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Antibiotic Residues and Antibiotic Resistant Bacteria Near Agricultural and Municipal Sources

Recent studies have reported an increase in the presence of multiple antibiotic resistance (MAR) bacteria in nature and a high correlation between positive MAR results and the presence of human pollution sources. At the same time, there is increasing evidence of antimicrobial residues in surface waters and sediment. However, it remains unclear how important these residual antibiotics are in contributing to observed MAR patterns in surface waters. Is the presence of MAR bacteria in nature due to release of the MAR bacteria themselves or to chronic exposure to antibiotics or both? We have hypothesized that the ability to detect these compounds provides a means to potentially establish the link between environmental exposure to antimicrobials and the presence and persistence of antibiotic resistant bacteria. The measurement of residual levels of both veterinary and human antibiotics found in the environment also could help to differentiate the source of antibiotics that has the greatest influence on resistance in nature. In this paper we will present initial results of a field study in Eastern North Carolina designed to identify and track sources of antibiotics to the environment and relate these residues to observed MAR patterns. Preliminary data provide a very good picture of the spatial and temporal patterns of antibiotic residues coming from both agricultural and municipal sources. We document the source and downstream depletion of antibiotics due to dilution, partitioning to sediment, and degradation. Although the antibiotic residue patterns are generally consistent with MAR patterns, there is a high degree of variability with many positive MAR results at sites with little or no antibiotic residue. In addition, the antibiotic residues in the surface waters are very low (parts per trillion) and thus may not support the development of resistance in natural populations. This latter point is the subject of ongoing investigation.

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