ANTIMICROBIAL RESISTANCE IN SALMONELLA FROM 1997-2003 NARMS SWINE SAMPLES

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Abstract A total of 3246 swine slaughter and 3147 swine diagnostic Salmonella isolates from the National Antimicrobial Resistance Monitoring System (NARMS) for the years 1997-2003 were tested for antimicrobial resistance. No resistance was detected in any Salmonella isolates for ciprofloxacin or amikacin. For all other antimicrobics tested, more resistance was observed in diagnostic isolates compared to slaughter isolates. In 2003, more than 50% of diagnostic isolates were resistant to 4 antibiotics: tetracycline (77.4%), streptomycin (75.5%), sulfamethoxazole (65.5%), and ampicillin (57.1%). Tetracycline (30.8%) was the antimicrobial with the most resistance in slaughter isolates. Continued monitoring of both slaughter and diagnostic isolates from swine are needed to demonstrate if changes industry use patterns of antimicrobials lead to changes in resistance patterns of Salmonella isolates from swine.

Introduction Public health concerns associated with the use of antimicrobials in livestock led to the development of the National Antimicrobial Resistance Monitoring System (NARMS) in 1996. The program was developed in part as a mechanism to monitor the effect of the use of veterinary antimicrobials on changes in antimicrobial resistance patterns in bacteria associated with farm animals. Non-typhoid Salmonella were selected as the sentinel organism and have been continuously tested for since 1997. This paper focuses on the monitoring of resistance changes in Salmonella isolated from diagnostic and slaughter samples from swine from 1997–2003.

Materials and Methods Slaughter samples were collected and cultured by the USDA, FSIS, and diagnostic samples were collected and cultured by state veterinary laboratories around the U.S or the USDA, APHIS, National Veterinary Services Laboratory (NVSL). Slaughter and diagnostic isolates were shipped to USDA, ARS in Athens, GA. All Salmonella isolates were serotyped at the NVSL in Ames, IA. After serotyping, 3246 slaughter and 3147 diagnostic isolates were tested for antimicrobial resistance using custom made plates containing up to 16 antimicrobics in a semi-automated minimal inhibitory concentration format system (SensititerTM, Trek Diagnostic) at the USDA, ARS in Athens, GA. Isolates were classified as susceptible, intermediate, or resistant based on Clinical Laboratory Standards Institute (CLSI) (formerly National Committee for Clinical Laboratory Standards) established breakpoints, where available.

Results No resistance was detected in any Salmonella isolates for ciprofloxacin or amikacin. For all other antimicrobics tested, more resistance was observed in diagnostic isolates than in slaughter isolates. In 2003, more than 50% of diagnostic isolates were resistant to tetracycline (77.4%), streptomycin (75.5%), sulfamethoxazole (65.5%), and ampicillin (57.1%). For slaughter isolates, tetracycline (30.8%) was the antimicrobial with the most resistance. Also, in 2003, amoxicillin, cefoxitin, ceftiofur, cephalexin, and chloramphenicol resistance in diagnostic isolates was 10–20% greater than in any previous year. An analysis of antimicrobial resistance profiles of the eight most frequently identified serotypes of Salmonella suggests that S. Derby, Typhimurium var. Copenhagen, Typhimurium, Heidelberg, and Agona were more resistant to tetracycline, sulfamethoxyazole, and streptomycin, with little difference observed between slaughter and diagnostic isolates. More ampicillin resistance was observed with slaughter and diagnostic isolates of S. Typhimurium var Copenhagen, Typhimurium, and diagnostic isolates of Agona. S. Heidelberg appears to be developing more resistance to ampicillin and ceftiofur in diagnostic isolates and to streptomycin and tetracycline in slaughter isolates. Multiple drug resistance will be reported in a separate paper.
Discussion A limited number of studies have closely examined the development of antibiotic resistance in *Salmonella* from swine samples. Cray *et al.* (1999) reported on the swine NARMS samples collected in 1998 and as in this larger study reported that more resistance was seen in diagnostic samples than in slaughter samples and that most resistance was to tetracycline, streptomycin and sulfamethoxazole. Farrington and co-workers (2001) determined antibiotic resistance patterns of 365 *Salmonella* isolates from lymph nodes and cecal content of market-age swine at slaughter, and reported that although no subtherapeutic antibiotics were used on the farm in the past five years that resistance to chlorotetracycline, penicillin G, streptomycin, and sulfisoxazole was common. These authors suggest that a correlation exists between the somatic serogroup or serovar of a *Salmonella* isolate and its antimicrobial resistance status. Although specific serotypes of *Salmonella* may possess different susceptibilities to antibiotic resistance, it is also possible that the source, diagnostic versus slaughter, may contribute more to the development of resistance than does the specific serotype.

Conclusion Continued monitoring of both slaughter and diagnostic isolates from swine are needed to demonstrate if changes in industry use patterns of antimicrobials lead to changes in resistance patterns of *Salmonella* isolates from swine. More directed studies are needed to determine if development in resistance characteristics if individual *Salmonella* isolates is influence more by serotype or more by sample source.

References