Salmonella Atlas

Salmonellosis is one of the more common bacterial pathogens causing intestinal infections. A new atlas from CDC is providing a summary of decades of surveillance data for common forms of Salmonella.

The Organism

In 1885, the researcher Theobald Smith isolated the bacterium Salmonella while searching for the cause of hog cholera, which was eventually found to be a viral infection. The genus was named for the United States Department of Agriculture (USDA) program administrator, Daniel Salmon. There are currently two known species in the genus, Salmonella bongori and S. enterica, the latter including thousands of serovars (serological variants) which are often geographically named for the location first isolated. The full name of a familiar organism is Salmonella enterica subspecies enterica serovar Enteritidis, more commonly thought of as the serotype Salmonella Enteritidis.

Salmonella are found worldwide, occurring in the digestive tracts of mammals, birds, reptiles, and amphibians, as well as persisting in the environment. Often the organisms have no effect on the host animals, particularly cattle, birds, and reptiles, but are pathogenic for humans.

An estimated 1.2 million cases of salmonellosis occur each year in the United States but only around 42,000 cases (3.5%) are laboratory confirmed. While intestinal infection is most common, there can also be infections of the bloodstream, spinal fluid, joints, bones, or organs. A few serotypes such as S. Typhi can cause systemic illness with fever, rash, abdominal symptoms, and other complications. Salmonellosis diarrhea can be severe in younger children, the elderly, and persons with immune suppression including sickle cell anemia and untreated HIV infection. Some intestinal infections are apparently minimal, and are detected only when a urinary tract infection develops through skin contamination.
The Atlas

Centers for Disease Control and Prevention (CDC) just released “An Atlas of *Salmonella* in the United States, 1968-2011” which is based on national laboratory surveillance. In most states, including Washington, clinical laboratories are required to submit all *Salmonella* isolates to a public health laboratory at the local or state level. These public health laboratories receive the *Salmonella* isolates from the clinical laboratories, identify the *Salmonella* serotypes, and report results to the clinician, the state department of health, and CDC. Any unusual *Salmonella* isolates that cannot be serotyped are forwarded to CDC for characterization.

Four decades of *Salmonella* data were analyzed for the 30 most common serotypes. These 30 serotypes encompass the most prevalent serotypes in Washington State for most years where the top five serotypes for 2009-2013 were *S.* Enteritidis (21%), *S.* Typhimurium (16%), *S.* Heidelberg (7%), *S.* Newport (5%), and *S.* Montevideo (3%). National time trends for each serotype are given by year and by onset month. The analyses and figures were developed by age, gender, geography to the county level, and specimen anatomic source.

Specimen source for the *Salmonella* isolates is predominantly stool, consistent with diarrhea as the predominant symptom of salmonellosis. *S.* Typhi is an exception to this pattern, with blood more common than stool as the source of the positive culture. Urine isolates can occur and are more common for certain *Salmonella* serotypes such as *S.* Senftenberg (10%) and *S.* Mdandaka (9%) (Figure 1).

For most *Salmonella* serotypes, children under five years of age have a consistently elevated rate as compared with the remainder of the population for the entire surveillance period. This elevation may reflect higher susceptibility to the infection, risk of more severe disease if
infected, and patterns of health care by which younger children are more likely to be seen by a healthcare provider for diarrhea and are more likely to have stool cultures taken for bacterial agents when seen by a provider.

S. Typhimurium is the most commonly identified serotype in the United States, while the second most common in Washington. The national time trend reveals one of the largest salmonellosis outbreaks identified in the country and the particular risk for younger children. In 1985 there were over 150,000 salmonellosis cases and possibly as many as 250,000 cases associated with widely distributed commercial milk that was contaminated after pasteurization. A major spike in salmonellosis cases for that year can be seen for younger children (Figure 2).

The atlas includes data for non-human isolates, both clinical testing for animal diagnosis and non-clinical testing. While unlikely to be representative data, the results can suggest most likely sources of exposure for cases of salmonellosis. For example, origins for the non-human isolates of S. Enteritidis, S. Heidelberg and S. Thompson are primarily chickens, suggesting that poultry products and/or eggs are risks for this serotype (Figure 3). In contrast, S. Reading and S. Saintpaul are most associated with turkey. A majority of non-human S. Derby and S. Panama isolates are from pigs, S. Montevidoe and S. Newport are most commonly isolated from bovine specimens, and S. Poona and S. Stanley have a marked reptile association.

Although the atlas is slow to load and not recommended for light reading, it demonstrates how compiling surveillance data over space and time and produce useful information. Check out the full publication at: