

# Temporal changes in antimicrobial resistance of fecal coliforms isolated from dairy cows

**E.M. Corbett, DVM, MS; B. Norby, CMV, MPVM, PhD; L.W. Halbert, DVM, PhD**

*Department of Large Animal Clinical Sciences, Michigan State University, East Lansing, MI 48824*

## Introduction

Antimicrobial resistance is a growing concern in both food animal and public health. However, the role of antimicrobial use and management practices used on livestock operations on the accumulation, dissemination, and persistence of resistance has not been clearly determined. Most studies on antimicrobial resistance were conducted as cross-sectional observational studies; therefore, little is known about the dynamics of antimicrobial resistance in an animal as it transitions through various production phases or the impact of antimicrobial treatments on resistance over time. The goals of this study were to determine temporal changes in the quantities of susceptible and resistant coliform bacteria to four antimicrobials in fecal samples that were collected throughout a full production cycle, and to determine whether health or performance events affect the quantity or patterns of antimicrobial-resistant bacteria in dairy cattle.

## Materials and Methods

Fifty cows on a commercial dairy herd in Michigan were enrolled in the study. Ten cows were selected randomly for each of five stages of production: recently freshened, mid-lactation, late-lactation, far-off dry, and close-up dry. From each cow, fecal samples were collected every other week and cultured for coliform bacteria via spiral plating on plain MacConkey agar plates, as well as MacConkey agar plates with ceftiofur (8 µg/mL), ampicillin (32 µg/mL), tetracycline (16 µg/mL), and ciprofloxacin (0.5 µg/mL). Plates were incubated at 99°F (37°C) for 18 to 24 hours and bacterial colonies were counted with an automated colony counter. Descriptive and summary statistics were calculated using SAS.

## Results

Preliminary findings from three sampling dates indicate that 29% of all fecal samples contained coliforms that had reduced susceptibility to at least one of three antibiotics (ampicillin, ceftiofur, or tetracycline). Reduced susceptibility to ciprofloxacin was not detected in any of the samples. Of those samples that had coliforms with reduced susceptibility, 35% had reduced susceptibility to at least two antibiotics and 12% had reduced susceptibility to all three antibiotics. Further analysis revealed that 80% of fecal samples with coliforms with reduced susceptibility to ampicillin, ceftiofur, and tetracycline were isolated from cows during the periparturient transition period. Further results will be presented and discussed.

## Significance

By following the same cows throughout a full production cycle, we can evaluate changes in antimicrobial susceptibility for commensal coliform bacteria quantitatively, as well as assess whether the stage of production, antimicrobial treatments, or seasonality affect the extent or patterns of antimicrobial resistance. Understanding the variation in susceptibility patterns of fecal coliforms in dairy cows will assist in the design of targeted sampling strategies and potential interventions to minimize the risk of cull dairy cows with antimicrobial resistance entering the human food chain. Moreover, characterization of these changes will be important during the design of future studies conducted to evaluate at which production stage interventions will have the greatest effect on antimicrobial resistance.