

Typhoid Fever & Salmonella Enterocolitis

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Typhoid Fever

Typhoid fever is an acute generalized infection of the:

- Mononuclear phagocyte system
- Intestinal lymphoid tissue
- Gallbladder caused by *Salmonella enterica* serovar Typhi.

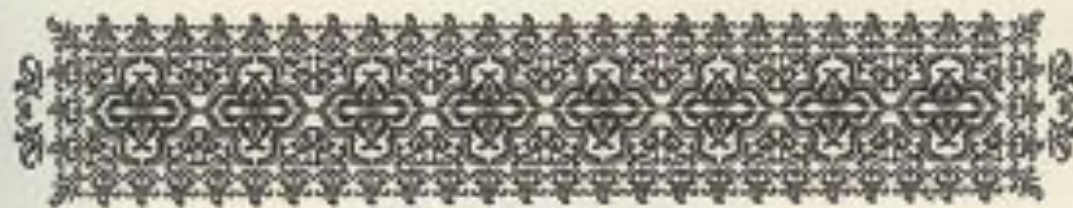


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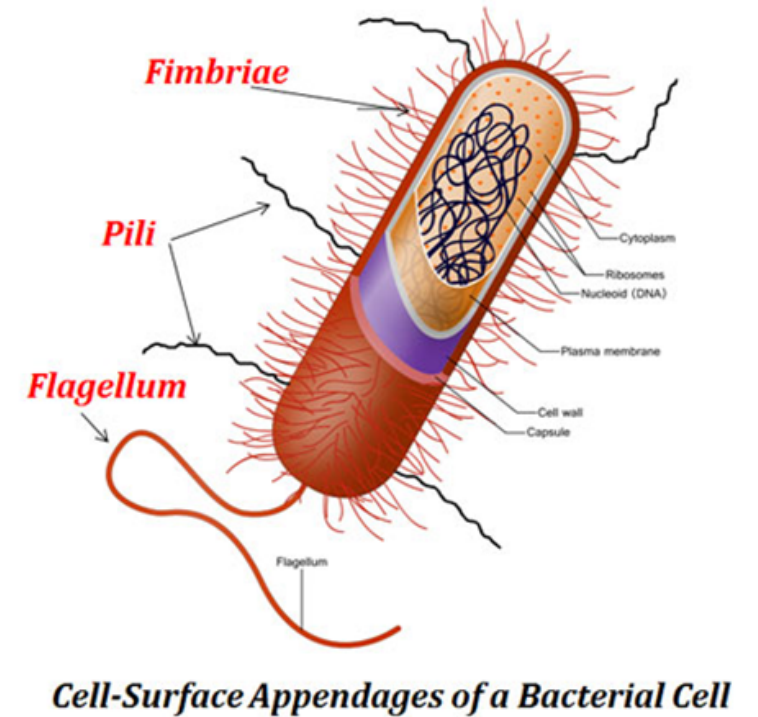


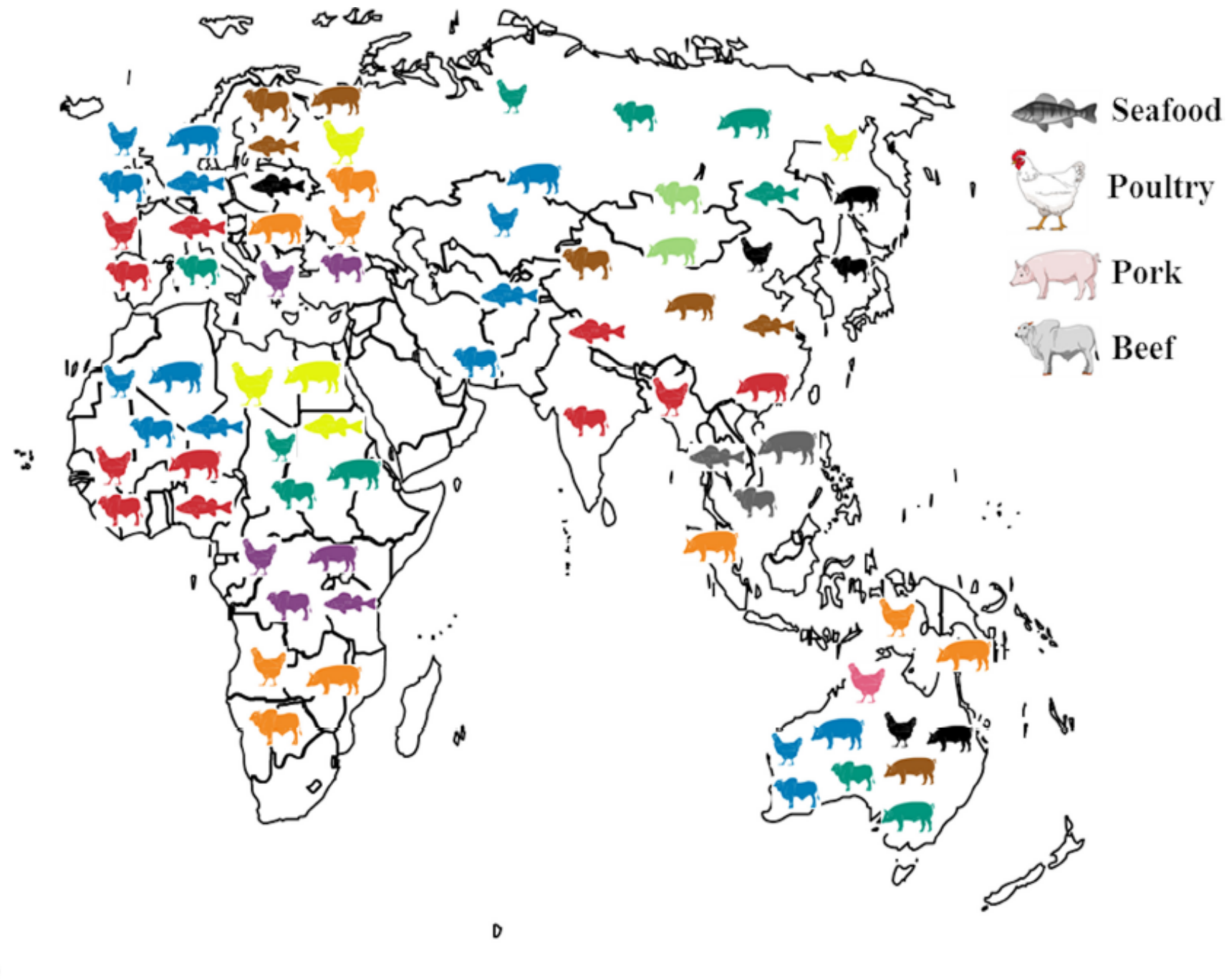
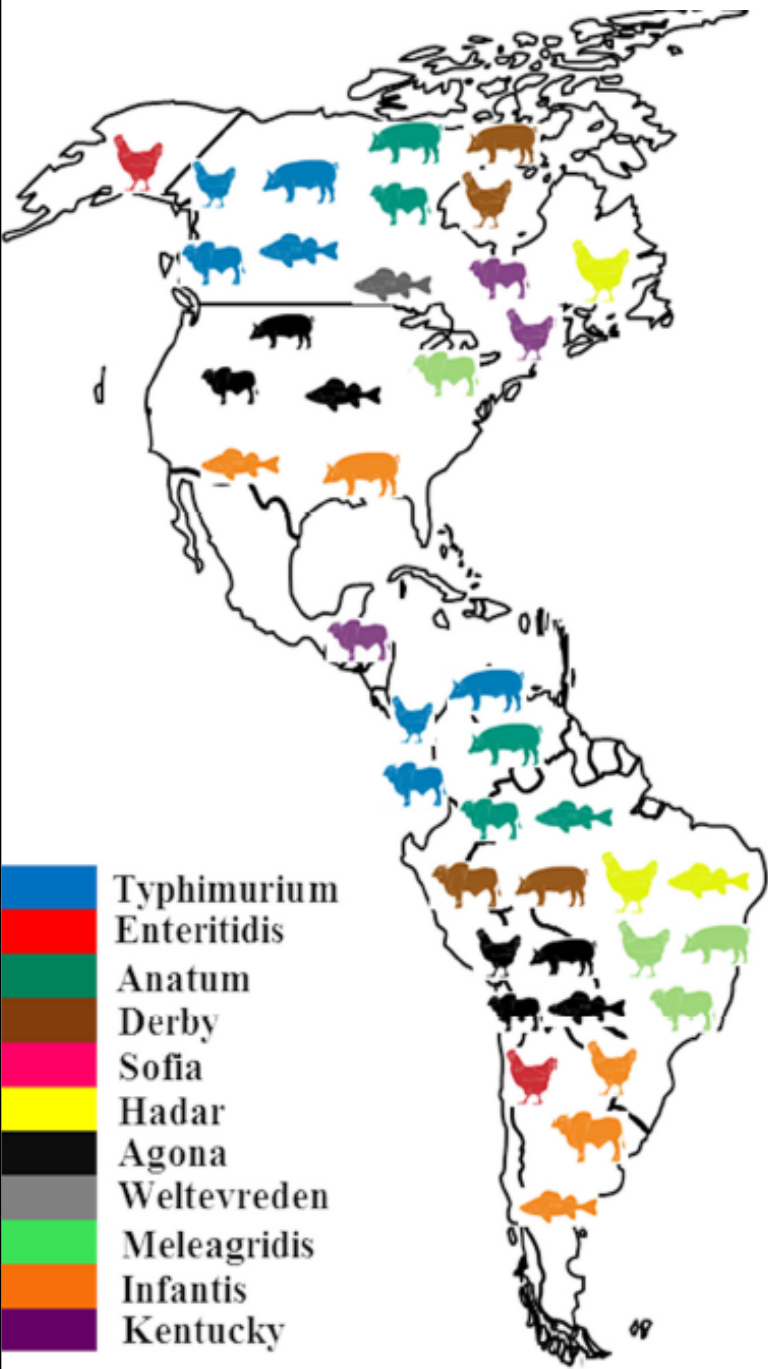
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Salmonella

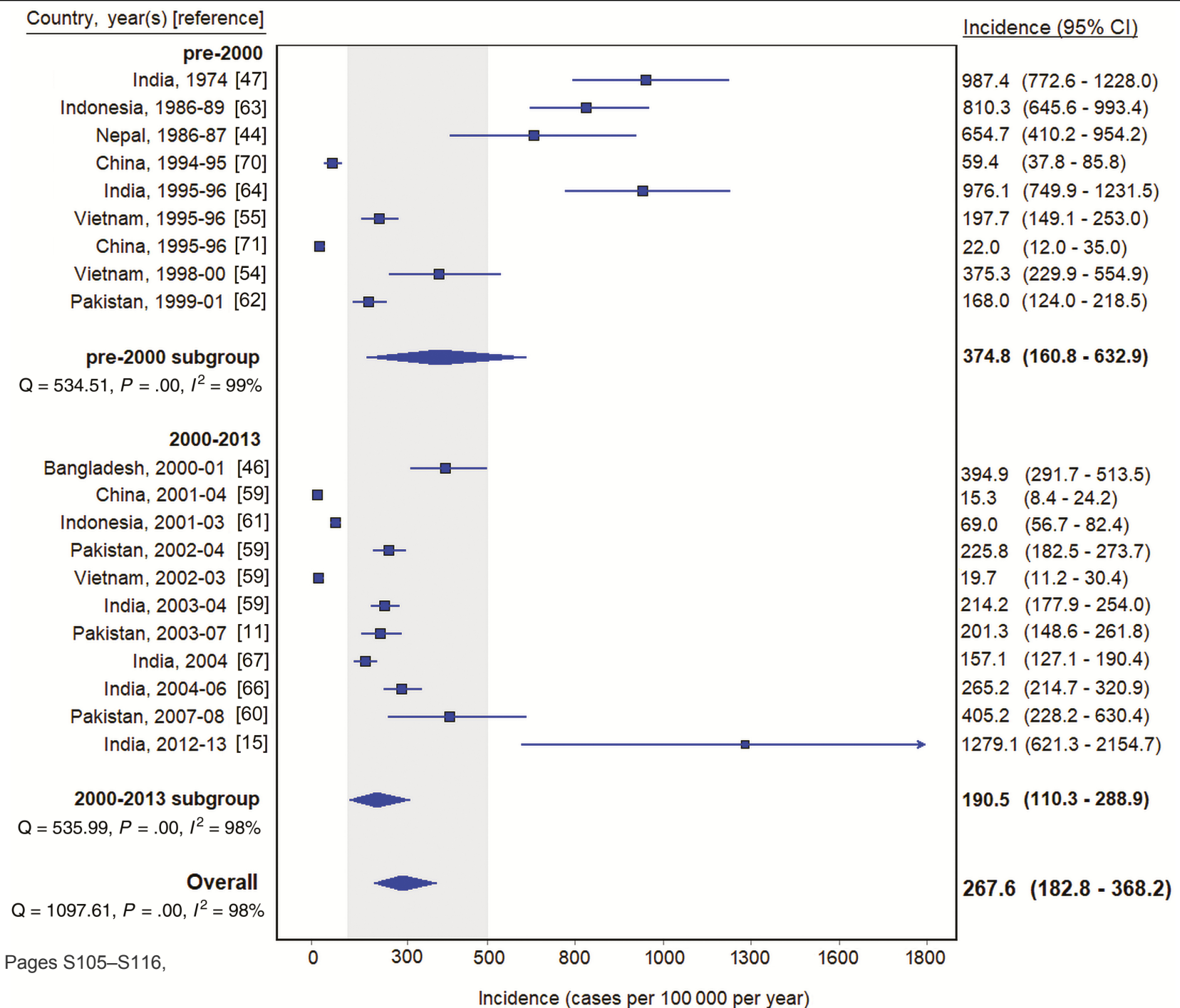
- Gram-negative motile, nonsporulating, straight-rod bacteria.
- Intracellular facultative pathogens
- *S. typhi* and *Salmonella paratyphi* A, B, and C causes typhoid or paratyphoid
- Salmonellosis-causing serotypes are isolated from humans and animals, including livestock.
- Food poisoning is caused mostly by Serotypes
 - *Salmonella* Typhimurium
 - *Salmonella enteritidis*
 - *Salmonella* Newport
 - *Salmonella* Heidelberg
 - *Salmonella* Cholerasuis
 - *Salmonella* Dublin





Typhoid incidence estimates among population-based studies in Asia, 1954–2018.

Gray shading indicates 100–500 per 100 000 per year.
CI, confidence interval.



How It Causes Disease

- The Vi antigen of *S typhi* is important in preventing antibody-mediated opsonization and complement-mediated lysis
- Through the induction of cytokine release and via mononuclear cell migration, *S typhi* organisms spread through the reticuloendothelial system, mainly to the liver, spleen, and bone marrow.
- Within 14 days, the bacteria appear in the bloodstream, facilitating secondary metastatic foci (eg, splenic abscess, endocarditis).

Humans are the Reservoir

- Defined as the habitat in which the agent normally lives, grows, and multiplies) of *Salmonella* Typhi.
- *Salmonella* Typhi has a limited capacity to multiply outside of the human host, but it may survive for extended periods in the environment
- The case fatality risk of typhoid fever was approximately 10%–30% in the pre-antimicrobial era. With effective antimicrobials, the case fatality risk is usually <1%.

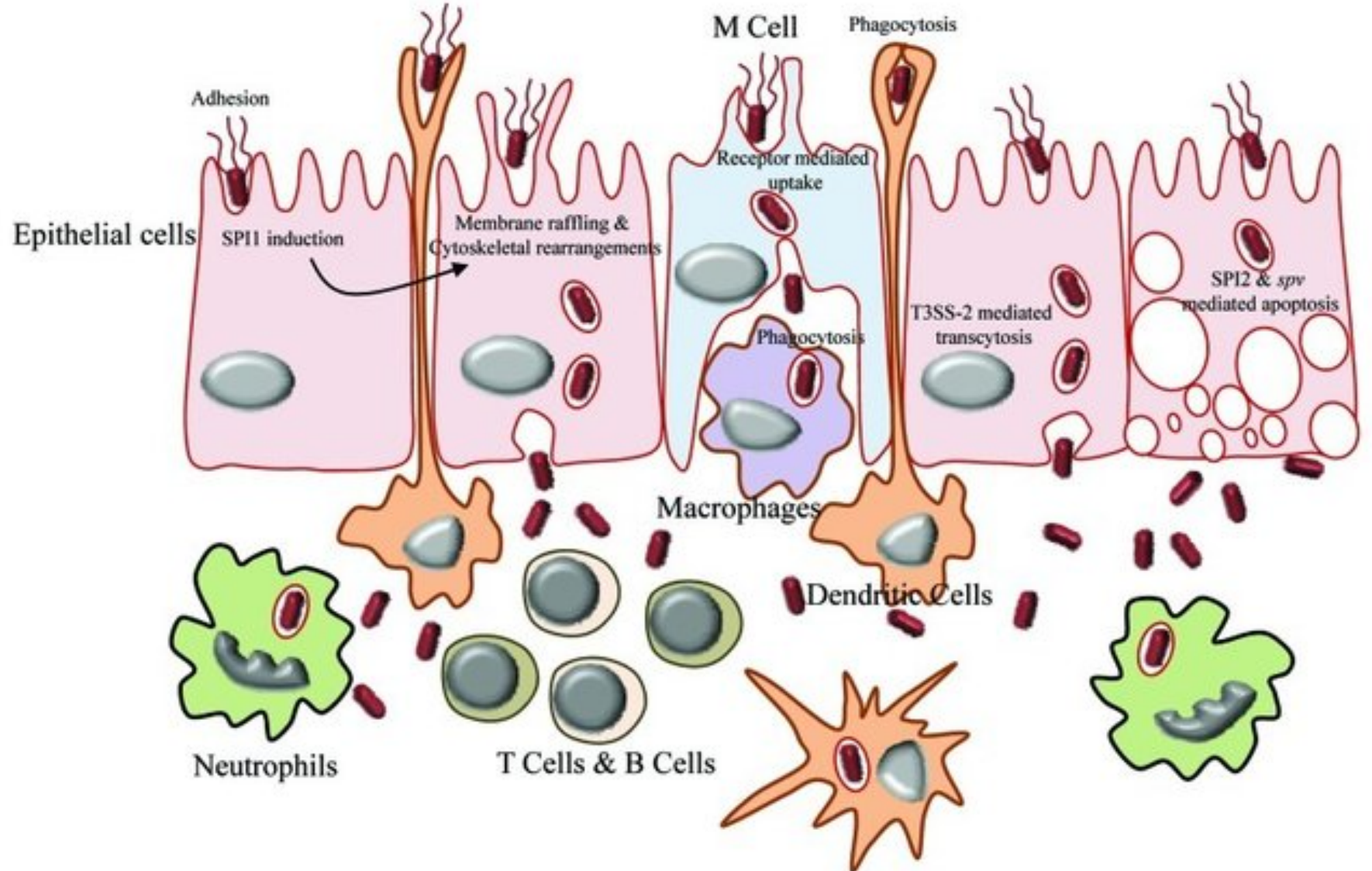
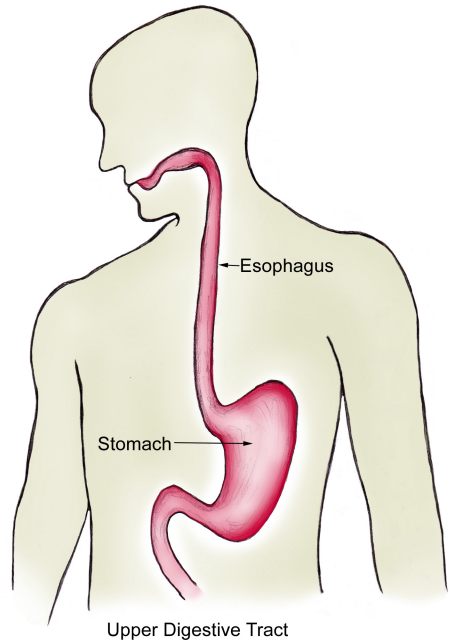
Portal of Exit, Route of Infection, and Source

- Transmission is indirect
- Feces represent the major portal of exit of *Salmonella typhi*, although shedding in urine has also been documented
- *Salmonella typhi* may be shed in the stool or urine during and following both clinical and subclinical acute infection.
- Shedding may be temporary or chronic.
 - Temporary shedding may be acute or convalescent
 - A convalescent carrier sheds *Salmonella Typhi* for ≥ 3 –12 months after the onset of acute illness.
 - A chronic carrier sheds typhoid bacilli for >12 months after the onset of acute illness.
- Chronic carriers are known to be a major source of domestically acquired *Salmonella typhi* infections in countries with low typhoid incidence

Disease Transmission, and Inoculum?

- Hygiene
- The portal of entry for *Salmonella* Typhi infection is the mouth, usually through ingestion of fecally contaminated water or food. Infection occurs in a **susceptible human host**.
- Large inoculums are also associated with higher rates of illness and shorter incubation periods.
 - In general, about 10^6 bacterial cells are needed to cause infection.
 - Low gastric acidity can decrease the infective dose to 10^3 cells,
 - Prior vaccination can increase the number to 10^9 cells.

Pathogenesis



Clinical Presentations; History and Examination

Nontyphoidal enterocolitis

- Symptoms
 - Acute onset of fever
 - Acute abdominal pain
 - Acute diarrhea
 - Nausea, sometimes vomiting.
- The onset of disease symptoms occurs 6–72 hours (usually 12–36 hours) after ingestion of *Salmonella*, and illness lasts 2–7 days.

• Nontyphoidal focal disease

- Kidney
- Brain
- Bone
- ... etc

SYMPTOMS OF TYPHOID

HIGH FEVER

HEADACHE

DRY COUGH

RASHES

WEAKNESS

Weakness and fatigue
Loss of appetite, weight loss

STOMACH PAIN

CONSTIPATION



Incubation period of 10-14 days

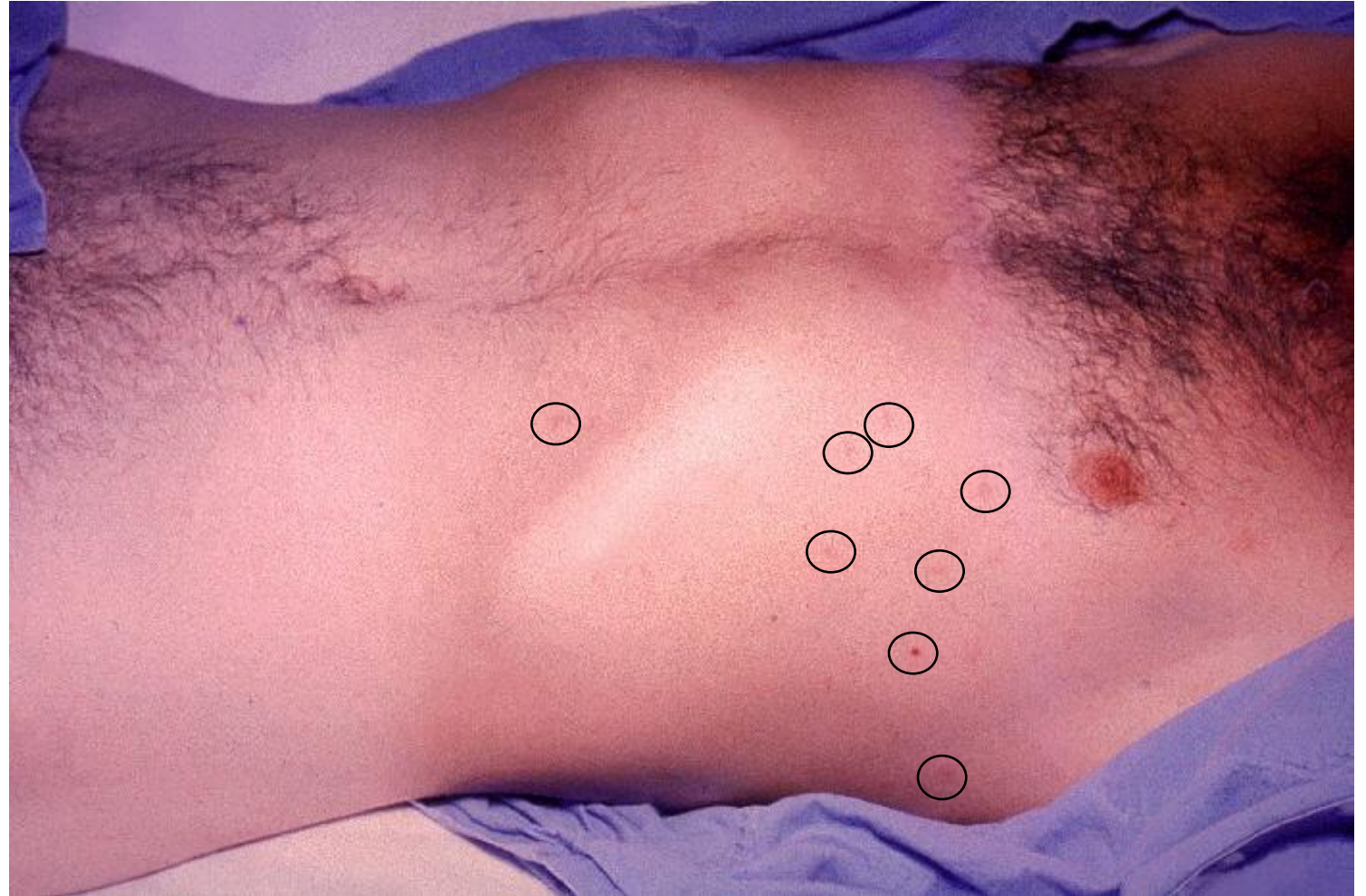
Typhoid fever Signs

Fever

Prolonged low-grade fever

Relative bradycardia

Splenomegaly



The Pattern of Typhoid Fever

Temperature curve from a case of typhoid fever, the first nine days there was no fever but wide daily fluctuation. On the tenth day, the fever started.

The fever may progress in a stepwise manner to become **persistent** and high grade by the end of the second week.

If left untreated, it can last up to 4 weeks, then return to a normal temperature.

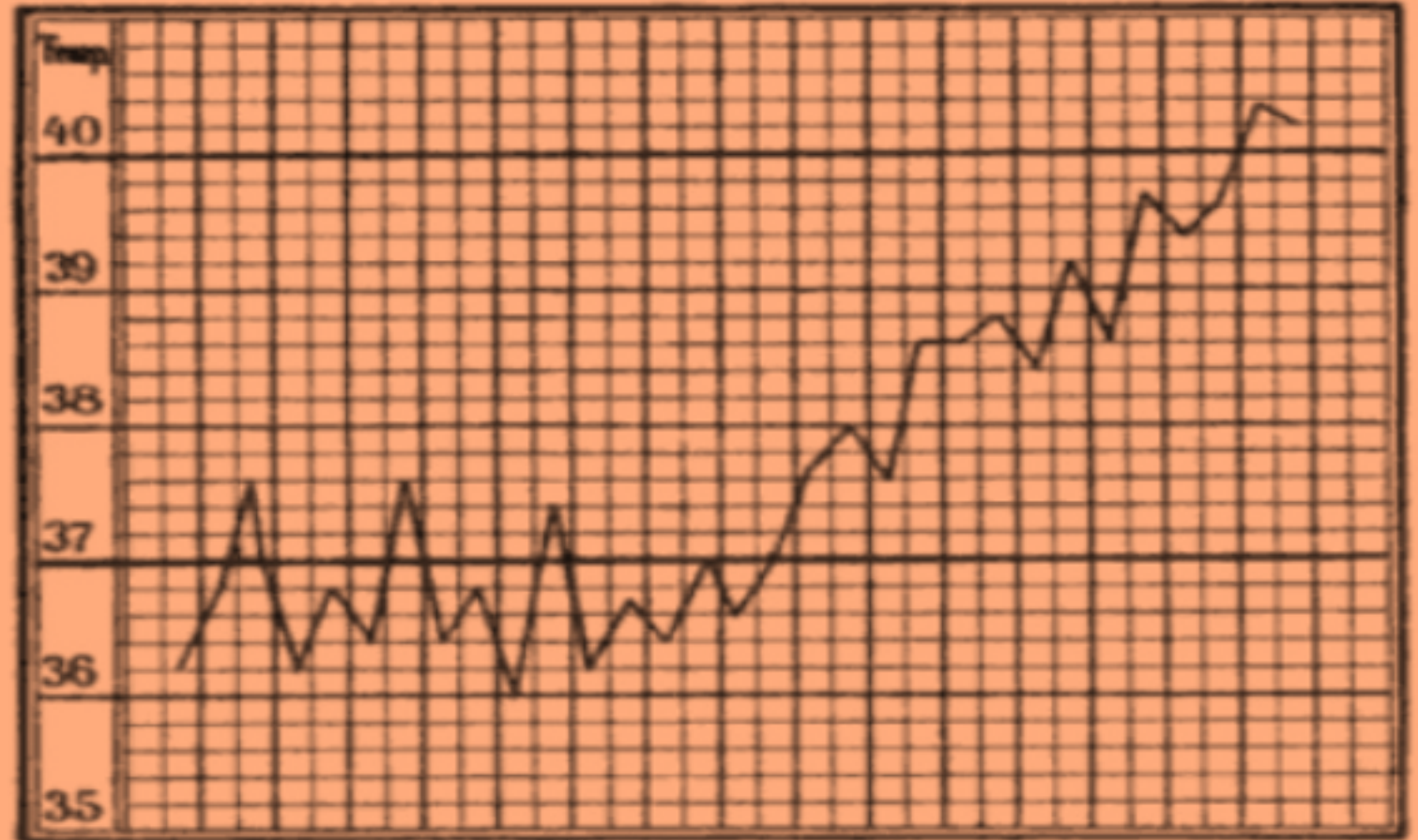


FIG. 9.—Temperature-curve from a case of typhoid fever in a waiter, twenty-six years old, admitted with a suspicion of simulation. During the first nine days there was no febrile elevation of temperature, but only abnormally wide daily fluctuations. On the tenth day the febrile period of a moderately severe attack of typhoid fever pursuing a regular course set in.



Differential Diagnoses

- Campylobacter Infections
- Cryptosporidiosis
- Cyclospora Infection (Cyclosporiasis)
- *Escherichia coli* (*E. coli*) Infections
- *Listeria Monocytogenes* Infection (Listeriosis)
- Shigellosis
- Vibrio Infections
- *Yersinia Enterocolitica*

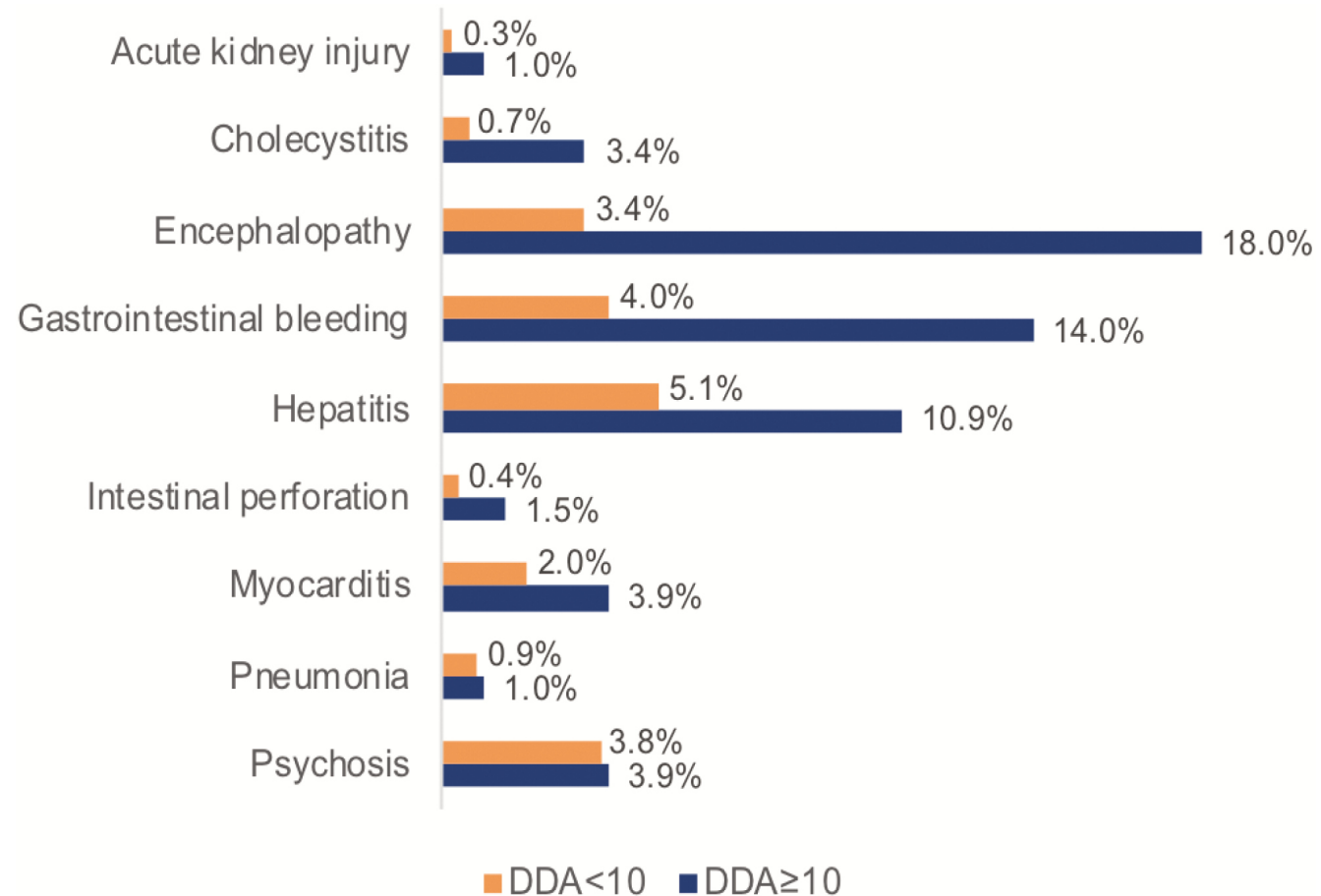
Frequency and Prevalence a of Specific Typhoid Fever Complications Reported From a Meta-analysis (1990–2018)

In 10%–15% of hospitalized patients

27% (95% CI, 21%–32%) of all blood culture–confirmed typhoid fever cases resulting in complications


- Perforation
- Hemorrhage
- Pneumonia
- AKI
- Encephalopathy
- Hepatitis
- Myocarditis
- Osteomyelitis
- Sever anemia
- Meningitis
- Bone marrow suppression
- Hypothermia
- Pleural effusion
- Paralytic Ileus
- Psychosis
- SIADH
- Stupor, Coma
- Seizure
- Sepsis Syndrome
- Secondary infections
- Carrier status
- Persistent *Salmonella* infection can lead to the development of other severe diseases such as inflammatory bowel disease (IBD) and cancer.
- Infective aortitis, which is characterized by high morbidity and mortality.
- Other Organs abscesses

Frequency (pooled across the studies reporting the complications and illness duration at hospitalization) of typhoid fever complications (1990–2018).



DDA, mean/median illness duration at hospitalization.

Workup?

- Analysis
- Cultures
- PCR??
- Imaging
- Endoscopy
- Serological tests (Widal  est)

Medical Management

Depends on:

- Typhoid (enteric) fever (Ciprofloxacin, Azithromycin, Ceftriaxone,)
- Nontyphoidal focal disease (Kidney, brain ... etc)
 - The Usual Typhoid treatment
 - Certain world Parts has Extensively Drug-Resistant Typhoid Fever

Management

Nontyphoidal enterocolitis or Salmonella enterocolitis

1-

2-

3-

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Surgical Management

- Gall bladder
- Bone
- Heart
- Bowel
- Splenic Abscess
- Soft-tissue abscess formation

Prevention?

1. Safe hygiene practice

1. Wash green food before eating
2. Wash hands
3. Travel to an endemic area, cooked or canned food

2. Vaccination

Prevention

Typhoid **Vaccines** Available

Abbreviated vaccine name (brand name, manufacturer)	How given	Number of doses recommended	When taken	How long to complete immunization before travel	Minimum age for vaccination	Booster needed
Ty21a (Vivotif, Swiss PaxVax)	1 capsule by mouth	4	Every other day	1 week	6 years	Every 5 years
ViCPS (Typhim Vi, Sanofi Pasteur)	Injection	1	Once	2 weeks	2 years	Every 2 years

- Oral vaccine: Can be given to people at least 6 years old. It consists of four pills taken every other day and should be finished **at least 1 week** before travel.
- Injectable vaccine: Can be given to people at least 2 years old and should be given at least **2 weeks** before travel.
- Typhoid vaccines are not 100% effective.

The most important in Prevention is

- Hand Hygiene
- Food Hygiene