

Enteric fever caused by Salmonella infections

High disease burden in the developing world

Salmonella enterica serovar Typhi (*S. typhi*), *Salmonella paratyphi* A and nontyphoidal salmonellae (NTS) are important causes of infection and disease in children. Over 21 million cases of *S. typhi* were estimated (in 2000) worldwide, mostly in underdeveloped countries. Typhoid fever is particularly common in South and South East Asia, and is estimated to cause more than half a million deaths each year. ¹ *S. paratyphi* A is now a growing emerging cause of enteric fever in Nepal, India, Pakistan, China, Vietnam and Indonesia where up to half the cases of enteric fever may well be due to this organism rather than *S. typhi*. ²

Leading cause of morbidity and invasive disease in developing countries

NTS is a major cause of food-borne infections in developed countries and is a common cause of gastroenteritis worldwide. In developing countries NTS is also an important cause of invasive disease, particularly in tropical regions of Africa, where *Salmonella enterica* serovar Typhimurium (*S. typhimurium*) and *Salmonella enterica* serovar Enteritidis (*S. enteritidis*) are consistently the most common causes of childhood bacteraemia, as well as important causes of meningitis, septic arthritis and pneumonia. ³

Poorer populations are especially vulnerable

NTS has a particularly profound impact in populations of high HIV/AIDS prevalence, since mortality in those with co-infections has been reported to be high. Source and transmission of NTS in developing country populations has not been well documented, but poverty appears as an important risk factor. A major and worrying development that has global significance is the increasing and often rapid emergence of multidrug resistant (MDR) strains for all the above serovars. ⁴

Current treatments and vaccines

Antibiotics: Fluoroquinolones are widely used, but the emergence of multidrug-resistant (MDR) strains of *Salmonella* are now encountered frequently and the rates of multidrug-resistance have increased considerably in recent years⁵. The emergence of MDR *Salmonella* strains with resistance to fluoroquinolones and third-generation cephalosporins is a serious development, which results in severe limitation of the possibilities for effective treatment of human infections. ⁶

Antibiotic resistance a growing problem

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Vaccines: Two safe and effective vaccines are licensed for use to prevent typhoid fever caused by *S typhi*: live oral Ty21a and parenteral Vi polysaccharide. However neither vaccine is effective (or indicated) in children and infants under the age of two. For a multitude of reasons, the uptake of these vaccines in endemic developing countries has been slow. Additionally, there are currently no licensed vaccines for *S paratyphi A*, *S typhimurium*, or *S. enteritidis*.⁷

Vaccines either do not exist or need to be improved

NVGH program

Develop a broad-range vaccine for *S. typhi*, *S. paratyphi A*, *S. typhimurium*, and *S. enteritidis*.

NVGH is developing an innovative multi-valent vaccine

Endnotes

1. Current Opinions in Infectious Diseases, "Salmonellosis in children in developing and developed countries and populations", Stephen M. Graham, 15:507-512, 2002
2. Vaccine, "Enteric fever due to *Salmonella typhi A*: A neglected and emerging problem", Henry Wilde, 11 April 2007
3. BMC Microbiology; "Characterisation of community acquired non-typhoidal *Salmonella* from bacteraemia and diarrhoeal infections in children admitted to hospital in Nairobi, Kenya"; Samuel Kariuki, Gunturu Revathi, Nyambura Kariuki, John Kiiru, Joyce Mwituria, and Charles A Hart; 15 December 2006
4. Current Opinions in Infectious Diseases, "Salmonellosis in children in developing and developed countries and populations", Stephen M. Graham, 15:507-512, 2002
5. WHO Fact Sheet N°139, Revised April 2005
6. Current Opinions in Infectious Diseases, "Salmonellosis in children in developing and developed countries and populations", Stephen M. Graham, 15:507-512, 2002

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7. Vaccine, "Enteric fever due to *Salmonella typhi* A: A neglected and emerging problem", Henry Wilde, 11 April 2007