Evaluating the potential contribution of beef cattle to antimicrobial resistance

Project Title:
Surveillance of E. coli, enterococci, antimicrobial resistance (AMR) and Enterococcus species distribution in beef operations and associated environments

Researchers:
Tim McAllister, Ph.D.  tim.mcallister@agr.gc.ca
Tim McAllister, Ph.D., (Agriculture and Agri-Food Canada), Sheryl Gow, D.V.M., Ph.D. and Richard Reid-Smith, D.V.M., D.V.Sc. (Public Health Agency of Canada), Trevor Alexander, Ph.D. and Mueen Aslam, Ph.D. (Agriculture and Agri-Food Canada), Ron Read, M.D., Ph.D. (University of Calgary), Calvin Booker, D.V.M and Sherry Hannon, D.V.M., Ph.D. (Feedlot Health Management Services), Sylvia Checkley, D.V.M., Ph.D. (University of Calgary), Lisa Tymensen, Ph.D (Alberta Agriculture and Rural Development) and Patrick Boerlin, D.V.Sc. (University of Guelph)

Project Code:  FOS.10.13
Completed:  In Progress. Results expected in March 2018.

Background

Increasing public concern regarding antimicrobial use (AMU) and resistance (AMR) in livestock is leading to increased pressure on livestock producers, veterinarians, industry groups, processors, foodservice companies and governments to address these concerns. Science-based, epidemiologically sound research is critical for sound industry policy and communication, legislation, and educated consumer choices.

Objectives

1. To determine how AMU in beef cattle potentially contributes to antimicrobial resistance (AMR)
2. To determine the prevalence of indicator bacteria (E. coli and enterococci) in feedlot cattle and downstream drainage basins to identify the potential chain of transmission within these environments
3. To examine the fate (persistence and movement) of veterinary antimicrobial residues and AMR genes in on-farm agroecosystems (e.g. commercial feedlots), and their impacts on microbial communities using conventional and molecular methods.
4. To examine the presence of veterinary antimicrobial residues in off-farm agroecosystems (e.g. irrigation water).
5. To investigate the fate of AMR genes during composting and stockpiling of manure.
6. Provide robust AMU estimates for Canadian feedlot cattle.
7. Relate AMU estimates to feedlot production practices to improve our understanding of the feedlot industry’s contribution to the total consumption of antimicrobials important in human medicine, and to understand how it may change over time.

8. Validate Population Corrected Unit (PCU; total kg of antimicrobials used, adjusted for population size and average body weight at treatment) estimates for feedlot cattle to determine whether the way in which CIPARS has adapted European PCU methodologies are appropriate for Canada.

What they will do

This study will focus on antimicrobials classified as being of high and very high importance in human medicine. AMU records will be collected from Alberta feedlots. E. coli and enterococci will also be isolated from bovine feces, manure drainage/catchment basins at feedlots, downstream surface water and retail beef, and compared to isolates obtained from human clinical samples. The zoonotic potential of these species and any link between AMU in livestock and humans colonized by antibiotic resistant enterococci will be examined. Advanced genotyping techniques will be used to evaluate similarities and differences between enterococci species isolated from cattle and人类, as well as the genetic sequences of genes associated with AMR in cattle and human clinical cases.

Additional samples will be collected within the feedlot environment to assess the degree to which antimicrobial residues that are not absorbed or metabolized by the animal enter the environment via manure, how long they persist in the environment, and whether manure management practices like composting or stockpiling affect how quickly and completely antimicrobial residues are broken down.

Implications

Canada’s beef industry has very limited data on antimicrobial use. The most current data we have was collected from several thousand cattle in four feedlots between 2006 and 2011. This project will look at records from 2.2 to 2.7 million feedlot cattle in 25-35 commercial feedlots over a four year period, providing a much more current and more comprehensive picture of what, how, when and why antimicrobials are used in Canada’s cattle feeding sector.

This study will provide insights into the relationships between AMU in feedlot cattle, the nature of AMR bacteria in cattle, and the possible spread of pathogens and AMR bacteria in downstream environments. These results will help to identify appropriate on-farm intervention points for the control of AMR in feedlots, and help to decipher and quantify the association between AMU and AMR in Canada’s beef production system with AMR in humans. This continues the leadership role that the Canadian beef industry has taken in promoting and quantifying good antimicrobial stewardship within feedlot production systems.

Proudly Funded By:

---

The Beef Cattle Industry Science Cluster is funded by the Beef Cattle Research Council, a division of the Canadian Cattlemen’s Association, and Agriculture and Agri-Food Canada to advance research and technology transfer supporting the Canadian beef industry’s vision to be recognized as a preferred supplier of healthy, high quality beef, cattle and genetics.

For More Information Contact:
Beef Cattle Research Council
#180, 6815 - 8th St. NE
Calgary, AB T2E 7H7
Tel: (403) 275-8558 Fax: (403) 274-5686
info@beefresearch.ca

For More Information Visit:
www.beefresearch.ca