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Feedlot sampling study measures resistance to antimicrobial drugs

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Animal agriculture's role in global antimicrobial resistance is sometimes a subject of heated debate. Knowledge is limited about how subtherapeutic and therapeutic antimicrobial usage contributes to the development of resistance, which can ultimately be transferred to humans.

Shedding light on the mechanisms and paths of resistance development depends on being able to accurately and efficiently evaluate patterns of antimicrobial resistance in bacteria isolated from production animals and their environment.

Gaining knowledge about the mechanisms and patterns will enable better management approaches to be implemented. Proper study design is crucial.

Designing a sampling strategy to measure the antimicrobial resistance pattern in bacteria found in feedlot cattle entails a number of important considerations. Perhaps the most critical question is: "How many fecal samples should we take and how many bacterial samples should we take from each fecal sample?"

RESEARCHERS HAVE IDENTIFIED FACTORS THAT PROMOTE BACTERIAL RESISTANCE IN CATTLE.

SAMPLING

The ecology of bacterial resistance in a pen of feedlot cattle will influence the number of fecal samples that need to be obtained. If individual animals have unique resistance patterns, then many animals will need to be tested. However, if there is a great deal of sharing of bacteria, then perhaps fewer samples are needed.

Similar questions can be asked about bacteria sampling. Each gram of fecal sample has millions of bacteria. If the resistance patterns among a species of bacteria in a sample are similar, then only a single bacterium may need to be tested. If there are many different patterns, then

Adopting efficient sampling methods will lead to a clearer picture of the ecology of resistance on feedlots, while reducing research costs.

it might be useful to sample more bacteria from a single fecal sample.

With support from USDA's National Research Initiative (NRI), researchers at Colorado State University, the University of California at Davis, and the USDA Animal and Plant Health Inspection Service's Veterinary Services (Centers for Epidemiology and Animal Health) investigated many of the questions surrounding the measurement of antimicrobial resistance in feedlot cattle.

To answer some of the questions, the researchers analyzed results from field sampling and laboratory testing.

Initial results showed that the antimicrobial resistance pattern obtained from samples taken from individual animals did not substantially differ from the pattern obtained from samples taken from the pen floor. These results also indicated that variability in the antimicrobial resistance pattern over a 2-day period was not substantial. If the results of further analysis corroborate the preliminary analysis, then there may be some time-saving strategies to implement in sampling. If pen floor sampling can be used, it may reduce collection costs and still make it possible to determine the antimicrobial resistance pattern.

If the short-term variation in the resistance pattern is small, then researchers can use a point-in-time sample to represent the resistance pattern for the cattle over a longer period of time.

THE ECOLOGY OF BACTERIAL RESISTANCE IN A PEN OF FEEDLOT CATTLE INFLUENCES THE NUMBER OF FECAL SAMPLES THAT NEED TO BE OBTAINED, AS DONE HERE BY RESEARCH ASSISTANT KIRSTEN CHMIELEWSKI.

IMPACT

This NRI-sponsored research is contributing to knowledge of resistance patterns and ways to measure them effectively. Adopting efficient sampling methods will lead to a clearer picture of the ecology of resistance on feedlots, while reducing research costs.

With more comprehensive information on the distribution of antimicrobial resistance in feedlots, researchers can direct more effort to identifying the factors that promote resistance in cattle. This can naturally lead to a better understanding of pathways of the prophylactic and therapeutic use of antimicrobial drugs in food animals.

A better understanding of this issue will be critical for identifying specific management programs that are effective in protecting the public from problems associated with antimicrobial drug use in these animals.

The research reported in this factsheet was sponsored by Epidemiological Approaches for Food Safety Program of the Nutrition, Food Safety, and Health Division of the National Research Initiative Competitive Grants Program. To be placed on the mailing list for this publication or to receive additional information, please contact the NRI (202-401-5022 or NRICGP@reeusda.gov). The factsheet also is accessible via the NRI section of the Cooperative State Research, Education, and Extension Service website (http://www.reeusda.gov/nri).

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