Arctic Investigations Program

Strategic Plan

2016–2020

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

Priorities

The CDC Arctic Investigations Program has adopted the following top five Priorities for the period 2016–2020:

- Reduce the burden of disease and health disparities among Alaskans caused by respiratory infections, *Helicobacter pylori* gastric infections, viral hepatitis, and emerging invasive or antimicrobial-resistant infections.
- Strengthen infectious disease monitoring in the circumpolar north through enhancements to laboratory-based surveillance, use of electronic health records and biorepositories, and collaborations such as the International Circumpolar Surveillance system.
- Support efforts to improve access to in-home water and sanitation services for circumpolar populations.
- Provide leadership for domestic and international activities to promote improvements in health and well-being among indigenous populations in the Arctic region and the U.S.
- Respond to infectious disease threats to Arctic and sub-Arctic populations caused by the rapidly changing climate and environment.

Background

The first U.S. Public Health Service office in Alaska, the Arctic Health Research Center, was founded in 1950 to investigate and respond to health problems in Alaska. In 1973, the infectious disease laboratory and research activities of this Center were transferred to CDC. The new Arctic Investigations Program (AIP) was established to support the Indian Health Service (IHS) and the State of Alaska in fighting infectious diseases. AIP is physically located on the Alaska Native Medical Center campus in Anchorage, and organizationally located within the Division of Preparedness and Emerging Infections (DPEI) in CDC's National Center for Emerging and Zoonotic Infectious Disease (NCEZID).

This strategic plan was created through the combined efforts of AIP and DPEI leadership and staff, as well as through partner engagement, both inside and outside CDC. This included a formal external peer review in 2014, extensive internal discussions about program drivers such as anticipated changes to AIP's working environment, staff changes and partner needs. The strategies and objectives presented here build upon the principles described in the Office of Infectious Diseases' *A CDC Framework for Preventing Infectious Diseases: Sustaining the Essentials and Innovating for the Future*, which serves as a roadmap for all of CDC's infectious disease work. The AIP strategic plan also aligns with CDC priorities to strengthen surveillance and epidemiology, support state and local public health, provide leadership in global health, promote effective public health policy, and address the causes of death, illness, and disability.

Mission and Guiding Principles

AIP's mission is the prevention of infectious disease morbidity and mortality among the peoples of the Arctic and sub-Arctic, with special emphasis on diseases of concern among indigenous people. As CDC's infectious disease field station in Alaska, AIP focuses on the people of northern circumpolar region with the aim of reducing health disparities related to infectious diseases. Consistent with CDC's priority to provide leadership in global health, AIP is actively engaged in international circumpolar health concerns through collaborations that promote infectious disease surveillance and research, address emerging health issues and advise policy formation in established bodies such as the Arctic Council and the International Union for Circumpolar Health. The AIP Logic Model, at the end of this document, provides a simplified Program summary of resources and activities grouped by outputs (new knowledge, outreach/education, public health response, partner support and authority to operate) with linkages to short- and long-term desired outcomes.

Strengths, challenges, opportunities, threats

The strengths of AIP, as identified in an external peer review, include a tight link between epidemiology and laboratory science in planning and conducting research activities, a spirit of collaboration and cooperation with partners that has built longstanding trust relationships, training opportunities for students and fellows, and the established leadership role in supporting public health in Alaska and the circumpolar region. AIP's focus on health disparities among indigenous peoples has helped develop the program's cultural competency and fostered relationships with tribal leaders and tribal health organizations that have led to concrete successes in combating infectious diseases. The AIP laboratory was cited as a valuable resource for supporting surveillance, advanced pathogen diagnostics and subtyping, immunologic assays and for housing the Alaska Area Specimen Bank, a biorepository of materials from research activities dating back to the 1960s.

The broad mission presents a challenge for AIP to avoid being spread too thin, thus diluting the Program's expertise and impact. This means AIP must focus on undertaking activities with the greatest chance of making a meaningful impact. This is best accomplished in consultation and collaboration with partners to identify the areas of highest need and the gaps in current local/state/tribal capacity. This has been AIP's historical approach and explains the current research priorities that complement or fill gaps in existing local programs. The Arctic regional focus calls for a cross-cutting approach, where addressing the underlying determinants of health is sometimes the most promising approach for prevention or control. Also, the wide range of infectious threats in the circumpolar region has meant that AIP draws on scientific and laboratory support and expertise from parts of CDC outside of NCEZID. AIP's small size means that loss of a single key staff member can create large gaps in expertise and capacity. Succession planning for anticipated retirements and cross-training are important to maintain program continuity and manage change.

Substantial challenges and opportunities exist in the circumpolar north for AIP and CDC to consider. The Arctic region is undergoing rapid and intense climate change with increases in commerce, shipping, mineral extraction, tourism and alterations in the physical environment and ecosystems. For northern residents, these changes will be accompanied by new infectious disease threats and profound challenges to the sustainability of current communities, their lifestyles and cultural traditions. AIP is well-placed to address these infectious disease threats, building from our established epi-lab capacity and strong partner relationships, we have added tools such as the One Health approach, advanced molecular diagnostics and newly

available data from electronic health records and environmental observing networks. Conversely, through the leadership of AIP and its partners, some infectious disease disparities have been successfully addressed, such as the near-elimination of acute hepatitis A and B infections and the dramatic declines in invasive disease due to vaccine-type *Haemophilus influenzae* and *Streptococcus pneumoniae*. Shifting resources at AIP away from those diseases will require balancing the need for continued surveillance and completing high-value projects with the demands of new challenges or unmet needs.

AIP's Priorities, Goals and Implementation Plan, 2016–2020

This document highlights Priorities of increased emphasis for the near future, but is not a comprehensive overview of all AIP activities. Some of these Priorities will require additional investment in equipment, training or new staff. Likewise, accomplishing the goals associated with these Priorities will, in some cases, require developing and testing new interventions or methodologies. For some goals, the data systems needed to assess these efforts may not be currently available. Therefore, these Priorities are aspirational and are intended as a guide towards continued Program evolution and growth.

Reduce the burden of disease and health disparities among Alaskans caused by respiratory infections, Helicobacter pylori *gastric infections, viral hepatitis, and emerging invasive or antimicrobial-resistant infections.*

Goals

- Anticipate the introduction of adult and maternal Respiratory Syncytial Virus (RSV) vaccines by determining the burden of RSV disease in Alaska Natives living in areas of rural Alaska with high infant RSV rates. Establish ongoing surveillance for RSV in adults and children to allow measurement of post-licensure vaccine effectiveness in this population.

  #### Implementation

  - Add pediatric epidemiologic expertise to AIP. (Done in 2016)
  - Add a research coordinator to the tribal health partner in southwest Alaska to support ongoing studies. (Done in 2016)
  - Create a joint investigation on the burden of RSV hospitalization in southwest Alaska between AIP and NCIRD Division of Viral Diseases for funding, epidemiologic and laboratory support. (Done in 2016)

- Evaluate markers and methods that can identify persons infected with *H. pylori* infection who are at high risk for gastric ulcers or gastric cancer. Assist tribal partners in evaluating screening approaches for high risk persons. Continue disseminating *H. pylori* antimicrobial resistance data from AIP's surveillance system to aid in therapeutic decisions.

  #### Implementation

  - Develop capacity and expertise to use advanced molecular techniques to evaluate *H. pylori* strains from persons with cancer, ulcer and gastritis to determine high risk markers. (In process, 2016)
  - Propose and support a new initiative with Alaska Native tribal partners for increased screening of *H. pylori* severe outcomes.
  - Complete 12-year follow-up study of rural Alaska Native persons treated for *H. pylori* infection to determine risk for reinfection.

- In collaboration with ANTHC's Viral Hepatitis and Liver Disease Program and CDC's Division of Viral Hepatitis, provide epidemiologic and biostatical support to evaluate the cohorts of persons with chronic infections from hepatitis C or hepatitis B. Support strategies and evaluations of efforts to enhance screening and linkage to care for Alaskans at increased risk of hepatitis C.

  Implementation

  - Include a strategy for increased screening of hepatitis C in the next CDC-ANTHC hepatitis cooperative agreement.
  - Create partnerships with state, local and tribal partners to evaluate hepatitis C screening in novel locations such as prenatal clinic, jails/prisons, treatment centers and emergency rooms.

- Continue lab and epidemiologic support for periodic evaluations of long-term cohorts of Alaska Native persons vaccinated with hepatitis A or B vaccines, through collaborations with ANTHC's Viral Hepatitis and Liver Disease Program and CDC's Division of Viral Hepatitis.

  Implementation

  - Conduct the 35-year follow-up of the hepatitis B vaccine cohort in 2016–17. Use these data to inform deliberations by ACIP on the need for revaccination of health care workers and U.S. general population.
  - Conduct the 25-year follow-up of hepatitis A vaccine cohort for antibody duration.

- Continue lab and epidemiologic collaborations with Alaska and Canada to characterize *Haemophilus influenzae* type A (Hia) infections among Arctic indigenous children. Use these data and expertise to contribute to efforts by the Public Health Agency of Canada to develop a protein-polysaccharide conjugate vaccine for Hia that could be licensed for use among Alaska Native and other indigenous populations at high risk.

  Implementation

  - Expand lab capacity through addition of Hia ELISA antibody testing and serum bactericidal assays in anticipation of antibody response studies in Alaska populations.
  - Use advanced molecular diagnostic methods to evaluate virulence and immunologic features of Alaska and Canadian Hia strains.
  - Coordinate with CDC and other USG Federal partners to inform and advise Hia vaccine development efforts.

- Use existing laboratory-based surveillance to contribute to deliberations on vaccine recommendations, detect and respond to emergence of non-vaccine pneumococcal infections, and respond to clusters of *Streptococcus pyogenes* invasive infections in Alaska.

  Implementation

  - Use pneumococcal invasive disease and colonization data to determine the indirect effect of PCV13 vaccine use on adult disease.

- Use ongoing surveillance for invasive pneumococcal infections in Alaska and circumpolar indigenous populations to determine the burden of pneumococcal disease disparities in Alaska Natives.
- Apply PCR-based emm typing of *S. pyogenes* to detect related clusters of invasive disease for investigation along with the State of Alaska using statewide laboratory-based surveillance. (Done in 2016)

- Evaluate the impact of vaccination with human papilloma virus vaccine among Alaska Native persons.

  Implementation

  - Complete studies of the burden of HPV-caused cancers in Alaska Natives using the Alaska Tumor Registry tissue bank.
  - Evaluate the immunogenicity, reactogenicity and long-term antibody response of HPV vaccines among a cohort of Alaska Native teens. Add a new cohort receiving HPV9 2-dose series in 2017.
  - Evaluate feasibility of introducing periodic HPV genotype-specific surveillance among women undergoing colposcopy at Alaska Native Medical Center to monitor vaccine impact and genotype changes.

- Develop and evaluate community-level interventions to reduce the burden of Methicillin-resistant *Staphylococcus aureus* skin and soft-tissue infections in rural Alaska communities with limited access to water and sanitation services

  Implementation

  - Complete pilot-study in rural Southwest Alaska that promoted boils prevention practices. Consider scale-up of this implementation with tribal health partner to include other villages.

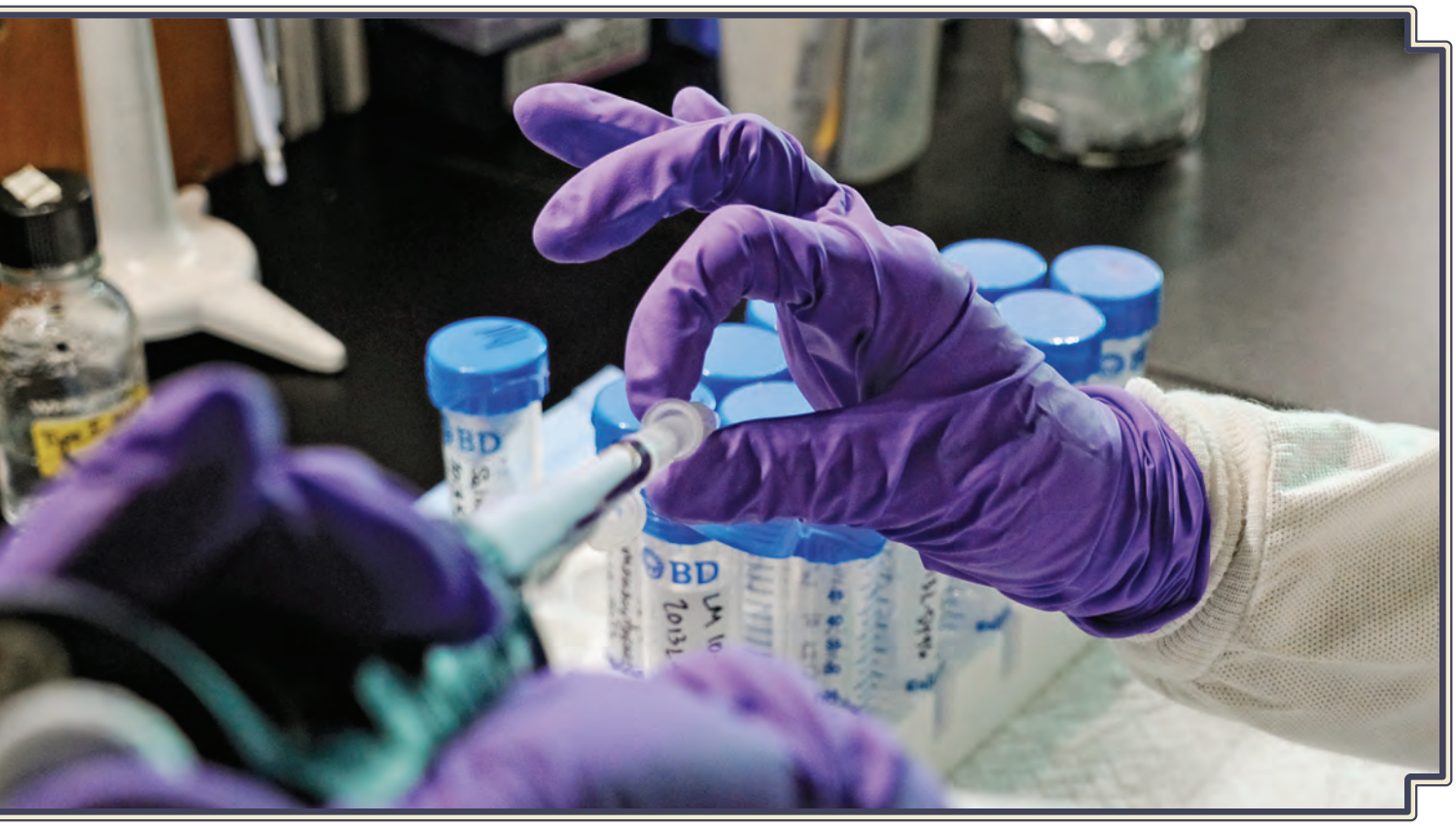
Strengthen infectious disease monitoring in the circumpolar north through enhancements to laboratory-based surveillance, use of electronic health records and biorepositories, and collaborations, such as through the International Circumpolar Surveillance system.

Goals

- Develop staff expertise in advanced molecular methods, such as whole genome sequencing, and apply this to pilot projects related to *H. pylori* and *H. influenza* type A genetic lineages and virulence factors.

Implementation

- Create working relationship with Office of Advanced Molecular Detection to support project development and use of MiSeq technology through a short-term assignment at AIP and/or AMD lab-fellowship position.
- Add a doctoral-level laboratorian at AIP to support new lab initiatives and anticipated increase in epi-lab collaborations.
- Develop collaborations with Public Health Canada's National Microbiology Lab to support joint activities on AMD aspects of *H. influenzae* type A infections in indigenous children.
- Develop a working relationship with the University of Alaska, Anchorage to support bioinformatics mentorship at AIP.



- Implement CDC's Laboratory Quality Management System and apply laboratory safety initiatives.

  Implementation

  - Assign a lab QMS manager, promote a laboratorian to assist with management. (Done in 2016)
  - Undergo QMS and CDC lab safety reviews, implement suggested improvements. (Done in 2016)

▲ *Large racks in a –30° walk-in freezer hold the Specimen Bank samples.*
◀ *Plastic vials provide long-term protection and are bar-coded for rapid identification.*

- Improve access to and use of electronic health records and administrative data sets to support tracking and documentation of health disparities.

  Implementation

  - Continue MOU with Indian Health Service to obtain inpatient and outpatient data from National Patient Information Reporting System and with AHRQ for access to Healthcare Cost and Utilization Project (HCUP) databases such as the state-specific Inpatient Database for Alaska and National Inpatient Sample.
  - Add a master's level statistician with expertise in IHS and AHRQ databases to support these analyses. (Done in 2016)
  - Complete evaluation of Healthy Alaskans 2020 indicator #22 on Preventable Hospitalizations using the combined State of Alaska and IHS inpatient databases, and promote use of these results to reduce burden of preventable hospitalizations in Alaska.

- Improve the Alaska Area Specimen Bank as a tool for health research and evaluations.

  Implementation

  - Conduct a complete inventory of serologic specimens to modernize storage containers, barcoding and inventory. (Begun in 2016)
  - Work with Alaska Native tribal partners to add to the Bank stored tissue specimens from the Alaska Native Medical Center pathology department dating back to 1969.

- Replace outdated laboratory information system with an in-house system based using the approved SQL server and that meets OCISO standards for data security.

  Implementation

  - Process begun in 2010 by AIP programmer with ongoing updates and improvements.

- Support efforts to develop surveillance for pediatric dental caries using electronic dental records to reduce the burden of severe caries among Alaska Native children.

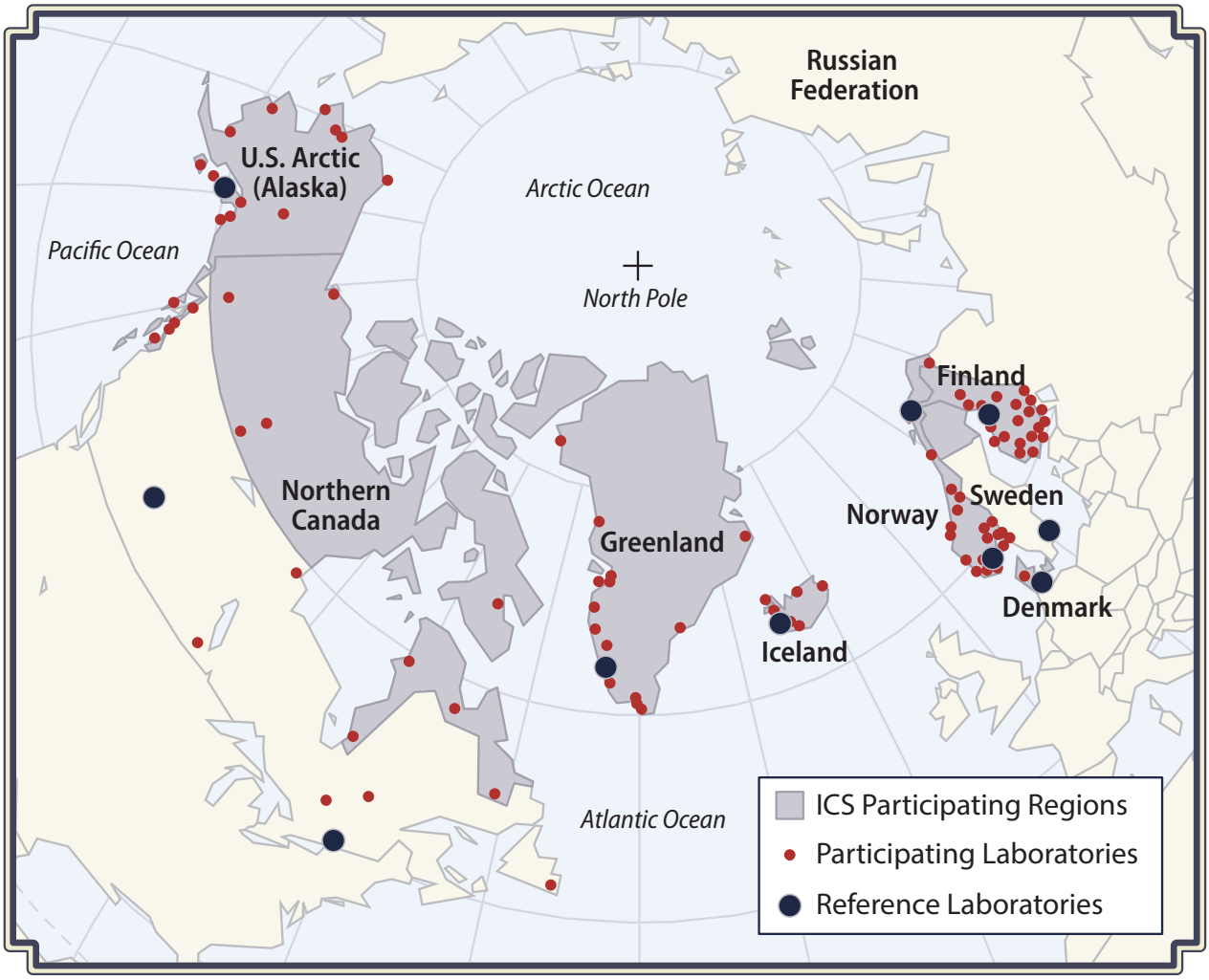
  Implementation

  - Transfer expertise on data acquisition and analysis to tribal health partners so they can access and use these data for evaluation of public health and clinical interventions.
  - Publish results of prior evaluations using tribal health data on dental caries.

- Support and enhance laboratory collaborations through the International Circumpolar Surveillance system.

  Implementation

  - Continue proficiency testing exercises to ensure accurate pathogen identification and susceptibility testing among participating labs.
  - Expand the system by adding new locations, such as the Faroe Islands, and seek full collaboration on all pathogens among existing partners.
  - Report findings from ICS activities in the peer reviewed literature and through annual reports to the Arctic Council Sustainable Development Working Group.



▲ *Photo courtesy of the Alaska Department of Environmental Conservation.*

Support efforts to improve access to in-home water and sanitation services for circumpolar populations.

Goals

- Promote efforts to increase in-home water and sanitation services in Arctic and sub-Arctic communities to meet the Healthy Alaskans 2020 Goal #19 and the UN Sustainable Development Goal #6 by 2030.

Implementation

- Conduct research on the relationship of water, sanitation and health that can be used in evaluating the value of sanitation services. Such activities could include health evaluations before- and after water infrastructure improvements or loss, the Arctic Council water/sanitation survey, and health economics activities to document return on investment of water/sewer services.
- Continue to provide leadership for activities promoting water/sanitation services among groups such as the Alaska Rural Water and Sanitation Working Group, Healthy Alaskans 2020, the Alaska Water and Sewer Challenge.
- Promote and support engagement of the U.S. Government in research on water/sanitation services, health and climate change through the U.S. Interagency Arctic Research Policy Committee.

Provide leadership for domestic and international activities to promote improvements in health and well-being among indigenous populations in the Arctic region and the U.S.

Goals

- Engage in partnerships within Alaska to promote health equity in the area of infectious diseases and underlying health determinants affecting indigenous populations.

  Implementation

  - Maintain active roles in collaboration with state and tribal partners through shared public health activities (research, surveillance), education efforts (students, fellows, medical residents), advisory roles (Alaska Native Tribal Epidemiology Center, University of Alaska Institute for Circumpolar Health Research, ANTHC Center for Climate and Health) and policy-related engagements (Healthy Alaskans 2020, Alaska Rural Water and Sanitation Working Group).

- Support CDC and U.S. Government activities that address the health of indigenous populations.

  Implementation

  - AIP Director to continue to serve as a Center representative to the CDC Tribal Advisory Committee.
  - AIP Director to continue to serve as CDC liaison to and Health Collaborations Team lead for the U.S. government Interagency Arctic Research Policy Committee

- Represent CDC in international collaborations and research that affects northern circumpolar populations.

  Implementation

  - Continue to provide leadership in the International Union of Circumpolar Health and related working groups and projects, such as International Circumpolar Surveillance.
  - AIP Director to continue to represent the U.S. Government on the Arctic Council's Human Health Experts Group.

Respond to infectious disease threats to Arctic and sub-Arctic populations caused by the rapidly changing climate and environment.

Goals

- Expand and strengthen existing Alaska and Arctic region networks and collaborations to assess and respond to health threats occurring at the interface of human, animal and environmental health. Many of these threats will be from zoonotic infections and are likely to disproportionately affect those who have a close connect with the natural environment such as rural Alaska Native persons and others involved in hunting, trapping and fishing.

Implementation

- Strengthen and improve the existing Alaska One Health Working Group so that is able to recognize, analyze and respond to new health threats by engaging local observers with subject matter experts and response agencies. This could include developing a work plan to identify key indicators for measurement and tracking, data systems and data use agreements, and the training needs, organizational structure and financial support needed.
- Support the U.S.-led initiative in the Arctic Council to operationalize One Health (OH) in Arctic nations. This could include development of the Alaska OH workgroup and connecting to other Arctic OH "hubs", planning and conducting an Arctic OH table-top exercise in February 2017, presenting the results of the Arctic Council One Health Survey in the report for the Arctic Council Ministerial in 2017.

- Develop AIP capacity and expertise in One Health approaches to provide regional leadership for infectious disease threats from climate or environmental change.

  Implementation

  - Add a One Health scientist to AIP to provide the leadership and scientific expertise to carry out these goals while working in close collaboration with the Alaska Native Tribal Health System, State of Alaska, University and Federal partners.
  - Continue to co-chair the Climate Change and Infectious Disease Working Group within the International Union for Circumpolar Health.

- Use existing tools such as biorepositories or past prevalence studies as a baseline for assessing changes in zoonotic disease threats and associated risk factors.

  Implementation

  - Complete the seroprevalence study of zoonotic infectious diseases among Alaska Native subsistence hunters, wildlife biologists and sports hunters.

- Enhance surveillance for climate-change associated health threats using established notifiable disease reporting, augmented by special studies of human, animal and environmental reservoirs.

  Implementation

  - Develop working collaborations and use agreements with Alaska Native organizations, the University of Alaska and other researchers to create joint investigations of human and animal infectious disease threats.

AIP: Capacity and Expertise

For more than four decades, AIP's portfolio has evolved to include a broad range of activities that promote health in the Arctic and sub-Arctic. Working to combat and respond to infectious disease threats requires expertise in diverse areas of public health and consistent integration of epidemiology, biostatistics and laboratory capacity. While AIP holds much of this knowledge and technical capacity, the program also benefits from strong regional partnerships and subject matter expertise held in other CDC offices and U.S. government entities.

To implement its activities, AIP draws support from staff members with a range of skills, including:

- Laboratory proficiency
  - Expertise in bacterial microbiology
  - Ability to apply molecular diagnostics with PCR-based antigen detection, antibody measurements, and sequencing
  - Operation of a Biosafety Level III Laboratory with registration in the Laboratory Response Network system
  - Maintenance of the Alaska Area Specimen Bank, a biorepository of over 400,000 human specimens and infectious agents from research in Alaska dating back to the 1960's

- Epidemiology
  - Surveillance, outbreak response, and special studies of risk factors and program evaluations
  - Medical expertise, including six medical doctors and three nurses with extensive experience in rural Alaska communities
  - Ongoing training activities for numerous audiences, including Epidemic Intelligence Service Officers and professional students in medical, veterinary, nursing, dental and pharmacy programs

- Biostatistics and computing
  - Technological expertise, including three biostatisticians supported by data managers and data entry personnel

AIP: Charting a Path Forward

INPUTS

Mission

Prevent infectious disease morbidity/mortality in Arctic and Subarctic populations

Resources

CDC funding allocation

External funding: Federal, Partner in-kind

AIP building, equipment, materials

Alaska Area Specimen Bank

Staff time and expertise

Partnerships

Alaska clinical laboratories

CDC subject matter experts

External partners: Tribal, University, State, Federal, International

OUTPUTS

ACTIVITIES	RESULT
Conduct research on the epidemiology of infectious diseases Identify infectious disease health disparities of regional importance Manage data: collect, validate and protect Conduct statistical analyses Write, edit and publish technical reports Design studies, write research protocols and obtain Institutional Review Board/Tribal/Agency approval Evaluate public health interventions or clinical treatments Conduct field/clinical investigations and recruit participants	New Knowledge
Provide service to community, e.g., flu vaccine clinics Train students and fellows Educate providers, public health professionals, policy makers, public	Outreach and Education
Develop and improve laboratory diagnostic tests Maintain preparedness and response capability for biothreat agents Analyze laboratory and clinical samples Support CDC and DHHS emergency response missions Conduct invasive bacterial disease surveillance in Alaska Conduct surveillance for *Helicobacter pylori* infections Conduct surveillance for respiratory hospitalizations in Alaska Conduct outbreak investigations	Public Health Response
Maintain the Alaska Area Specimen Bank for public health benefit Provide consultation to health professionals and tribal health entities Build collaborations with public health and healthcare organizations Conduct laboratory diagnostics for invasive bacterial disease surveillance for the White River Apache and Navajo Reservations Process and ship lab specimens Develop and support international partnerships	Partner Support
Provide administrative support: personnel, records, travel, budget, purchasing, sustainability Manage computer systems Maintain required training and certifications Maintain laboratory accreditations Apply the highest standards of quality and safety in laboratory science	Authority to Operate

OUTCOMES—IMPACT		
SHORT-TERM	**MEDIUM**	**LONG-TERM**
Increased: • Awareness of disease threats • Knowledge of diseases and risk factors • Knowledge of prevention recommendations and treatments • Capacity to diagnose and measure infectious diseases under surveillance	Increased behaviors that reduce risk Policies are created that improve health Improvements in prevention and treatment	Reduced morbidity and mortality from infectious diseases Improved conditions that contribute to better health
Improved: • Knowledge about public health capacity • Vaccine uptake More knowledgeable and capable public health workforce	Improved public opinion and trust in public health	Better informed and more health-conscious public citizens
Improved capacity to detect, diagnosis and monitor emerging public health threats	Control of emerging public health threats	Reduced risk from emerging public health threats
Improved ability of partners to detect and respond to threats	Stronger partnerships Increased public health capacity	Improved efficiency and reduced costs of health system
Recognition and continued support from CDC and DHHS Recognition and continued support from Partners		

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