

## PORK SAFETY

**Title:** Associations among therapeutic and in-feed antimicrobial use and resistance in fecal commensals and pathogens of swine.  
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**Investigator:** Scott A. McEwen

**Institution:** University of Guelph

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### Abstract:

Antimicrobials are used in pork production for treatment and control of infectious disease and in some cases for promotion of growth and disease prevention. While these drugs are valuable, there have been concerns expressed about their role in promoting resistance among enteric bacteria. *E. coli* are important enteric pathogens and commensals of animals and humans and are important indicators of antimicrobial resistance.

There were two main components to this study: the first was a statistical analysis of a large body of resistance data collected in 1992 from weaner pigs, and the second was a follow-up investigation of the same farms and an analysis of temporal changes in resistance that could be attributed to on-farm antibiotic use. In the first component, 4356 *Escherichia coli* isolates were tested for resistance to seven antimicrobial drugs (ampicillin, carbadox, gentamicin, nitrofurantoin, spectinomycin, sulfisoxazole, and tetracycline) using a hydrophobic-grid membrane filter method according to N.C.C.L.S methods where applicable. The in-feed addition of a penicillin, carbadox, a sulphonamide and a tetracycline to weanling pig rations ("starter rations") was associated with increased risk of resistance to ampicillin, carbadox, sulfisoxazole and tetracycline, respectively. Individual weanling pig treatments were significant only in the ampicillin model. Management and housing factors were also significantly associated with the risk of resistance but without any consistent pattern. These results indicate that antimicrobial exposure to groups of pigs through feed is more consistently associated with increased risk of resistance among *E. coli* than individual animal treatment.

In the second component of the study, antimicrobial use data and an archive of fecal samples collected from 32 farms in 1992, along with a new series of comparable data from 1999, were used to identify temporal changes in the resistance pattern of *E. coli* and associations with antimicrobial use. Among the 32 farrow-to-finish farms sampled in 1992, 5 were no longer in business, and 10 changed their management practice to segregated early weaning or other system. No resistance was observed in any of the 900 *E. coli* isolates from both years, to amikacin, ciprofloxacin, florfenicol and nalidixic acid. Compared with 1992, the proportion of *E. coli* resistant to nitrofurantoin declined significantly ( $p < 0.01$ ). Although the prevalence of resistance increased in 14 of the 23 pairs of prevalences analyzed, only in 4 final regression models was this increase statistically significant (cephalothin, chloramphenicol and tetracycline at 8 and 16  $\mu\text{g/ml}$ ). In-feed administration of an antimicrobial was significant in several logistic regression models of resistance (i.e. ampicillin, carbadox, kanamycin, nitrofurantoin, spectinomycin, sulfisoxazole and tetracycline). However, individual treatment factors and in-water administration of antimicrobials were significant only in streptomycin and kanamycin models, respectively.

These studies provide further evidence that antimicrobial use in pork production is associated with increased risk of resistance among fecal *E. coli*. In-feed antimicrobials appear to be more consistently associated with increased risk than do individual-animal treatments.

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### For more information contact:

**National Pork Board, P.O. Box 9114, Des Moines, Iowa USA**

800-456-7675, Fax: 515-223-2646, E-Mail: [porkboard@porkboard.org](mailto:porkboard@porkboard.org), Web: <http://www.porkboard.org/>