RESEARCH FACTS

UNIVERSITY OF SASKATCHEWAN
Livestock and Forage Centre of Excellence
LFCE.USASK.CA

IN PROGRESS

Genomic ASSETS for Livestock

PROJECT TITLE

Genomic ASSETS (Antimicrobial Stewardship Systems from Evidence-based Treatment Strategies) for Livestock

In progress:

Results expected in September 2023

RESEARCHERS

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Background:

Disease-causing bacteria are increasingly able to resist antibiotics used for treatment creating an unprecedented and growing global threat to human and animal health. Animal agriculture is also facing pressure to reduce its use of antibiotics in food animals. Specifically, the livestock industry has been challenged by the World Health Organization, consumers and major retailers to select and use antibiotics more prudently.

To meet this challenge, veterinarians and livestock producers need fast and precise information about disease in their animals. They need to know quickly whether the bacteria causing those diseases are resistant to the antibiotics intended for treatment. Calves entering feedlots and backgrounding operations are routinely treated with antibiotics to control costly and common infections such as bovine respiratory disease. Respiratory disease circulates through groups of calves in feedlot pens much as colds and flu circulate in classrooms of children. Antibiotics are almost always needed to treat sick calves and control disease spread because untreated bacterial pneumonias can have severe health and welfare impacts including the death of calves. Timely and accurate diagnostic tests can help identify the most effective antibiotics and can minimize unnecessary use of antibiotics that are important to human and animal health.

Objectives:

1. Develop diagnostic workflows using cutting-edge, commercially available genomic platforms. We will apply Oxford Nanopore Technologies sequencing methods and explore other emerging tools such as recombinase polymerase amplification.

2. Develop animal sampling and testing strategies (collection methods, timing, required sample numbers) for practicality, compatibility with feedlot practices and utility of resulting information.

3. Create dynamic risk assessment tools to support prudent antimicrobial selection for treatment and disease control (pen-level precision medicine) using agent-based models supplemented with economic data.

What They Will Do:

Genomics-based diagnostic test protocols for important respiratory pathogens of cattle and associated antimicrobial resistance will be developed in the lab and applied initially to calves at the Livestock and Forage Centre of Excellence, University of Saskatchewan. We will take nasal swabs from 1,600 calves placed in the feedlots over two fall seasons and perform conventional culture and sensitivity methods alongside innovative genetic sequencing techniques. Samples taken upon arrival in the feedlot, two weeks after arrival, and from calves that develop respiratory disease will be analyzed. Taken together, these samples help us assess how sampling strategies can best inform antimicrobial usage. In the second phase of the research project, strategies developed at the LFCE will be rolled out to commercial feedlot settings in collaboration with partnering veterinary clinics.

Throughout the project, concurrent analyses of the economics of implementing genomics-based diagnostic techniques and their acceptance by stakeholders will help shape the development of these rapid diagnostic tests. In addition, bioinformatics specialists will work to develop the computational techniques needed to ensure efficient and timely analysis of genomics data and their translation into practical diagnostic reports for veterinarians and feedlot operators.

Implications:

This research supports large-scale uptake of genomic tools and strategies to rapidly field-test groups of calves for disease and antibiotic resistance. We will develop a diagnostic support network and cutting-edge computing tools for the livestock industry to manage genomic test data, assess risk and inform therapy decisions. The result will be precision use of antibiotics—quick and accessible information for veterinarians to tailor antibiotic therapy for individual pens of calves.

Engagement of end users and stakeholders throughout the research process is an important aspect of our knowledge transfer plan. In addition, results will be shared through both industry and academic venues.

Our genomics-based precision health strategy will directly and immediately benefit livestock industries, animal health, consumers and public health by providing rapid practical support for prudent decisions on using antibiotics in food animals.

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