

# Herd-level association between antimicrobial use and antimicrobial resistance in bovine mastitis *Staphylococcus aureus* isolates

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Surveillance of antimicrobial use and resistance is needed to manage antimicrobial resistance in bacteria. The present study determined an association between antimicrobial use and resistance in *Staphylococcus aureus* (n=562), isolated from milk samples on 89 dairy farms in four regions of Canada. Dairy producers were asked to deposit empty drug containers into specially provided receptacles, and antimicrobial drug use rate was calculated to quantify antimicrobial use. MIC were determined using Sensititre<sup>®</sup> bovine mastitis plate containing antimicrobials commonly used for mastitis treatment and control. Multivariable logistic regression models were built to determine herd-level risk factors of penicillin, ampicillin, pirlimycin, penicillin-novobiocin combination, tetracycline and sulfadimethoxine resistance in *S. aureus* isolates.

The use of penicillin-novobiocin combination for dry cow therapy was associated with penicillin and ampicillin resistance (Odds Ratio [OR]: 2.17 and 3.10, respectively). Systemic administration of penicillin was associated with penicillin resistance (OR: 1.63). Intramammary administration of pirlimycin for lactating cow mastitis treatment was associated with pirlimycin resistance as well (OR: 2.07). Average herd parity was associated with ampicillin and tetracycline resistance (OR: 3.88 and 0.02, respectively). Dairy herds in the Maritime region had higher odds of penicillin and lower odds of ampicillin resistance than dairy herds in Québec (OR: 2.18 and 0.19, respectively). Alberta dairy herds had lower odds of ampicillin and sulfadimethoxine resistance than dairy herds in Québec (OR: 0.04 and 0.08, respectively). Ontario dairy herds had lower odds of tetracycline and sulfadimethoxine resistance than dairy herds in Québec (OR: 0.05 and 0.33, respectively).

**Implications:** Use of certain antimicrobials administered for mastitis treatment and control was positively associated with antimicrobial resistance in bovine mastitis pathogens in the field conditions. Geographical variation in antimicrobial resistance outcomes was observed.