



SURPRISE PREPAREDNESS: IF WE CAN'T PREDICT, WHY PAY ATTENTION TO NATURE?

KEY MESSAGES

- Millions has been spent trying to acquire early warning signals from nature to predict the next emerging disease, but we continue to be surprised.
- Public health can prepare for surprise by using signals from nature to classify community resilience and vulnerability, thus informing preparedness strategies.
- A wildlife health intelligence system can provide both data on the environmental distribution of hazards that affect risk perception and likelihoods of human exposure as well as information on social and environmental conditions that make communities vulnerable to harm to help prioritize risk communications and strategic management decisions.

EARLY WARNING - WHAT FOR AND WHY?

An early warning signal communicates information about impending risks to vulnerable people before a hazardous event occurs. The goal is to inspire actions to mitigate or prevent harm. In the era of emerging infectious diseases, there has been significant interest and investment in using signals from nature (ex. wildlife disease, domestic animal disease, changing climate or landscapes) to predict the next emerging disease. But our ability to predict remains limited.

There are many methods to try to predict infectious disease patterns, but all can only act as “the art of the possible” rather than predictive tools to direct specific risk management actions in specific locations and times. Significant knowledge gaps for even the most studied emerging infectious diseases along with a simplistic view of pathogens disconnected from their social and ecological context reduces the likelihood that we will be able to predict emerging infections with accuracy or regularity in the foreseeable future. The influence of social and ecological factors on the ecology of pathogen reservoirs and the complexity of pathogen traffic patterns can produce nonlinear responses that are inherently unpredictable. However, the rate of emerging risks is expected to accelerate with climate change and to grow beyond infectious diseases to include changes in contaminant exposure, catastrophic events like wildfire and floods, and shifts in access to natural resources that underpin economic and cultural needs. While we cannot predict the next surprise, we still need early warning systems to help anticipate, prioritize resources and prepare.

HARM REDUCTION INFORMS EARLY WARNING

Total harm can be decreased by reducing the total amount of harm (which is achieved by reducing exposure or sensitivity), or by reducing the total impact of harm (achieved by increasing capacity to cope or reducing cumulative effects). Surprise anticipation works by improving situational awareness of changes in distribution and exposure to hazards, or community willingness to act on early signals through awareness of possible harms from the hazards. It also works by tracking changes in determinants of health that might reduce a community's capacity to cope with unexpected harms from previously unknown hazards. Key to success is the capacity to access, integrate and apply information from throughout a socio-ecological system. This is often beyond the resources or capacity of public health agencies as many of the drivers of emerging disease and determinants of community coping capacity reside outside of the delegated authority of public health. Partnerships as needed.

WHAT IS THE ROLE FOR ENVIRONMENTAL SIGNALS FROM WILDLIFE?

There is an extensive history of wildlife serving as bio-sentinels for the effects and distribution of environmental pollutants and pathogens. This role will increase given the expected effects of climate change on distributions and burdens of pathogens and pollutants. Wild animals also signal vulnerabilities in social determinants of health and resilience, such a community access to country food, employment opportunities and access to cultural resources.

Wildlife signals can help public health identify and assess 5 community vulnerability scenarios.

1. Risk management scenario. Public health managers are fully aware of the nature of the hazard and community vulnerability. Surveillance should focus on understanding how a known environmental hazard is changing in distribution or abundance in the environment, as well as using signals from wildlife to inspire public or regulatory response to a known hazard by influencing risk perception.
2. Community coping assessment scenario. Managers are uncertain how a community can cope with known hazards. Using wildlife to help assess community coping capacity would rely on monitoring and assessing the contributions of fish and wildlife to social determinants of health (ex. income, food security, cultural cohesion). In natural resource dependent communities this would require monitoring changes in the presence, abundance or safety of fish or wildlife used by the community and relative changes in wildlife contribution to the determinants of health.
3. Hazard detection and monitoring. Variation in community or individual vulnerability is primarily driven by differences in exposure to known hazards. The goal of wildlife surveillance for this scenario is to provide reliable signals of the environmental distribution and abundance of known hazards and to yield information on the likelihood of human exposure by understanding human-wildlife interactions. By focusing on climate edges and exposure pathways, wildlife may contribute to hazard detection and monitoring through risk-based surveillance.
4. Bio-sentinels of effect. Either a suspected hazard is present in the environment but there is insufficient evidence of effect to warrant risk reduction actions or there are newly introduced or previously unknown agents in the environment, the effects of which are unknown. The role for wildlife surveillance in this case is to link the presence of the agent/hazard with a biological effect to inform recognition of a risk and help prioritize risks requiring further assessment or management.
5. Mixed strategies. The characteristics of community vulnerability are largely unknown and effects are unanticipated. A mixed strategy combines the bio-sentinel, hazard detection, community coping and risk management attributes of wildlife early warning functions to create a health intelligence program. Given the uncertainties associated with climate change in Canada, the mixed strategies approach is necessary for risk anticipation and preparedness.

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