

# SALMONELLA

## ID CORNER

# Overview of *Salmonella* Outbreaks in Wisconsin and the United States

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**S**almonellosis is a common gastrointestinal illness caused by the Gram-negative bacilli bacteria *Salmonella*.<sup>1</sup> More than 95% of human *Salmonella* infections occur through the ingestion of a contaminated food item, most commonly meat, poultry, eggs, unpasteurized dairy products, and fresh produce.<sup>2</sup> Additionally, transmission can occur through the handling of reptiles, chickens, birds, and other animals without thorough handwashing afterwards. Multiple reports of reptile-associated transmissions have occurred in the United States, accounting for approximately 3-5% of *Salmonella* infections in the United States.<sup>1</sup>

Within the *Salmonella* genus, there are over 2,500 different serotypes, but many are rare and unstudied with less than 100 serotypes accounting for most human infections. The most common serotypes identified in the United States includes *Salmonella* serotype Typhimurium and *Salmonella* serotype Enteritidis.<sup>2</sup> The Centers for Disease Control and Prevention (CDC) estimates that *Salmonella* causes about 1.2 million illnesses, 23,000 hospitalizations, and 450 deaths in the

United States every year.<sup>2</sup> Patients at the highest risk of developing *Salmonella* infection include children under the age of five. As with most foodborne illnesses, the peak occurrence occurs during the summer months.

The most common form of salmonellosis is a self-limited, uncomplicated gastroenteritis leading to diarrhea, abdominal cramps, nausea, vomiting, and fevers in infected individuals. The onset of symptoms typically occurs between 12 and 72 hours after infection, with the illness lasting anywhere between 4 to 7 days.<sup>2</sup> Symptoms are usually indistinguishable from other gastrointestinal (GI) pathogens, such as *Campylobacter* or *Yersinia*, however a clinical diagnosis can be made based on assessment of patient risk factors and isolation of *Salmonella* from a clinical sample, such as a stool or blood culture.<sup>1</sup> Other rapid diagnostic testing methods, such as NAAT and panel-based molecular diagnostics can also be utilized to distinguish *Salmonella* from other causes.<sup>9</sup>

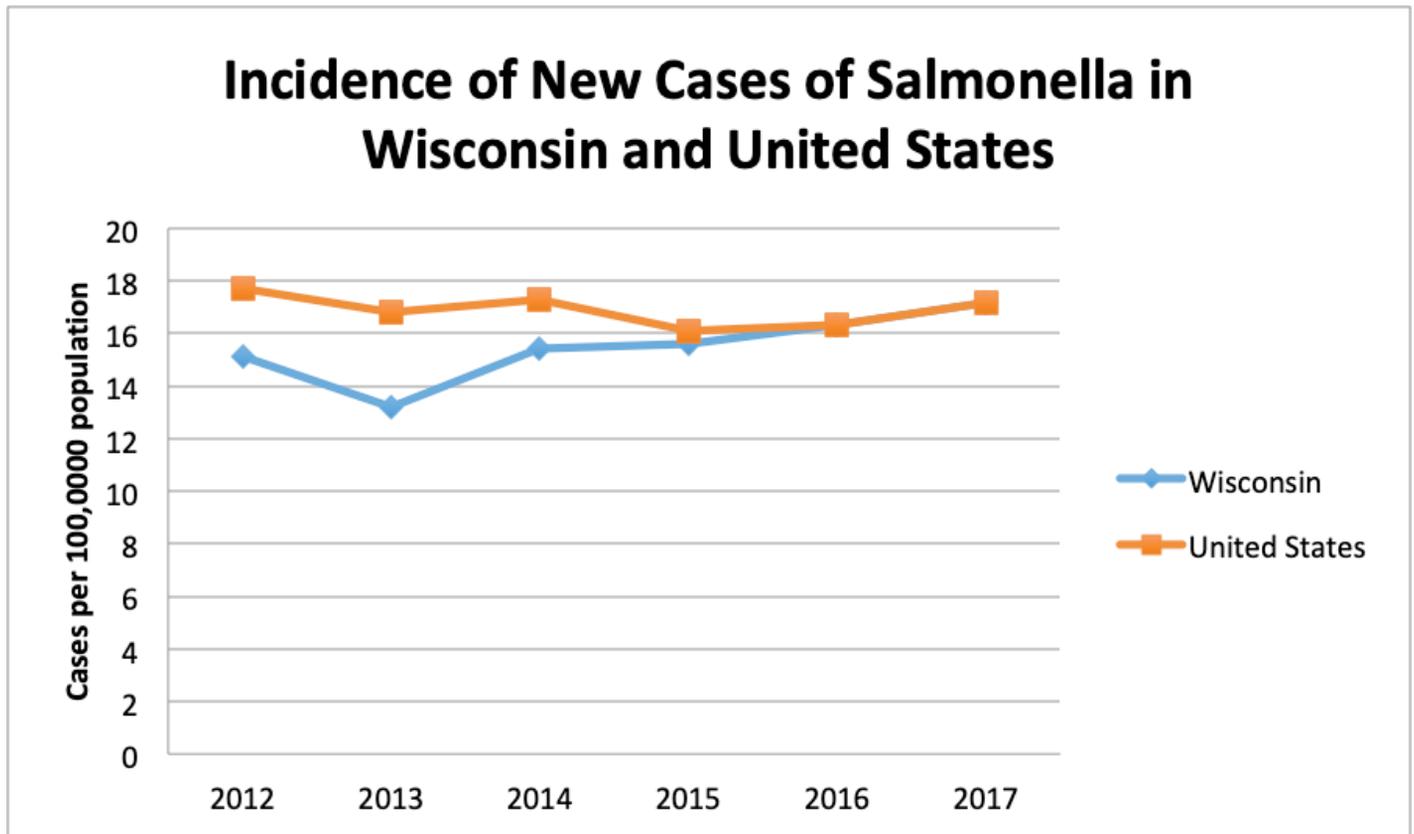
Although less common, more serious complications of salmonellosis can occur. Bacteremia occurs in approximately 1-4%

of immunocompetent patients, but the risk is much higher for younger children, elderly adults, and immunocompromised persons.<sup>1</sup> Vascular complications can occur in 10-25% of adults with bacteremia, which includes seeding of atherosclerotic plaques or aneurysms, or less commonly, venous thrombophlebitis. In addition, bacteremia can lead to localized infections in 5-10% of cases, including meningitis, endocarditis, pneumonia, empyema, abscess formation, osteomyelitis, or septic arthritis.<sup>1</sup> Antibiotics are often indicated in severe hospitalized patients with complications, but can be complicated by rising rates of *Salmonella* resistance in the United States, which limits the viability of early empiric antibiotic therapy in many patients.<sup>3</sup>

## Outbreaks

The CDC has several surveillance systems in place for obtaining information about *Salmonella*, including information on the number of outbreaks, antimicrobial-resistant infections, and subtypes (Figure 1).<sup>4</sup> One of the largest outbreaks ever recorded in the United States occurred in 1985, where a strain of *Salmonella*

FIGURE 1. Incidence of New Cases of Salmonella in Wisconsin and United States<sup>11</sup>



Typhimurium in milk was traced back to a dairy farm in Illinois. At that time, over 16,000 people were infected across multiple states, primarily including Illinois, Indiana, Iowa, Michigan, Minnesota, and Wisconsin.<sup>4</sup> There have been no outbreaks of such magnitude since 1985 however, there are frequently smaller outbreaks reported each year. Several recent notable outbreaks have resulted in the presence of multidrug resistant *Salmonella* and the recall of several products.

On October 17th, 2018, the CDC and public health officials investigated a multistate outbreak of *Salmonella* Infantis infections that were linked to raw chicken products.<sup>5</sup> The outbreak resulted in 92 reported cases of *Salmonella* across 29 states, leading to 21 hospitalizations.<sup>5</sup> Although the outbreak strain was identified in samples taken from raw chicken pet food, raw chicken products, and live chickens, no single common supplier was identified as a source.<sup>5</sup> An analysis of isolates from 43 ill people and 68 samples found predicted resistance to a variety of generic antibiotics, including: ampicillin, ceftriaxone, chloramphenicol,

ciprofloxacin, fosfomycin, gentamicin, tetracycline, and trimethoprim-sulfamethoxazole.<sup>5</sup>

More recently, as of November 5th, 2018, an outbreak of *Salmonella* Reading was reported in 35 states, resulting in 164 reported cases, 63 hospitalizations, and 1 death.<sup>5</sup> Epidemiologic and laboratory evidence linked the outbreak to raw turkey, which resulted in a recall of over 90,000 pounds of raw ground turkey products by Jennie-O Turkey<sup>®</sup> Store Sales in Barron, Wisconsin.<sup>5</sup> Similarly, on October 4th, 2018, another *Salmonella* outbreak was linked to contaminated beef products sold from JBS Tolleson, Inc., of Tolleson, Arizona. This outbreak resulted in almost 7 million pounds of beef product being recalled due to 246 reported cases across 25 states and 59 hospitalizations.<sup>5</sup> Although there were very few deaths reported in these instances, it is important to be aware of the proper prevention and treatment strategies when symptoms are recognized and suspected of a *Salmonella* infection.

## Treatment

Non-typhoidal *Salmonella* (NTS)

infection can manifest as either enterocolitis with diarrhea or as an invasive disease.<sup>6</sup> Treatment for NTS gastroenteritis primarily consists of supportive therapy including fluid and electrolyte replacement.<sup>7</sup> Antibiotics are not indicated for nontoxic immunocompetent patients with NTS gastroenteritis due to the self-limiting nature of the infection. A Cochrane Review including 12 trials and 767 participants detected no difference in duration or severity of illness and a higher number of adverse events among participants who received antibiotics.<sup>6</sup> Furthermore, some studies note that antibiotic use may actually prolong *Salmonella* shedding.<sup>6,8</sup>

The patient populations where antibiotics are recommended in addition to supportive management include neonates, adults at least 50 years of age with a history of atherosclerosis, immunosuppression, cardiac disease, significant joint disease, incapacitating diarrhea, hospitalization, or patients with severe disease, defined as 8 or more loose stools per day.<sup>7-9</sup> Extraintestinal manifestations occur most often in immunocompromised individuals

and can affect the meninges, bone, kidneys, lungs, joints, heart, and adrenal gland.<sup>6</sup> For severe disease, first line therapy is ceftriaxone 1-2g intravenous (IV) every 24 hours.<sup>7-9</sup> Alternative antibiotic options include ciprofloxacin, azithromycin, and sulfamethoxazole-trimethoprim. In the case of bacteremia, IV antibiotics are the mainstay of therapy with ceftriaxone as the preferred option. Recommended duration of antimicrobial therapy is 3-7 days for immunocompetent patients without bacteremia and 7-10 days for bacteremia. For extraintestinal infections, antibiotic therapy is usually prolonged and may require surgical resection or drainage to eradicate the infection.<sup>7</sup> Duration of therapy in immunocompromised patients can vary greatly and is usually greater than fourteen days.

A recent challenge to the treatment of these infections is the global increase in antibiotic resistant NTS, including resistance to fluoroquinolone and third generation cephalosporin.<sup>8</sup> Resistant strains result from the use of antimicrobial agents in food animals and the transmission to humans through the food supply.<sup>10</sup> Susceptibility testing is encouraged for invasive NTS infections and bacteremias.<sup>8</sup>

## Prevention

The most important way to decrease salmonellosis outbreaks is to emphasize prevention. Prevention and control of salmonellosis requires identification and removal of controllable hazards and the recognition of foodborne outbreaks.<sup>7</sup> NTS is primarily transmitted via the fecal-oral route; therefore, various infection control measures are aimed at increasing sanitation and hygiene. To limit the risk of healthcare-associated transmission, health care personnel should use personal protective equipment when performing direct patient care or handling soiled articles. Appropriate and timely laboratory tests and prompt reporting of positive cultures to local public health departments are a very important way healthcare systems can contribute to controlling outbreaks. Healthcare providers should also provide counseling and education to the public, specifically targeting patient populations at increased risk for complications including immunocompromised, pregnant women,

and the elderly.<sup>9</sup> For preventing the transmission in a non-health care setting, good personal hygiene and adhering to standards for safe food handling are also an important and cost-effective approach to controlling salmonellosis.<sup>7</sup> Routine screening for asymptomatic carriage of NTS is not recommended but is sometimes performed for food handlers who are symptomatic. Since animals are a major reservoir of NTS infections, vaccination of feed animals and reducing antibiotics as growth promoters are important in declining incidence as well as controlling resistant salmonellosis.<sup>6,8</sup> Prevention strategies for the community emphasize personal hygiene, specifically hand hygiene after using the toilet, changing diapers, before and after preparing food, before eating, after handling garbage or laundry.<sup>9</sup> It is important that consumers also avoid consumption of raw or undercooked eggs or poultry and use pasteurized eggs whenever possible.<sup>7</sup> Because of the adverse health consequences associated with the increasing incidence of antimicrobial-resistant salmonellosis, there is a need to emphasize non-antimicrobial infection control strategies, such as improved sanitation and hygiene, in the public.<sup>10</sup>

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