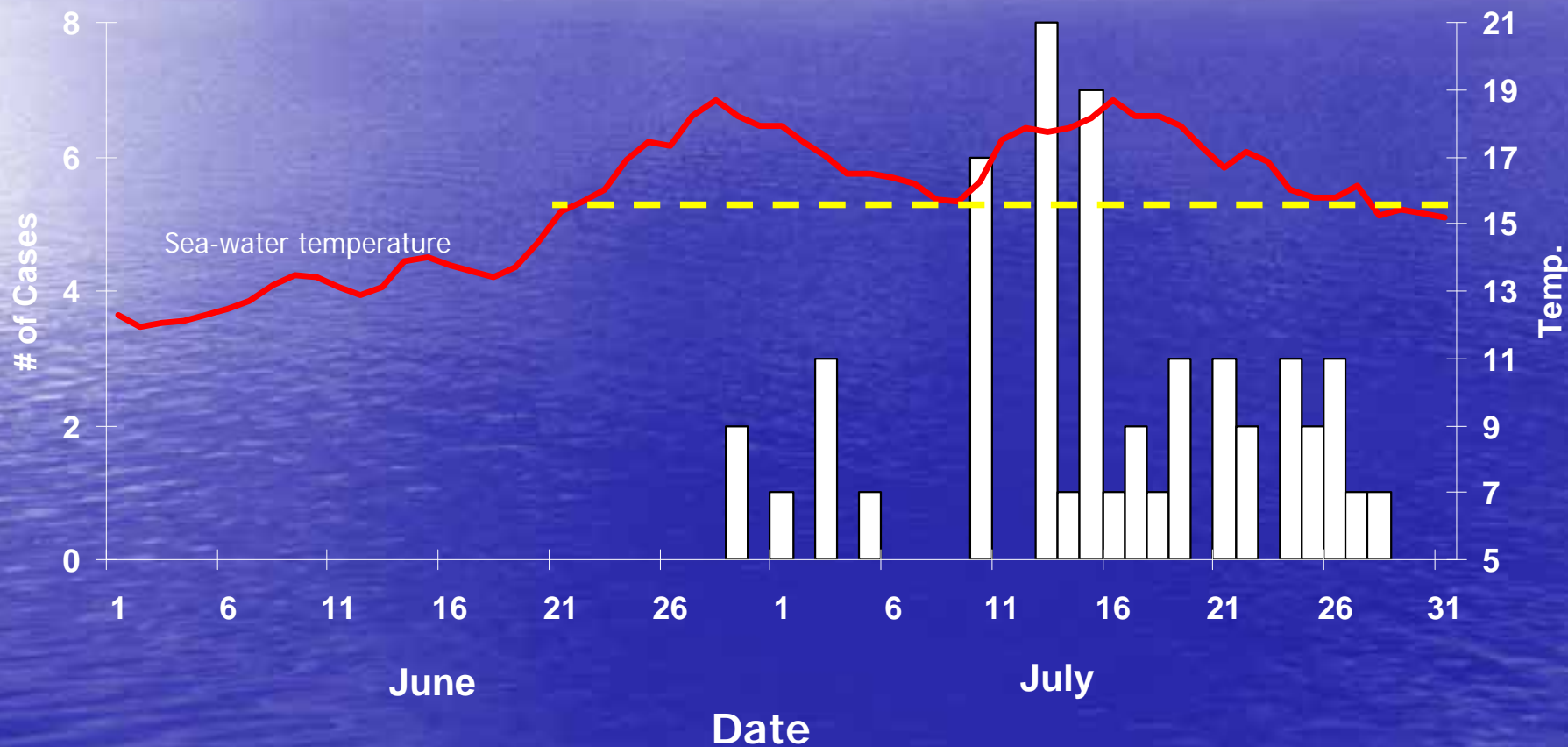


# Potential Impact of Climate Change on Infectious Diseases in the Arctic

- Gastroenteritis
  - *Vibrio parahaemolyticus*
    - Ubiquitous in marine environments
    - Associated with fish/shellfish
    - Causes gastroenteritis
    - Outbreaks associated with farm seawater mean temperatures of  $>15^{\circ}\text{C}$
    - Outbreaks increasing since 1997
      - California
      - Washington
      - British Columbia



# Mean Daily Farm "A" Water Temperature by Date, and Number of Farm "A"-associated Case-patients by Harvest Date of Consumed Oysters-2004



From McLaughlin et al NEJM 2005 353: 1463-70

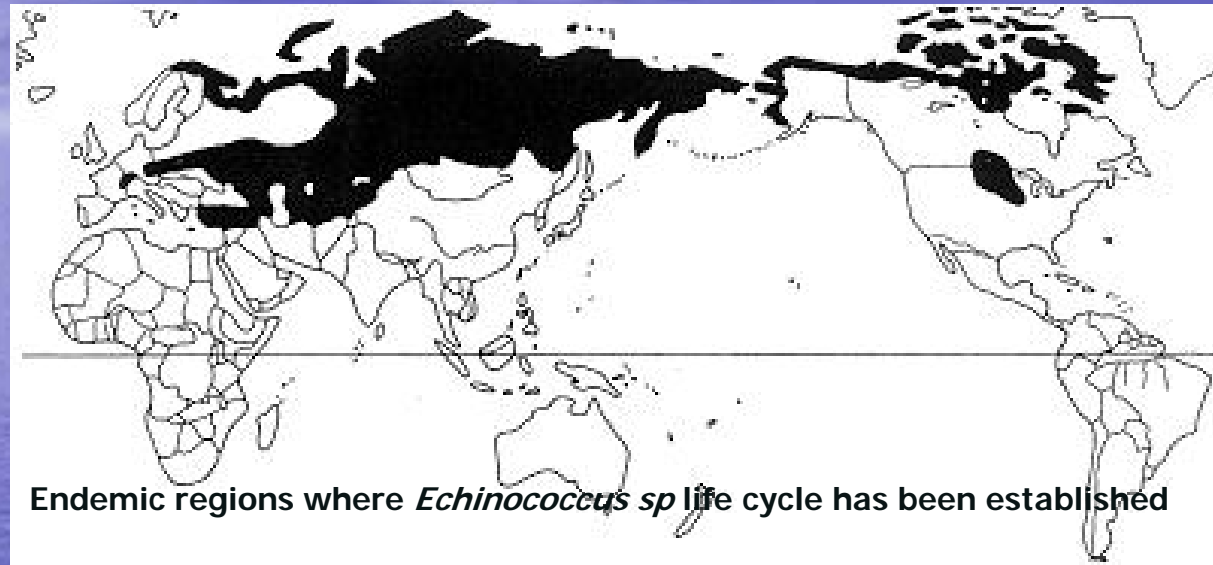


# Potential Impact of Climate Change on Infectious Diseases in the Arctic

- Gastroenteritis
  - *Giardia lamblia*
    - Beaver common host
    - Range expanding northward in Alaska and Canada
    - Expansion of habitat may result in appearance of disease in new regions.



# Potential Impact of Climate Change on Infectious Diseases in the Arctic



- *Echinococcus multilocularis*
  - Parasitic tape worm disease
  - Human accidental host
  - Cyst-like lesions in liver
  - Vectors are foxes, rodents (voles)
  - Dogs and man accidental hosts
  - Climate-favoring expansion of habitat may result in appearance of disease in new regions.

# Potential Impact of Climate Change on Infectious Diseases in the Arctic

- West Nile virus
  - Emerged in US 1999- outbreak of encephalitis
  - Infects mosquitoes, birds,
  - Humans, horses dead-end hosts
  - Mosquito vectors in Alaska and Canada
    - *A. vexans*
    - *C. pipiens*
    - *C. resuans*
  - Dead bird surveillance conducted 2000-2006
  - Furthest north 53-57° L North 2004

West Nile Virus Surveillance-Dead Birds 2004



West Nile Virus Surveillance-Dead Birds 2007



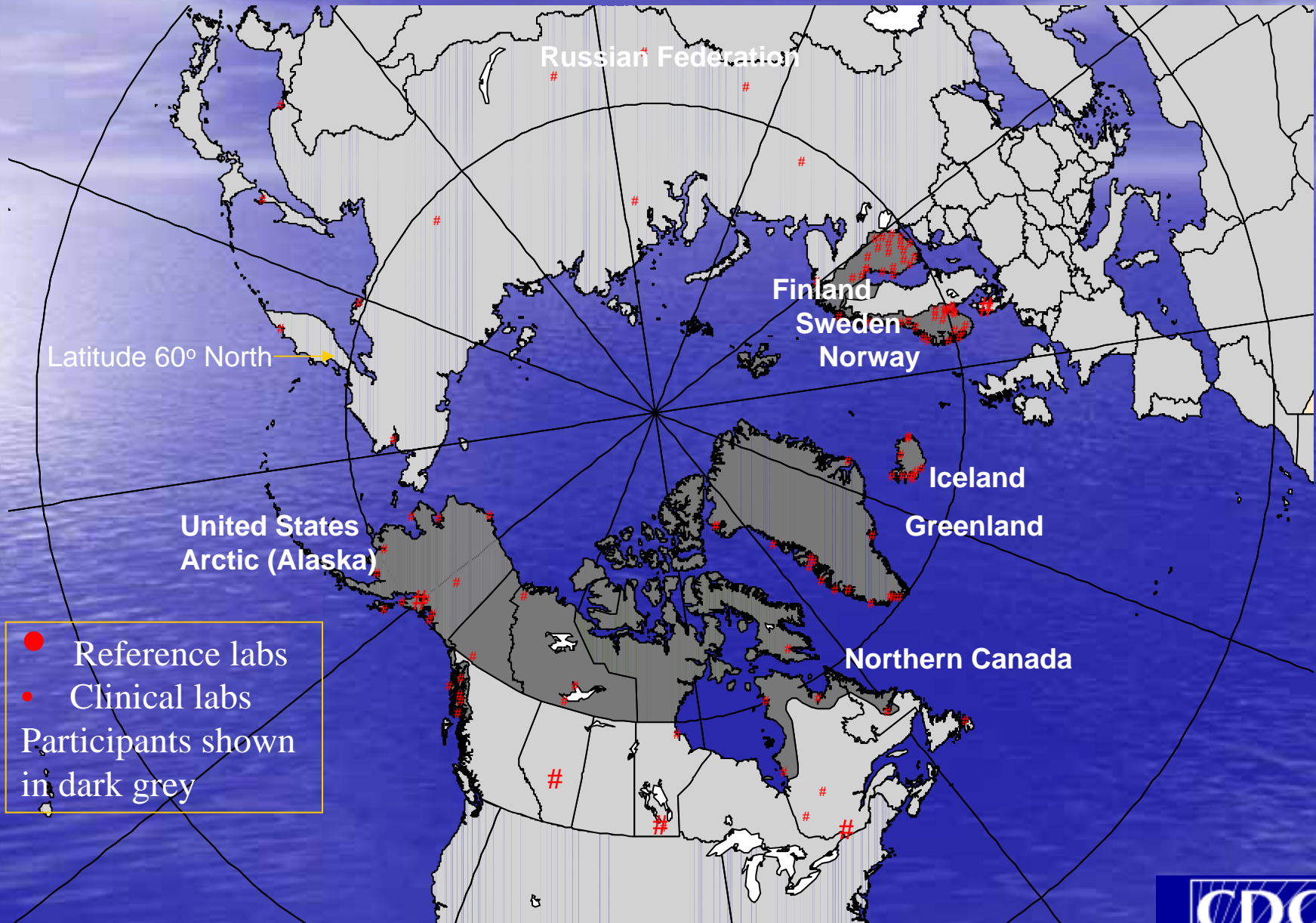


# Public Health Actions

- Build on existing public health capacity
- Track infectious diseases & trends
  - Surveillance
    - Climate sensitive diseases
      - Respiratory and skin infections
      - Gastrointestinal infections
      - Aseptic meningitis (WNV, Lyme disease TBE)
    - Expand Circumpolar Monitoring Networks
      - Harmonize methods, registries, laboratory
      - Use existing networks
        - ❖ Arctic Council
        - ❖ International Union for Circumpolar Health
        - ❖ International Network for Circumpolar Health Researchers
      - **International Circumpolar Surveillance (ICS)**



# International Circumpolar Surveillance Network



# Public Health Actions

- Investigate outbreaks
  - Gastroenteritis, aseptic meningitis, botulism
  - Are these related to climate or weather?
  - Develop science based support for public health actions
- Conduct Research
  - Baseline data is needed
  - Understand the associations between weather, weather extremes, climate and infectious disease emergence
- Ensure sufficient public health capacity
  - Remote regions, staff shortages, lack of training
- Community based partnerships
  - Education, outreach & communication
  - Community based monitoring networks



# Conclusion

- Indigenous populations vulnerable to climate change
- May see increase in:
  - Respiratory diseases
    - Influenza, RSV, pneumonia, skin infections (MRSA)
  - Food-borne diseases
    - Botulism, gastroenteritis (Giardia, Hep A)
  - Arboviral and other zoonotic infections
    - West nile, Tick borne encephalitis, echinococcus

# Conclusions

- Public Health Response
  - Enhance the public health capacity
  - Surveillance and monitoring
    - Expand networks (ICS)
    - Detection of trends over larger geographic area
  - Investigate outbreaks
  - Research
    - Relationship between climate and infectious diseases
    - Science based intervention
    - Develop baseline data
  - Community based monitoring
    - Standardize data collection
    - Link to regional, national international health

- More Information:

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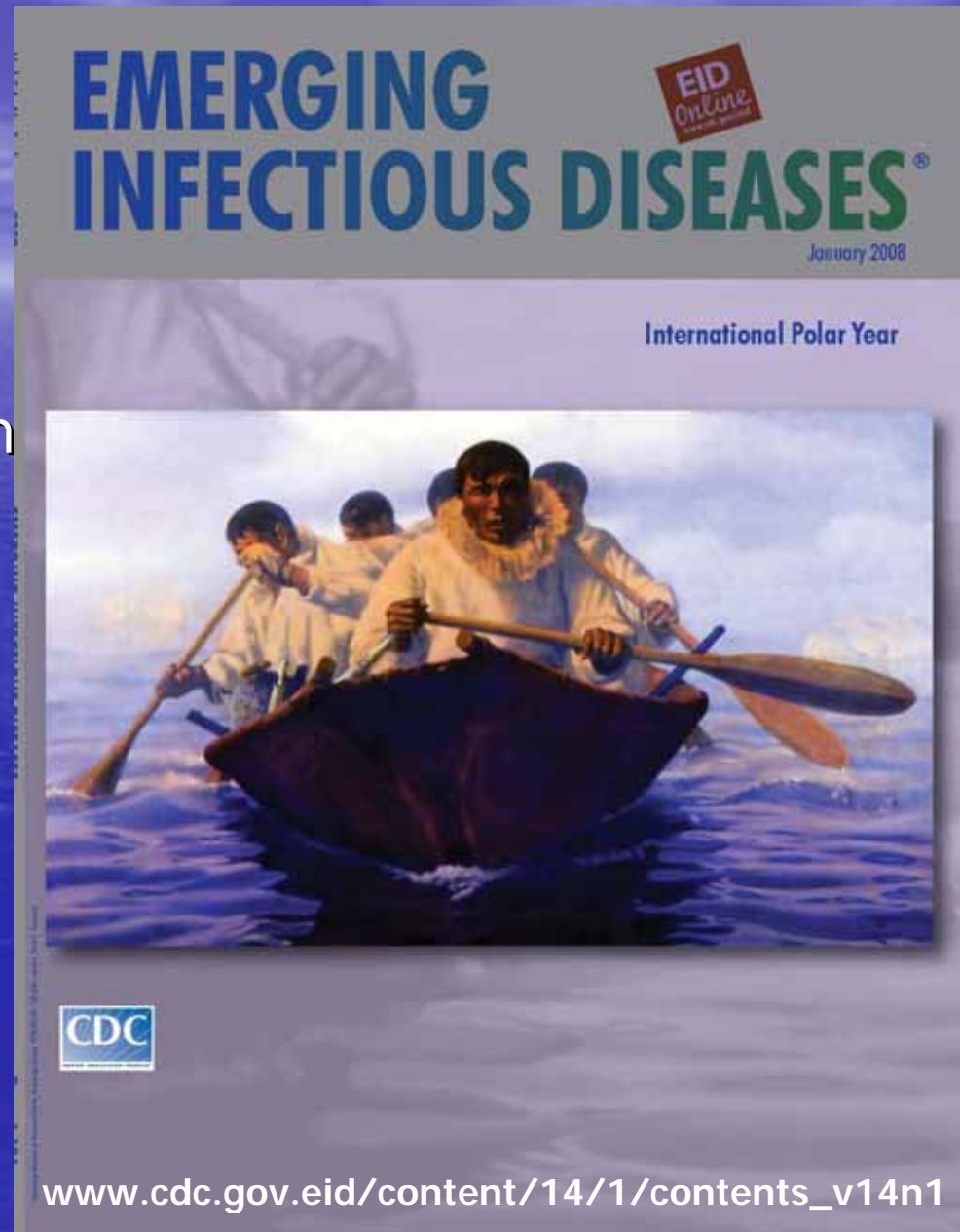
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*\*"The findings and conclusions in this report are those of the author(s) and do not necessarily represent the official position of the Centers for Disease Control and Prevention"*