containing immunoglobulins, mainly immunoglobulin G (IgG). It is obtained from plasma containing specific antibodies against the toxin of *Clostridium tetani*. Normal immunoglobulin may be added. It contains not less than 100 international units/mL. Both the liquid and freeze-dried preparations should be stored, protected from light, in a colourless, glass container. The freeze-dried preparation should be stored under vacuum or under an inert gas.

USP 31 (Tetanus Immune Globulin). A sterile solution of globulins derived from the plasma of adult human donors who have been immunised with tetanus vaccine. It contains not less than 50 units of tetanus antitoxin/mL. It contains 10 to 18% of protein of which not less than 90% is gamma globulin. It contains glycine as a stabilising agent, and a suitable preservative. It should be stored at 2° to 8°.

Adverse Effects and Precautions

As for immunoglobulins in general, p.2201.

Interactions

As for immunoglobulins in general, p.2201.

Tetanus immunoglobulins will neutralise tetanus toxoid and should not be injected into the same site or in the same syringe as a tetanus vaccine.

Uses and Administration

Tetanus immunoglobulins are used for passive immunisation against tetanus.

The use of tetanus immunoglobulins is recommended in the UK and the USA as part of the management of tetanus-prone wounds in persons unimmunised or incompletely immunised against tetanus, in persons whose immunisation history is unknown, in persons who received the last dose of tetanus vaccine more than 10 years previously, and in patients with impaired immunity. Active immunisation with a tetanus vaccine (p.2240) should also be started simultaneously, and antibacterials and symptomatic therapy given as appropriate (see p.196 and p.1901). The usual dose of tetanus immunoglobulin is 250 units by intramuscular injection but, if more than 24 hours have elapsed since the wound was sustained, or if there is a risk of heavy contamination, or after burns, 500 units should be given irrespective of the immunisation history.

Tetanus immunoglobulin is also used in the treatment of tetanus, a recommended dose being 150 units/kg in total, given intramuscularly into multiple sites.

A preparation suitable for intravenous use is available in some countries. It is given for the treatment of tetanus in a dose of 5000 to 10 000 units by intravenous infusion.

Preparations

Ph. Eur.: Human Tetanus Immunoglobulin;
USP 31: Tetanus Immune Globulin.

Proprietary Preparations (details are given in Part 3)

Arg.: Gammatet; Igantet; IT SD-T; Tetabulin; ***Austria:*** Tetabulin; Tetagam; ***Belg.:*** Tetabuline; ***Braz.:*** Tetanobulin†; Tetanogamma; ***Canad.:*** BayTet†; Hypertet; ***Chile:*** Igantet; ***Cz.:*** Tetabulin; Tetaglobuline†; ***Fr.:*** Gammatetanos; ***Ger.:*** Tetagam N; Tetanobulin; ***Gr.:*** Tetagam-P; ***Hong Kong:*** BayTet; Tetabulin†; Tetuman†; ***Hung.:*** Tetig; ***India:*** Tetagam-P; ***Indon.:*** Tetagam P; ***Irl.:*** Tetabulin; ***Israel:*** BayTet; Tetaglobuline; ***Ital.:*** Gamma-Tet P; Ig Tetano†; Igantet; Immunotetan; Tetabulin; Tetagamma†; Tetanus-Gamma; Tetaven†; ***Malaysia:*** Igantet; Sero-Tet; Tetuman†; ***Mex.:*** BayTet†; Probi-Tet†; Tetanogamma; ***Neth.:*** TetaQuin; ***Philipp.:*** BayTet; Tetagam-P; Tetanea; ***Pol.:*** Tetabulin; ***Port.:*** Tetagam; Tetuman†; ***S.Afr.:*** Tetagam; ***Singapore:*** BayTet†; Igantet; ***Spain:*** Gamma Antitetanos; Tetagamma P; Tetuman†; ***Switz.:*** Tetagam; Tetuman; ***Thai.:*** Tetagam; Tetuman†; ***Turk.:*** Tetanea; Tetuman; ***UK:*** Liberim T†; Tetabulin†; ***USA:*** BayTet.

Tetanus Vaccines

Vacunas del tétanos.

ATC — J07AM01.

Pharmacopoeias. Many pharmacopoeias, including *Eur.* (see p.vii) and *US*, have monographs.

Ph. Eur. 6.2 (Tetanus Vaccine (Adsorbed); Vaccinum Tetani Adsorbatum). It is prepared from tetanus formol toxoid adsorbed on a mineral carrier which may be hydrated aluminium phosphate or aluminium hydroxide. The resulting mixture is isotonic with blood. Suitable antimicrobial preservatives may be added. The antigenic properties are adversely affected by certain antimicrobial preservatives particularly those of the phenolic type and these should not be added to the vaccine. It contains not less than 40 units per dose. It should be stored at 2° to 8°, not be allowed to freeze, and be protected from light.
The BP 2008 states that Tet may be used on the label.
The BP 2008 directs that when Tetanus Vaccine is prescribed or demanded and the form is not stated, Tetanus Vaccine (Adsorbed) may be dispensed or supplied.

BP 2008 (Tetanus Vaccine). It is prepared from tetanus toxin produced by the growth of *Clostridium tetani*. The toxin is converted to tetanus formol toxoid by treatment with formaldehyde solution. It contains suitable non-phenolic antimicrobial preservatives. It should be stored at 2° to 8° and be protected from light.
The BP 2008 states that Tet/Vac/FT may be used on the label.
The BP 2008 directs that when Tetanus Vaccine is prescribed or demanded and the form is not stated, Tetanus Vaccine (Adsorbed) may be dispensed or supplied.

USP 31 (Tetanus Toxoid). A sterile solution of the formaldehyde-treated products of growth of *Clostridium tetani*. It contains a non-phenolic preservative. It should be stored at 2° to 8° and not be allowed to freeze.

USP 31 (Tetanus Toxoid Adsorbed). A sterile preparation of plain tetanus toxoid precipitated or adsorbed by alum, aluminium hydroxide, or aluminium phosphate adjuvants. It should be stored at 2° to 8° and not be allowed to freeze.

Adverse Effects and Precautions

As for vaccines in general, p.2201.

Local reactions, usually after the use of adsorbed vaccines, and mild systemic reactions may occur. The incidence and severity of reactions increases with the number of doses given.

Anaphylaxis and neurological reactions have been reported rarely.

Although vaccination is usually postponed in patients suffering from an acute febrile illness, tetanus vaccine should be given to such patients in the presence of a tetanus-prone wound.

With the exception of the first booster dose of tetanus vaccine (which is usually given before school entry and about 3 years after the primary course), further boosters should not generally be given at intervals of less than 10 years because of an increased risk of severe local reactions.

Effects on the nervous system. Neuropathies have been reported rarely with tetanus vaccination. Optic neuritis and myelitis occurred[1] in an 11-year-old girl after a routine booster dose. Corticosteroids and immunoglobulin were given, and both vision and muscle power were restored after 11 months. Acute transverse myelitis was reported[2] in a 50-year-old man who received a tetanus vaccine and immunoglobulin after an injury. Neurological deficits were unchanged after 1 month despite use of corticosteroids. Other causes could not be ruled out in either case. Brachial neuritis that developed in 2 infants after immunisation with diphtheria, tetanus, and pertussis vaccine was attributed to the tetanus component.[3]

1. Topaloglu H, *et al.* Optic neuritis and myelitis after booster tetanus toxoid vaccination. *Lancet* 1992; **339:** 178–9.
2. Read SJ, *et al.* Acute transverse myelitis after tetanus toxoid vaccination. *Lancet* 1992; **339:** 1111–12.
3. Hamati-Haddad A, Fenichel GM. Brachial neuritis following routine childhood immunization for diphtheria, tetanus, and pertussis (DTP): report of two cases and review of the literature. *Pediatrics* 1997; **99:** 602–3.

GUILLAIN-BARRÉ SYNDROME. For a discussion on the relationship between tetanus-containing vaccines and Guillain-Barré syndrome, see Diphtheria and Tetanus Vaccines, p.2210.

Pregnancy. No connection has been found between use of tetanus vaccine during pregnancy and either congenital malformations[1] or spontaneous abortion.[2]

1. Silveira CM, *et al.* Safety of tetanus toxoid in pregnant women: a hospital-based case-control study of congenital anomalies. *Bull WHO* 1995; **73:** 605–8.
2. Catindig N, *et al.* Tetanus toxoid and spontaneous abortions: is there epidemiological evidence of an association? *Lancet* 1996; **348:** 1098–9.

Interactions

As for vaccines in general, p.2202.

Tetanus immunoglobulins will neutralise tetanus toxoid and should not be injected into the same site or in the same syringe as a tetanus vaccine.

Uses and Administration

Tetanus vaccines are used for active immunisation against tetanus.

For primary immunisation combined tetanus vaccines, usually diphtheria, tetanus, and pertussis vaccines (p.2210) or diphtheria, tetanus, pertussis, poliomyelitis, and Haemophilus influenzae vaccines (p.2212), are used. For discussion of immunisation schedules, see under Vaccines, p.2202. In adults requiring primary immunisation combined vaccines such as diphtheria and tetanus vaccines (p.2210) or diphtheria, tetanus, and poliomyelitis vaccines (p.2212) are used.

In children who complete the primary course in infancy, reinforcing doses are given at school entry and in adolescence using the recommended appropriate combined vaccines. In adults, a reinforcing dose is desirable 10 years later with a further dose after a further 10 years.

Tetanus vaccines should be part of wound management if primary immunisation is incomplete or boosters are not up-to-date. For tetanus-prone wounds, tetanus immunoglobulin (see above) may also be required. Tetanus vaccine and tetanus immunoglobulin may be given at the same time, but not at the same site. In the event of injury in non-immunised persons or if immunisation status is uncertain, the opportunity is usually taken to initiate a course of primary immunisation. Since this provides no immediate protection, prophylactic treatment with tetanus immunoglobulin is recommended for tetanus-prone wounds. Suitable antibacterial therapy may also be given (see p.196).

Neonatal tetanus. In 1989 WHO adopted a resolution to eliminate neonatal tetanus after estimates revealed that worldwide (but excluding China) it was the cause of 800 000 neonatal deaths each year, a figure representing about 50% of all such deaths in developing countries. Control of neonatal tetanus may be achieved by ensuring adequate hygiene during delivery and by ensuring protective immunity of the mother in late pregnancy. However, by mid-2000 there were 57 countries that had still not eliminated maternal and neonatal tetanus and WHO, UNICEF, and UNFPA agreed to set a target date of 2005 for elimination (defined as a rate of neonatal tetanus below 1 in 1000 live births at district level). However, by the end of 2007, 47 countries were still considered to have not achieved elimination.

Tetanus vaccine is given to all women of child-bearing age as part of WHO's Expanded Programme on Immunization. For pregnant women, 2 doses of vaccine should be given, the second dose at least 4 weeks after the first and at least 2 weeks before delivery; this may provide the newborn infant with about 80% protection against tetanus. For all women of child-bearing age, 3 doses of vaccine, with at least 4 weeks between the first two doses and 6 to 12 months between the second and third doses, provide 95 to 98% protection for at least 5 years. Fourth and fifth doses, each at least one year after the previous dose, prolong the immunity for 10 and 20 years respectively.

Reinforcing doses in adults. Although the current recommendation in the UK is that 5 doses of tetanus vaccine (as a 3-dose primary course in infancy and 2 reinforcing doses at preschool and in adolescence) is sufficient to produce satisfactory long-term protection in most circumstances, there has been concern about immunity in the elderly, and in particular women. Routine primary immunisation against tetanus was introduced in the UK in 1961, so individuals born before that year would not have been immunised in infancy, and unless they had been in the armed forces, may never have received a full primary course. Unless there is a clear immunisation history immunity to tetanus may be difficult to assess. It is also recommended in the UK that travellers to areas where medical attention may not be accessible, and who had the last dose of vaccine more than 10 years previously, should receive a booster even if they have had 5 doses previously.

Studies in the USA,[1] Australia,[2] and Austria[3] have shown that at least half of healthy people over 50 years of age did not have adequate circulating tetanus antibodies. However, the level of circulating antibodies in the absence of an antigen challenge may not be an appropriate measure of the immune status. The low incidence of clinical tetanus in adults provides circumstantial evidence of an adequate inducible antibody response on exposure to tetanus despite a decline in antibody concentrations with increasing age.[4,5] Conversely, there have been reports of tetanus occurring despite high antibody concentrations.[6,7] There have been calls for the introduction of regular booster injections in adults,[3,7-9] as is standard practice in the USA or alternatively a single booster in late middle age[10,11] or giving a primary course to elderly persons who have never received one.[1]

1. Gergen PJ, *et al.* A population-based serologic survey of immunity to tetanus in the United States. *N Engl J Med* 1995; **332:** 761–6.
2. Heath TC, *et al.* Tetanus immunity in an older Australian population. *Med J Aust* 1996; **164:** 593–6.
3. Steger MM, *et al.* Vaccination against tetanus in the elderly: do recommended vaccination strategies give sufficient protection? *Lancet* 1996; **348:** 762.
4. Bowie C. Tetanus toxoid for adults—too much of a good thing. *Lancet* 1996; **348:** 1185–6.
5. Baily G. Are the elderly inadequately protected against tetanus? *Lancet* 1996; **348:** 1389–90.
6. Passen EL, Andersen BR. Clinical tetanus despite a 'protective' level of toxin-neutralising antibody. *JAMA* 1986; **255:** 1171–3.
7. Bowman C, *et al.* Tetanus toxoid for adults. *Lancet* 1996; **348:** 1664.
8. Rethy LA, Rethy L. Can tetanus boosting be rejected? *Lancet* 1997; **349:** 359–60.
9. Sehgal R. Tetanus toxoid for adults. *Lancet* 1997; **349:** 573.
10. Balestra DJ, Littenberg B. Tetanus immunization in adults. *JAMA* 1994; **272:** 1900.
11. Gardner P, LaForce FM. Protection against tetanus. *N Engl J Med* 1995; **333:** 599.

Preparations

Ph. Eur.: Tetanus Vaccine (Adsorbed);
USP 31: Tetanus Toxoid; Tetanus Toxoid Adsorbed.

Proprietary Preparations (details are given in Part 3)
Arg.: Tetanol; Tetavax; ***Austral.:*** Tet-Tox; ***Austria:*** Tetanol; ***Belg.:*** Tevax†; ***Braz.:*** Tetavax†; ***Chile:*** Tetavax; ***Cz.:*** Alteana; Tetavax; ***Ger.:*** Tetamun SSW†; Tetanol; ***Gr.:*** Anatoxal-TE-Berna†; ***Hong Kong:*** Te Anatoxal; Tetavax; ***Hung.:*** Tetanol; ***Ital.:*** Anatetall; Imovax Tetano; Tanrix†; Tetatox†; ***Malaysia:*** Te Anatoxal†; Tetavax†; TT Vaccine; ***Mex.:*** Tetamyn; Tetanol; Tetinox; ***Neth.:*** Tetavax†; ***Norw.:*** Tetavax; ***NZ:*** Te Anatoxal; Tet-Tox; ***Philipp.:*** Te Anatoxal; Tetavax; ***Port.:*** Anatoxal Te†; ***S.Afr.:*** Tetavax; ***Singapore:*** Te Anatoxal†; ***Spain:*** Anatoxal Te; ***Switz.:*** Anatoxal Te; ***Thai.:*** Anatetall†; Bio-TT; Te Anatoxal; Tetavax; TT Vaccine; ***Turk.:*** Anatetall; Tetavax; ***UK:*** Clostet†; ***USA:*** Te Anatoxal.

Tetanus and Influenza Vaccines

Vacunas del tétanos y la gripe.

Profile

Tetanus and influenza vaccines are available in some countries for active immunisation.

Preparations

Proprietary Preparations (details are given in Part 3)
Fr.: Tetagrip.

Tetanus and Poliomyelitis Vaccines

Vacunas del tétanos y la poliomielitis.

Profile

Tetanus and poliomyelitis (inactivated) vaccines have been used in some countries for active immunisation against tetanus and poliomyelitis.

Preparations

Proprietary Preparations (details are given in Part 3)
Fr.: T. Polio†; Vaccin TP†.

Tick Venom Antisera

Antisuero contra el veneno de garrapata; Tick Antivenins; Tick Antivenoms.

Profile

An antiserum is available in Australia for treatment of the neurotoxic effects of envenomation by the tick *Ixodes holocyclus*. The antiserum is prepared from the serum of dogs that have been immunised with tick venom.

Tick venom antiserum is given by slow intravenous infusion.

Tick-borne Encephalitis Immunoglobulins

Inmunoglobulinas de la encefalitis transmitida por garrapatas.
ATC — J06BB12.

Profile

Preparations containing antibodies against tick-borne encephalitis are available in some countries for passive immunisation against the disease.

Preparations

Proprietary Preparations (details are given in Part 3)
Austria: FSME-Bulin†; ***Cz.:*** FSME-Bulin†; ***Ger.:*** FSME-Bulin†.

Tick-borne Encephalitis Vaccines

Vacunas de la encefalitis transmitida por garrapatas.
ATC — J07BA01.

Pharmacopoeias. Many pharmacopoeias, including *Eur.* (see p.vii), have monographs.
Ph. Eur. 6.2 (Tick-borne Encephalitis Vaccine (Inactivated); Vaccinum Encephalitidis Ixodibus Advectae Inactivatum). A liquid preparation of a suitable strain of tick-borne encephalitis virus grown in cultures of chick-embryo cells or other suitable cell cultures and inactivated by a suitable method. It should be stored at 2° to 8°, not be allowed to freeze, and be protected from light.
The BP 2008 states that Tic/enceph may be used on the label.

Adverse Effects and Precautions

As for vaccines in general, p.2201.

Effects on the nervous system. Severe progressive sensorimotor spastic paralysis occurred in a 54-year-old man after a second booster dose of tick-borne encephalitis vaccine.[1] Partial recovery was noted after about 6 months.

1. Bohus M, *et al.* Myelitis after immunisation against tick-borne encephalitis. *Lancet* 1993; **342:** 239–40.

Interactions

As for vaccines in general, p.2202.

Uses and Administration

A vaccine is available in some countries for active immunisation against tick-borne viral encephalitis.

In the UK, vaccination against tick-borne encephalitis is recommended for those who anticipate prolonged exposure to the infective agent, for example persons visiting or working in the warm forested parts of Europe and Scandinavia. The vaccine is given by intramuscular injection in adult doses of 0.5 mL. The primary course consists of three doses, the second being given 4 to 12 weeks after the initial dose, and a third dose 5 to 12 months later. In children over 1 year of age and below 16 years of age, 3 doses of 0.25 mL of the junior formulation of the vaccine are given; the intervals between each dose are the same as for the adult schedule. To achieve rapid short-term protection in adults and children, the second dose may be given 2 weeks after the first dose. Booster doses for adults and children at continued risk should be given within 3 years of the last primary vaccination or booster dose.

Preparations

Ph. Eur.: Tick-borne Encephalitis Vaccine (Inactivated).

Proprietary Preparations (details are given in Part 3)
Austria: Encepur; FSME-Immun; ***Belg.:*** FSME-Immun; ***Canad.:*** FSME-Immun; ***Cz.:*** Encepur; FSME-Immun; ***Denm.:*** TicoVac; ***Fin.:*** Encepur; TicoVac; ***Fr.:*** TicoVac; ***Ger.:*** Encepur; FSME-Immun; ***Hung.:*** Encepur; FSME-Immun; ***Ital.:*** TicoVac; ***Norw.:*** TicoVac; ***Pol.:*** Encepur; FSME-Immun; ***Rus.:*** Encevir (Энцевир); ***Swed.:*** Encepur; FSME-Immun; ***Switz.:*** Encepur; FSME-Immun; ***UK:*** TicoVac.

Trichomoniasis Vaccines

Vacunas de la tricomoniasis.

Profile

A trichomoniasis vaccine containing inactivated *Lactobacillus* spp. is available in some countries for the prophylaxis of recurrent vaginal trichomoniasis. The vaccine is reported to stimulate production of antibodies against the aberrant coccoid forms of the lactobacilli associated with trichomoniasis and also, by cross-reaction, against the trichomonads themselves.

Preparations

Proprietary Preparations (details are given in Part 3)
Ger.: Gynatren.

Tularaemia Vaccines

Vacunas de la tularemia.

Profile

A tularaemia vaccine prepared from a live attenuated strain of *Francisella tularensis* has been used for active immunisation against tularaemia in persons at high risk of contracting the disease.

◊ References.

1. Titball R, Oyston P. A vaccine for tularaemia. *Expert Opin Biol Ther* 2003; **3:** 645–53.
2. Conlan JW. Vaccines against Francisella tularensis: past, present and future. *Expert Rev Vaccines* 2004; **3:** 307–14.

Typhoid Vaccines

Vacunas de la fiebre tifoidea.
ATC — J07AP01; J07AP02; J07AP03.

Pharmacopoeias. Many pharmacopoeias, including *Eur.* (see p.vii), have monographs.
Ph. Eur. 6.2 (Typhoid Vaccine; Vaccinum Febris Typhoidi). A sterile suspension of inactivated *Salmonella typhi* containing not less than 500 million and not more than 1000 million bacteria per dose which does not exceed 1 mL. It is prepared from a suitable strain of *S. typhi* such as Ty 2. The bacteria are inactivated by heat, or by treatment with acetone, formaldehyde, or phenol, or by phenol and heat. The vaccine should be stored at 2° to 8°, and be protected from light.
The BP 2008 states that Typhoid may be used on the label.
Ph. Eur. 6.2 (Typhoid Vaccine, Freeze-dried; Vaccinum Febris Typhoidi Cryodesiccatum). A freeze-dried preparation of inactivated *Salmonella typhi* containing not less than 500 million and not more than 1000 million bacteria per dose which does not exceed 1 mL. It is prepared from a suitable strain of *S. typhi* such as Ty 2. The bacteria are inactivated by heat, or by treatment with acetone or formaldehyde. Phenol may not be used in the preparation. The vaccine should be stored at 2° to 8°, and be protected from light. It is reconstituted by the addition of suitable sterile liquid and should be used within 8 hours.
The BP 2008 states that Typhoid may be used on the label.
Ph. Eur. 6.2 (Typhoid Vaccine (Live, Oral, Strain Ty 21a); Vaccinum Febris Typhoidis Vivum Perorale (Stirpe Ty 21a)). A freeze-dried preparation of live *S. typhi* strain Ty 21a grown in a suitable medium. It contains not less than 2×10^9 bacteria per dose. It should be stored at 2° to 8°, and be protected from light.
The BP 2008 states that Typhoid(live,oral) may be used on the label.
Ph. Eur. 6.2 (Typhoid Polysaccharide Vaccine; Vaccinum Febris Typhoidis Polysaccharidicum). A preparation of purified Vi capsular polysaccharide obtained from *S. typhi* Ty2 strain or some other suitable strain that has the capacity to produce Vi polysaccharide. It contains 25 micrograms of polysaccharide per dose. It should be stored at 2° to 8° and be protected from light.
The BP 2008 states that Typhoid may be used on the label.

Adverse Effects and Precautions

As for vaccines in general, p.2201.

Oral live typhoid and parenteral polysaccharide vaccines have been associated with fewer adverse effects than parenteral killed typhoid vaccines and have replaced them in many countries.

Interactions

As for vaccines in general, p.2202.

Conflicting advice has been issued about the use of live oral typhoid vaccines with antibacterials or antimalarials (particularly mefloquine or proguanil). WHO has stated that all these drugs should be stopped from 3 days before until 3 days after receiving the Ty 21a live oral vaccine. The UK licensed product information advises a separation of 3 days for antibacterials, 12 hours for mefloquine, and 3 days for other antimalarials (but the fixed-dose combination of atovaquone and proguanil may be given with the vaccine). The US product information has indicated that mefloquine (and chloroquine) can be given with the vaccine but that proguanil should only be taken 10 days after the vaccine.

Uses and Administration

Typhoid vaccines are used for active immunisation against typhoid fever. As with many vaccines, the efficacy of typhoid vaccine is not complete and the importance of maintaining attention to hygiene should be emphasised to those travelling to endemic areas.

Typhoid vaccination is advised for laboratory workers handling specimens which may contain typhoid organisms and for persons travelling to areas where typhoid fever is endemic. In the UK, vaccination of contacts of a known typhoid carrier is not recommended; in the USA such persons are advised to receive the vaccine. Typhoid vaccine is not useful in controlling outbreaks of the disease in non-endemic areas.

In the UK, two vaccines are used: a capsular polysaccharide vaccine for parenteral use, and a live oral vaccine.

The capsular polysaccharide typhoid vaccine contains 25 micrograms of the Vi polysaccharide antigen per dose. A single dose of 0.5 mL is given by deep subcutaneous or intramuscular injection. Booster doses may be given every 3 years to those who remain at risk. The response in children under 18 months of age may be suboptimal, and the decision to vaccinate will be governed by the risk of exposure to infection.

The live oral typhoid vaccine contains an attenuated strain of *Salmonella typhi*, Ty 21a, and is given as enteric-coated capsules containing not less than 2×10^9 bacteria per dose. A primary immunisation schedule of one capsule every other day for 3 doses is given.

In the USA, the Vi capsular polysaccharide vaccine and the live oral Ty 21a vaccine are available. The capsular polysaccharide vaccine is given intramuscularly similarly to that in the UK, with a booster dose suggested every 2 years. For the oral vaccine, 4 doses on alternate days are recommended for both primary immunisation and boosters, which are given every 5 years if exposure continues.

In areas where typhoid is endemic WHO advises that immunisation should be considered as part of the routine schedules; either the Vi capsular polysaccharide vaccine or the Ty 21a live oral vaccine should be given to schoolchildren over the age of 2 years. Immunisation of the whole community should also be considered during an outbreak of typhoid; if this is not possible, persons aged 2 to 19 years should be the target group.

Immunisation for travellers. In most developed countries where typhoid is not endemic, the major use for typhoid vaccine is for non-immune travellers visiting endemic areas. The highest incidence of the disease is associated with travel to the Indian subcontinent and parts of tropical South America, although immunisation is also recommended for travellers to lower risk areas of Africa, Asia, and south-east Europe. By far the most important form of protection against gastrointestinal infection is strict attention to personal, food, and water hygiene, although in practice this advice is often difficult to follow.[1]

None of the vaccines used has been 100% effective in preventing disease. The effectiveness of the vaccines has generally been assessed in field trials in the populations of endemic areas. Such populations acquire a degree of natural immunity due to continued exposure and it may not be possible to equate protection rates in these populations to non-immune travellers. The live oral vaccine has been shown to confer a useful degree of immunity in field trials but the dose used may have been insufficient to protect non-immune individuals. The degree of immunity induced may be increased by the use of higher inocula or liquid preparations. In addition, compliance with dosing and storage requirements may further limit the effectiveness of this dosage form.

Large field studies have verified the effectiveness of the capsular polysaccharide vaccine but its efficacy has not been assessed in