Antimicrobial Resistance in Young New Zealand Horses

A thesis submitted in fulfilment of the requirements for the degree of a Master of Veterinary Science

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Abstract

The emergence of bacteria that are resistant to antibiotics used in horses has been reported worldwide, including in Australia, the USA and United Kingdom. There is a lack of published comparative scientific information on the New Zealand equine population. However, recent individual cases of multi-drug resistant (MDR) bacterial infections reported by veterinarians have raised concerns about the situation in New Zealand. The use of antimicrobials coupled with less than ideal prescription practice in the horse industry may have led to inadvertent selection for MDR bacteria. An initial perspective on antimicrobial resistance in NZ is gleaned through a retrospective description of laboratory submissions in the form of a database analysis from 2004 to 2013/2014. In neonates (foals less than three weeks of age), the presence of MDR bacteria was identified in 37.5% (24/64) of foals; although 81.6% (102/125) of bacteria cultured from foals included in the study were sensitive to either penicillin or gentamicin. Of the respiratory samples from horses three-years-old and younger, the most commonly cultured bacteria were *Staphylococcus* species accounting for 40.1% (310/774) of isolates. These bacteria were sensitive to penicillin, ceftiofur and gentamicin for > 90% of isolates. Of all respiratory equine submissions, MDR bacteria were recovered from 39.2% (93/237) of horses. Using multiple correspondence analysis, MDR was associated with submissions from 2009-2014 and two-year-old horses from the Waikato region.

These two population groups were targeted specifically for examination due to the potentially severe consequences of bacterial disease in neonates (Chapter 3), and the anecdotal experience of high clinical use of antimicrobials in young horses, especially in the treatment of clinically apparent respiratory disease (Chapter 4). Multi-drug resistance was assessed as part of this work, and is presented in the systematic literature review (Chapter 2), and in both descriptive studies (Chapters 3 and 4). The results of the two retrospective descriptive studies presented show that there is a substantial proportion of submissions from young horses in New Zealand that grow multi-resistant bacterial isolates, and that there is decreased efficacy of commercially available antimicrobials in this country. The antimicrobial resistance reported in this study has potential clinical implications, and reflects the first step in a multifactorial approach to improve and maintain horse and human health.
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And of course, thank you to my mum!
Abbreviations

ACVIM American college of veterinary internal medicine
AMR Antimicrobial resistance
CC Clonal complex
CI Confidence interval
CIA Critically important antimicrobial
ESBL Extended-spectrum beta-lactamase
OR Odds ratio
MCA Multiple correspondence analysis
MDR Multi-drug resistance
MIC Minimum inhibitory concentration
MLST Multi-locus sequence typing
MPI Ministry for primary industries
MRCoNS Methicillin resistant coagulase-negative Staphylococcus species
MRS Methicillin resistant Staphylococcus species
MRSA Methicillin resistant Staphylococcus aureus
NZ New Zealand
OIE World organization for animal health (office international des epizooties)
PCR Polymerase-chain reaction
PFGE Pulse-field gel electrophoresis
PMQR Plasmid-mediated quinolone resistance
PRISMA Preferred reporting items for systematic reviews and meta-analysis
SVARM Swedish veterinary antimicrobial resistance monitoring
TMPS Trimethoprim-sulfonamide combination (i.e. trimethoprim-sulfamethoxazole, trimethoprim-sulphadiazine)
VRE Vancomycin resistant Enterococcus
WHO World health organisation
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