

Multidrug Resistant *Salmonella* in Nebraska

by Paul D. Fey, Ph.D.

An estimated 800,000 to four million salmonella infections occur in the United States each year. Most infections are gastrointestinal, self-limiting, and do not require antibiotic treatment. However, in the approximately 3-10% of patients that become septic after contracting salmonella gastroenteritis, appropriate antibiotic therapy is essential. Therefore, it is imperative to monitor resistance in the salmonella to clinically relevant antibiotics (e.g. fluoroquinolones, ceftriaxone, trimethoprim-sulfamethoxazole) both locally and nationally.

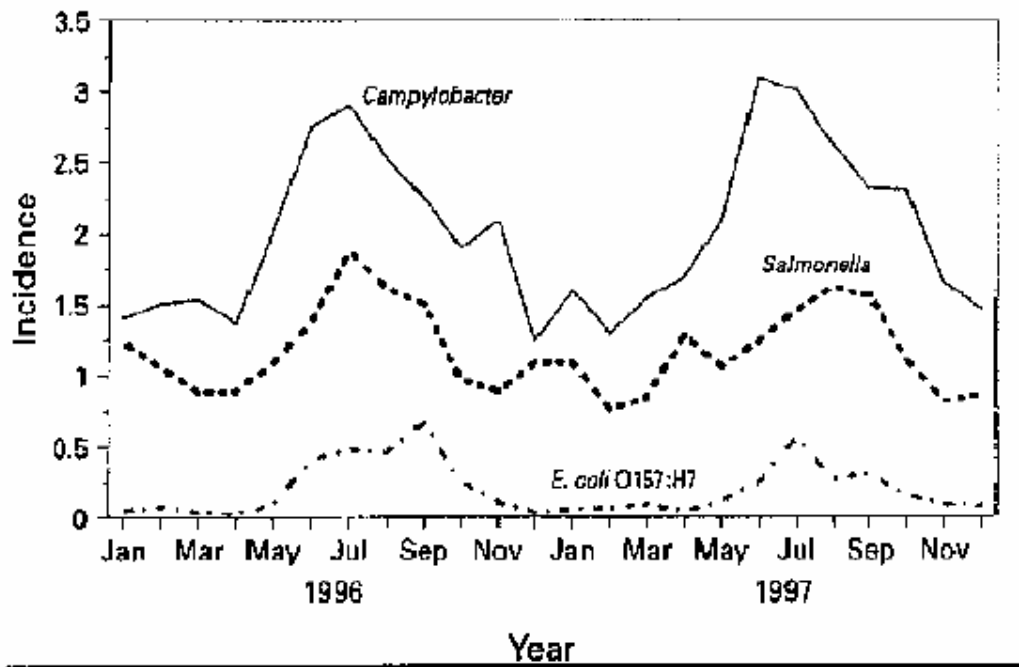
Antimicrobial-resistance surveillance studies performed recently in both the United States and the United Kingdom have shown a marked increase of a five-drug resistant strain of *Salmonella* serotype Typhimurium serotype designated as phage type DT104. The Typhimurium prevalence of DT104, which is usually resistant to ampicillin, chloramphenicol, streptomycin, sulphonamides, and tetracycline, has increased from 0.6% in 1979-80 to 34% in 1996. Similarly, submissions of DT104 to the Laboratory of Enteric Pathogens in the UK increased from 250 in 1990 to 4006 in 1996. 14% of these isolates in 1996 from the UK were also resistant to ciprofloxacin. Of further concern, a report from the UK suggests that DT104 may be associated with significantly greater morbidity and mortality than other phage types of *Salmonella* serotype Typhimurium.

Due to the national and international epidemic of DT104, the Nebraska Public Health Laboratory (NPHL) has been testing all *Salmonella* serotype Typhimurium for resistance to ampicillin, chloramphenicol, and tetracycline to screen for the DT104 phage type. In May of 1998, a *Salmonella* serotype Typhimurium var. copenhagen (SS/34) was sent to the NPHL from Kimball County, Nebraska. This isolate was resistant to ampicillin, chloramphenicol, tetracycline, as well as ceftriaxone. Due to the unusual nature of this resistance profile, the isolate was sent

to the Centers for Disease Control and Prevention for phage typing. The isolate was found to react to a specific set of salmonella phages, but did not conform to any known phage type and was not related to the DT104 phage type. Further susceptibility testing performed at the NPHL found that SS/034 was resistant to all penicillins, penicillin/b-lactamase inhibitor combinations, gentamicin, tobramycin, kanamycin, streptomycin, first and second generation cephalosporins, chloramphenicol, tetracycline, and sulphonamides. Subsequent genetic studies have shown all resistance determinants excluding kanamycin are encoded on a large (~200 Kb) conjugative plasmid. Additionally, DNA sequencing has revealed that the beta-lactamase which is conferring the resistance to the third-generation cephalosporins is a member of the BIL-1, LAT-1, CMY-2 family of plasmidic beta-lactamases. These beta-lactamases are all highly related to the chromosomal beta-lactamase of *Citrobacter freundii*.

Expanded-spectrum cephalosporin resistance in the *Salmonella* is rare in the United States, and has not reached the prevalence as that found in *Klebsiella pneumoniae* and *Escherichia coli*. In fact, according to the CDC, this is the first case of a domestically acquired *Salmonella* infection which is resistant to expanded-spectrum cephalosporins in the United States, making it the most resistant *Salmonella* ever isolated in the United States. Additional surveillance is needed to determine the prevalence of isolates similar to SS/034, as well as phage type DT104, in the State of Nebraska, the United States, and abroad. For further information, please contact Dr. Paul D. Fey at 559-2122.

Monthly Incidence[†] of Selected Pathogens—FoodNet,^{**} 1996-1997



[†] Per 100,000 population.

^{**} Laboratory-confirmed cases of *Campylobacter*, *Escherichia coli* O157:H7, and *Salmonella* infections were identified in Minnesota, Oregon, and selected counties in California (two), Connecticut (three), and Georgia (eight in 1996 and 20 in 1997). The Foodborne Diseases Active Surveillance Network (FoodNet), the primary foodborne diseases component of CDC's Emerging Infections Program, was developed to better characterize, understand, and respond to foodborne illnesses in the United States. MMWR 1998; 37: 762-85.