

## PUBLIC HEALTHWORKER SAFETY

**Title:** Influence of on-site manure storage and land application strategy on the fate and transport of antimicrobials and antimicrobial resistance genes in the environment, **NPB #11-018**

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### Scientific Abstract

Land application of swine manure is important as it provides a source of nutrients and can increase soil productivity, improve water filtration and reduce the potential for soil erosion. Swine manure contains residues of antimicrobials and antimicrobial resistance (AMR) genes and the presence of these constituents has been documented in water bodies adjacent to animal production facilities. In this study, we investigated the role of antimicrobial administration, on-site manure storage, field application method (broadcast, incorporation, or injection) and timing of rainfall on antimicrobial and AMR genes in manure, soil and runoff. Antimicrobial concentrations in runoff and manure were determined using liquid chromatography tandem mass spectroscopy and AMR genes were evaluated using qPCR. Results from laboratory storage experiments indicated that both AMR genes and antimicrobials in swine manure decreased over a 40-day period under anaerobic conditions. A half-life of approximately 10 days was determined for chlortetracycline and decreases in AMR genes *tetX*, *tetQ*, *ermB*, and *ermF* were also observed. Observed decreases in AMR genes were approximately 1 order of magnitude over the 40 day study period. Although sharp decreases in CTC and TYL concentrations were observed during manure storage, similar trends were not observed for AMR genes. Instead, the decreases in AMR genes were more moderate. There could be multiple explanations for the difference in the chemical and microbial profiles. In this study, antimicrobial metabolites were not analyzed. Because some metabolites may still have antimicrobial effects, the total selective pressure could remain high during the storage period. Results from the land application experiments indicate that antimicrobials and AMR genes can be transported in runoff after land application of swine manure. It was determined that application method and the timing of rainfall had a significant effect on the concentration of antimicrobials in runoff, but the effect of these variables on AMR gene transport was not as clear. AMR genes were determined to be transported vertically in the soil profile after three consecutive rainfall application experiments. In addition, mass loading rates for antimicrobials after land application were calculated. Mass loading rates for chlortetracycline ranged from 4.5 to 0.15 ug/m<sup>2</sup> for broadcast manure to 0.27 to 0.09 ug/m<sup>2</sup> for injected manure. Tylosin mass loading rates were highest for broadcast manure (280 to 56 ug/m<sup>2</sup>) and lowest for injected manure plots (1.7 to 5.2 ug/m<sup>2</sup>). Essentially no bacitracin was detected in runoff regardless of manure application strategy or rainfall timing. No bacitracin resistance genes were detected in manure.

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