Climate-change Effects on the Epidemiology of Infectious Diseases in the Arctic.

Linking landscape effects of climate change to the geographic spread of zoonotic infectious diseases.

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Introduction: Climate change is considered to have a significant impact on the epidemiology of Arctic infectious diseases, that threatens Arctic societies by terms of socio-economy, culture, health, welfare, security, animal husbandry, and food supply (etc.). With arctic societies being generally dependent on husbandry animals, the erosion of animal welfare introduced with emerging zoonotic diseases adds to the effects of human exposure, where the resulting dynamic scenario requires a holistic OneHealth study-approach. The OneHealth approach requires interdisciplinary collaboration across disciplines such as ecology, veterinary and human medicine, earth sciences, and mathematical statistics, in order to address the processes and effects of potentially spreading infectious diseases.

Methods: The authorities that administer national programs of infectious diseases control have been engaged in the acquirement of diseases data covering Denmark/Greenland, Iceland, Norway, Sweden, Finland, and Russia through the past 30-year climate reference period, regarding incidences of anthrax, borreliosis, brucellosis, cryptosporidiosis, leptospirosis, hantavirus infection, Q-fever, tick born encephalitis, and tularaemia. These data were supplemented with satellite-sensed climate data covering the same reference period of time with approximately 35 standard variables ranging from different temperature cumulations, via snow-cover duration, to chlorophyll density. The selection of diseases and climate variables was made via a process of expert review. When combined, a geographic information system was used to down-scale climate data into the climate-characteristics of individual administrative diseases report districts (basically at county-level). The resulting dataset was statistically inferred regarding the orthogonal linear combinations of climate data that best explain the observed variation of diseases incidences across report districts.

Results: Preliminary studies indicate strong climate sensitivity regarding some diseases, and lesser sensitivity regarding others. This conforms well with empirical observations, where climate sensitivity indicates a potential of diseases to migrate with climate change, and where this potential is much regulated by the ecological characteristics of the vector and reservoir organisms that carry diseases pathogens through the landscape.

Discussion: By determining statistical relations across the geographic spread of climate and diseases through the 30-year climate reference period, future diseases scenarios may be predicted in accordance with the standard IPCC climate scenarios. Such projections of future diseases scenarios constitute invaluable decision support in the process of strengthening the climate resilience of Arctic societies and cultures.