Risk factors for high levels of antibody to *Salmonella* spp. among market weight pigs.

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Exposure to *Salmonella* spp. results in detectable antibody, and assays have been described to measure this response (Mousing et al., Gray and Fedorka-Cray). We designed this study to describe the strength of association between potential herd-level risk factors for exposure and/or transmission of *Salmonella* spp. and the detection of antibodies against *Salmonella* spp. in commercially produced, slaughter-weight pigs.

**Methods and Materials:** Farms participating in a health monitoring program were eligible for this study if they were in the state of Minnesota and were within a 200 km radius of one slaughter plant. A survey of 72 questions, designed to collect information in the areas of health, facility design, hygiene and biosecurity, and farm management was administered by personal interview. Two investigators (Fransen L and Grass J) validated responses by direct visual inspection. In cases where questions could not be answered at the time of the visit, respondents were provided a copy of the survey and asked to return it by post. One investigator visited each farm within 48 hours of shipment to slaughter, individually identified the animals to be shipped and collected a blood sample.

Ten variables representing potential risk factors among growing pigs were defined. These were the same variables assessed for risk of culture positive status (Bahnson, et al.), except that variables related to transportation to and lairage at slaughter were excluded.

Antibodies were detected from 15 serum samples per herd using a mixed antigen ELISA (Davies et al., 1997b). Briefly, heat extracted antigens from four *Salmonella* reference strains, *S. typhimurium* 798, *S. choleraesuis* 3246pp, *S. enteriditis* ATCC 21108, and *S. anatum* 281-43, were used to coat 96 well microtiter plates. These represent
serogroups B, C1, D1, and E1, and account for a high percentage of U.S. swine isolates. Test serum was diluted 1:160 in diluent buffer (0.01M PBS, pH 7.2, 0.05% Tween 20, 0.5% BSA), a dilution that was selected based on the flat portion of the ELISA response curve. A single serum positive control was run in duplicate and one negative serum control derived from another study (Kim, et al.) were added in each plate. Results were reported as a ratio of the optical density of the sample well to that of the positive control well. Pigs with a test result greater than the median value of this population were classified “responders” for further analysis.

**Results.** The mean herd-level prevalence of responders was 48.9%, with a range of 0-100% prevalence (65 herds, 1120 pigs). Among 48 herds with complete survey results, all possible regression models were created, and the adjusted $R^2$ statistic was used to compare the best fitting models across subsets. The model with the highest adjusted $R^2$ (adjusted $R^2 = 0.22$, $R^2 = 0.30$) associated increasing seroprevalence with solid flooring ($p < 0.01$) and the combined effect of good hygiene and batch pig flow ($p < 0.01$). Pen divisions that allow pig to pig contact, access to non-swine domestic animals and 100% nipples for water delivery were marginally associated with seroprevalence ($0.1 < p < 0.2$).

**Discussion.** Solid floors result in increased exposure to feces and a consequent increase in high responding pigs, a finding that has been reported elsewhere (Davies et al., 1997a). In contrast, the combination of good hygiene and batch pig flow might be expected to reduce exposure to *Salmonella* and has been associated with decreased risk of *Salmonella* culture prevalence (Bahnson, et al.) and chemical disinfection has been associated with a decreased risk of *Salmonella* antibody occurrence (van der Wolf, et al.). Higher seroprevalence in this group indicates cycling of *Salmonella* and suggests that either the hygiene and biosecurity practices among these farms are not effective, or other, non-recorded risk factors have caused the exposure that resulted in increase seroprevalence.

The comparison of statistical models with nearly identical goodness of fit suggests that other factors are likely associated with risk of antibody responder status in this population. Examination of the strength of association for these factors may help prioritize future research efforts. The factors identified here differ from a parallel assessment of risk factors for culture results (Bahnson et al.), suggesting that factors most important for exposure and/or immune response to *Salmonella* spp. may differ from most important factors for shedding of the organisms at slaughter age.
References:


