

Shedding of *Salmonella* by Finisher Hogs in the U.S.

"Over 9,000 people are affected by an outbreak of *Salmonella*." The year was 1954. The place was Sweden. Today, Sweden and many other Scandinavian countries have stringent *Salmonella* monitoring and control programs. Similarly, in the U.S., a 1993 outbreak of *E. coli* O157:H7 in the Pacific Northwest and the contamination of ice cream across the Midwest with *Salmonella* in 1994 ignited public concern for food-borne pathogens.

There are approximately 2,400 known serotypes of *Salmonella* found in animals and the environment. Salmonellosis in swine should be viewed as two separate problems. One which is a disease of swine causing a septicemia with pneumonia and/or diarrhea as clinical signs. The second is contamination of pork carcasses and retail products with the potential of causing a food-borne illness in people.

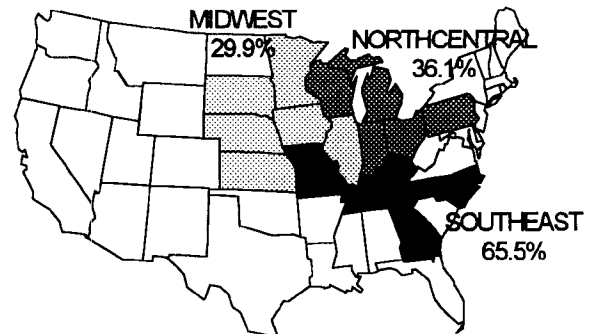
In 1995, the USDA's National Animal Health Monitoring System (NAHMS) conducted a national study of U.S. pork producers in 16 states that contained nearly 91 percent of the U.S. hog inventory. A primary objective was to generate information regarding the presence of food-borne pathogens, such as *Salmonella*, on the farm.

Additionally, the NAHMS Swine '95 study will help identify on-farm factors that may be useful in controlling shedding of these organisms and reduce the risk of food-borne illness due to consumption of contaminated pork. Carrier animals can shed *Salmonella* without exhibiting clinical signs of disease.

One hundred and sixty (160) of the NAHMS Swine '95 producers were selected to participate in the collection of 50 fecal samples from their farm. Samples were collected from pens of late finish hogs

Figure 1

Percent of Operations with at Least One Fecal Sample Positive for *Salmonella* by Region



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and sent to the USDA's National Veterinary Services Laboratories (NVSL) and National Animal Disease Center (NADC) to be tested for the presence of *Salmonella* and other food-borne pathogens. A total of 6,655 samples were collected from 988 pens on 152 operations.

Evidence of *Salmonella* in fecal samples was found on 58 (38.2 percent) of the operations. Figure 1 shows a greater proportion of operations with positive samples in the southeastern states (65.5 percent) as compared to the Midwest (29.9 percent) and the Northcentral states (36.1 percent). It is not clear whether this distribution was related to climate, differences in herd size, or other regional management factors.

The proportion of herds shedding *Salmonella* increased with herd size, from 32.2 percent of herds marketing less than 2000 head annually to 45.6 percent and 57.1 percent for herds marketing 2,000 to 9,999 and 10,000 or more head, respectively.

Salmonella was found in 173 (17.5 percent) of the 988 pens sampled. Up to 10 pens were sampled per farm. The percentage of pens on a farm that contained at least one positive sample ranged from 10

to 100 percent. Figure 2 shows the distribution of farms by the percent of pens positive. Thirty-five of the 58 positive farms (60.3 percent) had a positive sample in less than half of the finisher pens tested. However, one-fourth (15) of the operations had evidence of active shedding of *Salmonella* in more than two-thirds of their finisher pens.

Single sex pens were twice as likely to contain pigs shedding *Salmonella* (25 percent for pens containing either gilts only or barrows only) than mixed pens (12.7 percent).

Of the 6,655 samples collected from finisher pens, 398 samples (6.0 percent) were positive for *Salmonella*, indicating that *Salmonella* is sporadically shed at low levels. Of the more than 2,400 serotypes of *Salmonella* identified, the 10 most frequent serotypes shed by finish hogs accounted for 85 percent of the isolates found in this study (Table 1).

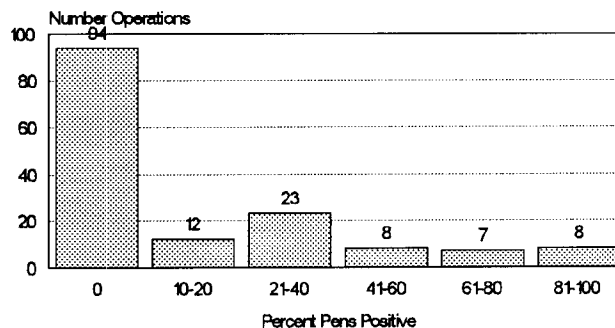
Some of the more frequent serotypes isolated from swine are *S. derby*, *S. agona*, *S. typhimurium copenhagen*, *S. brandenburg*, and *S. mbandaka*. Even though these latter serotypes are often isolated from pigs, they seldom cause clinical disease. Four of the serotypes are also present on the Centers for Disease Control and Prevention's (CDC) list of top 10 isolates from human cases (see bolded serotypes in Table 1). Thus, these isolates are more of a concern of possible carcass contamination.

Salmonellosis, besides being a swine pathogen, has become one of the top food-borne health concerns in the U.S. *Salmonella* serotypes known to cause illness in humans are shed by clinically normal finishing hogs in the U.S. Prevalence of shedding *Salmonella* by finishing hogs on an operation is variable. Overall, shedding of *Salmonella* by finishing hogs occurs at low levels (6.0 percent of samples) on roughly four out of 10 operations (38.2 percent).

NAHMS collaborators on the Swine '95 study included the National Agricultural Statistics Service (NASS) and State and Federal Veterinary Medical Officers and Animal Health Technicians.

Figure 2

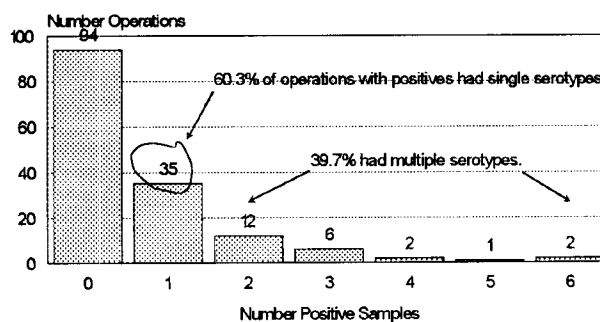
Number Operations by Percent of Pens with at Least 1 Positive Fecal Sample for *Salmonella*



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Figure 3

Number of *Salmonella* Serotypes Isolated per Operation



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Table 1

Top 10 *Salmonella* Serotypes Isolated from Three Data Sources

	Swine '95: Non-clinical finishing swine	NVSL: Clinical swine	CDC: Human
1	<i>S. derby</i>	<i>S. derby</i>	<i>S. enteritidis</i>
2	<i>S. agona</i>	<i>S. cholerasuis kunzendorf</i>	<i>S. typhimurium</i>
3	<i>S. typhimurium copenhagen</i>	<i>S. typhimurium copenhagen</i>	<i>S. heidelberg</i>
4	<i>S. brandenburg</i>	<i>S. agona</i>	<i>S. newport</i>
5	<i>S. mbandaka</i>	<i>S. typhimurium</i>	<i>S. hadar</i>
6	<i>S. typhimurium</i>	<i>S. heidelberg</i>	<i>S. agona</i>
7	<i>S. heidelberg</i>	<i>S. cholerasuis</i>	<i>S. martevidae</i>
8	<i>S. anatum</i>	<i>S. anatum</i>	<i>S. oranienburg</i>
9	<i>S. enteritidis</i> BA	<i>S. mbandaka</i>	<i>S. thompson</i>
10	<i>S. worthington</i>	<i>S. schwarzengrund</i>	<i>S. muenchen</i>

Swine '95: Isolates from randomly selected operations across the U.S. (sample collection: 7/95-1/96).
 NVSL: Isolates from diagnostic laboratories across the U.S. (samples submitted: 7/94-6/95).
 CDC: Isolates from across the U.S. (samples submitted: 1994).

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Centers for Epidemiology and Animal Health
 USDA:APHIS:VS, attn. NAHMS
 2150 Centre Ave., Bldg. B, MS 2E7
 Fort Collins, CO 80526-8117
 (970) 494-7000
 E-mail: NAHMSweb@aphis.usda.gov
<http://www.aphis.usda.gov/vs/ceah/cahm>

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