

Environmental health surveillance using a One Health approach

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Abstract

This environmental health surveillance project uses a collaborative One Health approach to describe water quality in rural groundwater drinking water systems in the context of animal health, human health and environment health. Retrospective and prospective data from several sampling frames focus on indicator organisms, groundwater pathogens and antimicrobial associated risk factors over time. The data will be used to assess and visualise risk factors, create composite risk maps, and identify environmental/hydrological processes that may be involved in the well contamination process. Interpreted surveillance data will be packaged and interpreted to aid decision makers in water policy development.

Keywords: *One Health surveillance, water quality, environmental public health, enteric disease*

Introduction

One Health surveillance has been defined as “collaborative, on-going, systematic collection and analysis of data from multiple domains to detect health related events and produce information which leads to actions aimed at attaining optimal health for people, animals, and the environment” (1).

Surveillance is particularly important with respect to water contamination which has been associated with significant waterborne disease outbreaks in Canada and the world (2,3).

The objective of this surveillance system, with a one health lens, is to provide a more robust system for concurrently monitoring microbial contamination in early drinking water, early identification of potential health concerns in the related animal and human populations with data made available to use for mitigation of these concerns including intervention and risk assessment.

Materials and methods

Retrospective screening of routine drinking water samples submitted to the Alberta Provincial Laboratory for Public Health (ProvLab), 2008-2012, were tested for routine water quality indicators (*Escherichia coli* and total coliforms). Over 1200 *E. coli* positive samples from across Southern Alberta were also assessed for shiga-toxin production and resistance to antimicrobials. *Bacteroides* spp are being used as a marker for source tracking of fecal contamination.

This is combined with prospective sampling well water samples from 90 livestock operations within a sentinel region in Alberta, chosen based on a sampling frame as part of another One Health surveillance project. All prospective samples were tested for water quality indicators (presence or absence of total coliforms and *E. coli*), STEC, Enterococcus, and antimicrobial resistant *E. coli* as well as source tracking (*Bacteroides* spp) and water borne pathogens (*Salmonella* spp, *Campylobacter* spp). A subset of farms were also tested for waterborne viruses.

Results

The preliminary temporal and spatial patterns of STEC and antimicrobial resistant organisms in well water across Alberta are described both retrospectively and prospectively. The retrospective samples represent a unique archive of positive well samples for further assessment. Evidence of shiga-toxin producing *E. coli* and multi drug resistance was found in these groundwater samples. The prospective part of the project has results that link in to other agricultural testing being done on these farms providing more information within the newly designated sentinel area.

Discussion

Analytic epidemiologic techniques include descriptive statistics, mapping, spatial regression analysis, temporospatial cluster analysis, and event detection. Limitations of the study are taken into account for interpretation. We will also assess associations with environmental (climatic, geologic) and animal husbandry risk factors.

We will use information gained from the study to inform decision makers on the implications for human, animal and environmental health (e.g. water testing policies (microorganisms to test, lack of regulation of testing for private drinking water), risk maps, livestock biosecurity and other mitigation strategies).

References

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