



Salmonella Infections in Childhood

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Keywords

• Salmonellosis • Nontyphoidal *Salmonella* • Typhoid • Enteric fever

Key points

- *Salmonella* are gram-negative bacilli within the family Enterobacteriaceae. They are the cause of significant morbidity and mortality worldwide.
- Animals (pets) are an important reservoir for nontyphoidal *Salmonella*, while humans are the only natural host and reservoir for *Salmonella* Typhi.
- *Salmonella* infections are a major cause of gastroenteritis worldwide. They account for an estimated 2.8 billion cases of diarrheal disease each year.
- The transmission of *Salmonella* is frequently associated with the consumption of contaminated water and food of animal origin, and it is facilitated by conditions of poor hygiene.
- The most important measures to prevent the spread and outbreaks of *Salmonella* infections and typhoid fever are adequate sanitation protocols for food processing and handling as well as hand hygiene.
- In the United States, 2 vaccines are commercially available against *Salmonella* Typhi. The World Health Organization recommends the use of these vaccines in endemic areas and for outbreak control.

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INTRODUCTION

Salmonella species were discovered more than a century ago by the American scientist Salmon, after whom they are named. They are recognized worldwide as a common cause of childhood infections, particularly gastroenteritis, bacteremia, and typhoid (enteric) fever. *Salmonella* serotype Typhi and *Salmonella* serotype Paratyphi A, B, and C (ie, typhoidal *Salmonella*) are responsible for causing typhoid fever in humans, an illness that is most burdensome in the developing world. The World Health Organization (WHO) estimates 16 to 33 million cases of typhoid fever causing 500,000 to 600,000 deaths worldwide annually. In the United States, it is estimated that approximately 200 to 300 cases occur annually. In a surveillance report from 1999 to 2006 in the United States, a total of 1902 cases of typhoid fever and 3 deaths were recorded [1]. The majority (about 80%) of cases in the United States are acquired while traveling internationally, especially to countries in south-central Asia.

Nontyphoidal *Salmonella* (NTS) species, which are found widely in animals, are estimated to cause more than 90 million illnesses worldwide and to account for approximately 155,000 deaths each year. In the United States, more than 40,000 NTS infections are reported annually to the Centers for Disease Control and Prevention (CDC); however, many milder illnesses go unreported, thus underestimating the true burden of these infections. Despite the mild and self-limiting nature of most NTS infections in healthy hosts, they are responsible for more than 450 US deaths annually [2]. The transmission of these organisms is frequently associated with the consumption of contaminated water and food of animal origin (eg, eggs, meat, dairy products), and to be facilitated by conditions characterized by poor hygiene. Young children are at risk for acquiring *Salmonella* infections, and young infants as well as children with certain underlying conditions (such as hemoglobin disorders, infection with human immunodeficiency virus [HIV], malignancy, or other causes of immune suppression) have an increased risk of severe disease and death from complications.

MICROBIOLOGY AND NOMENCLATURE

The organisms that belong to the genus *Salmonella* are motile, gram-negative, facultative anaerobic bacilli and are classified within the family Enterobacteriaceae. *Salmonella* organisms are not difficult to identify in the laboratory. These bacteria grow under both aerobic and anaerobic conditions. They ferment glucose but not lactose, are oxidase-negative, are indole-negative, and reduce nitrate to nitrite. Most *Salmonella* species produce hydrogen sulfide, a property commonly used for easy identification using selective media (eg, Salmonella-Shigella agar) [3].

The genus *Salmonella* consists of 2 species: *enterica* and *bongori*. Recently, DNA hybridization studies have suggested that most clinically important *Salmonella* organisms may be included into a single species: *Salmonella enterica* subspecies *enterica*. More than 2500 serotypes can be identified by serologic studies, which can be performed at reference laboratories, but serotyping is rarely of any clinical utility.

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