Immunologicals

Active immunity

Active immunity may be induced by the administration of micro-organisms or their products which act as antigens to induce antibodies to confer a protective immune response in the host. Vaccination may consist of (a) a **live attenuated** form of a virus or bacteria, (b) **inactivated** preparations of the virus or bacteria, or (c) **extracts of** or **detoxified exotoxins** . Live attenuated vaccines usually confer immunity with a single dose which is of long duration. Inactivated vaccines may require a series of injections in the first instance to produce an adequate antibody response and in most cases, require reinforcing (booster) doses. The duration of immunity varies from months to many years. Extracts of or detoxified exotoxins require a primary series of injections followed by reinforcing doses.

Passive immunity

Passive immunity is conferred by injecting preparations made from the plasma of immune individuals with adequate levels of antibody to the disease for which protection is sought. Treatment has to be given soon after exposure to be effective. This immunity lasts only a few weeks but passive immunization can be repeated where necessary.

Diagnostic agents

The **tuberculin test** has limited diagnostic value. A positive tuberculin test indicates previous exposure to mycobacterial antigens through infection with one of the tubercle bacilli, or BCG vaccination. The tuberculin test does not distinguish between tuberculosis and other mycobacterial infection, between active and quiescent disease, or between acquired infection and seroconversion induced by BCG vaccination.

Tuberculin purified protein derivative (tuberculin PPD)

All tuberculins should comply with the WHO Requirements for Tuberculins (Revised 1985). WHO Expert Committee on Biological Standardization Thirty-sixth report. WHO Technical Report Series, No.745, 1987, Annex 1.

Injection , tuberculin purified protein derivative 100 units/ml, 10 units/ml

Uses:

test for hypersensitivity to tuberculoprotein

Contraindications:

should not be used within 3 weeks of receiving a live viral vaccine

Precautions:

elderly; malnutrition; viral or bacterial infections (including HIV and severe tuberculosis), malignant disease, corticosteroid or immunosuppressant therapy—diminished sensitivity to tuberculin; avoid contact with open cuts, abraded or diseased skin, eyes or mouth

Dosage:

NOTE. National recommendations may vary

Test for hypersensitivity to tuberculoprotein, *by intradermal injection* , **ADULT** and **CHILD** 5 or 10 units (1 unit may be used in hypersensitive patients or if tuberculosis is suspected)

ADMINISTRATION. According to manufacturer's directions

Adverse effects:

occasionally nausea, headache, malaise, rash; immediate local reactions (more common in atopic patients); rarely, vesicular or ulcerating local reactions, regional adenopathy and fever

Sera and immunoglobulins

Antibodies of human origin are usually termed **immunoglobulins** . Material prepared from animals is called **antiserum** . Because of serum sickness and other allergic-type reactions that may follow injections of antisera, this therapy has been replaced wherever possible by the use of immunoglobulins.

All immunoglobulins and antisera should comply with WHO requirements for blood and plasma products.

CONTRAINDICATIONS AND PRECAUTIONS

Anaphylaxis, although rare, can occur and epinephrine (adrenaline) must always be immediately available during immunization.

Immunoglobulins may interfere with the immune response to live virus vaccines which should normally be given *either at least 3 weeks before or at least 3 months after* the administration of the immunoglobulin.

ADVERSE REACTIONS

Intramuscular injection. Local reactions including pain and tenderness may occur at the injection site. Hypersensitivity reactions may occur including, rarely, anaphylaxis.

Intravenous injection . Systemic reactions including fever, chills, facial flushing, headache and nausea may occur, particularly following high rates of infusion. Hypersensitivity reactions may occur including, rarely, anaphylaxis.

Anti-D immunoglobulin (human)

Anti-D immunoglobulin is prepared from plasma with a high titre of anti-D antibody. It is available to prevent a rhesus-negative mother from forming antibodies to fetal rhesus-positive cells which may pass into the maternal circulation. The aim is to protect any subsequent child from the hazard of haemolytic disease of the newborn. It should be administered following any potentially sensitizing episode (for example abortion, miscarriage, still-birth) immediately or within 72 hours of the episode but even if a longer period has elapsed it may still give protection and should be used. The dose of anti-D immunoglobulin given depends on the level of exposure to rhesus-positive blood. The injection of anti-D immunoglobulin is not effective once the mother has formed anti-D antibodies. It is also given following Rh_0 (D) incompatible blood.

Anti-D immunoglobulin (human)

Plasma fractions should comply with the Requirements for the Collection, Processing and Quality Control of Blood, Blood Components and Plasma Derivatives (Revised 1992). WHO Technical Report Series No 840, 1994, Annex 2

Injection , anti-D immunoglobulin 250-microgram vial

Uses:

prevention of formation of antibodies to rhesus-positive blood cells in rhesus-negative patients (see notes above)

Contraindications:

see introductory notes; known hypersensitivity

Precautions:

see introductory notes; caution in rhesus-positive patients for treatment of blood disorders; caution in rhesus-negative patients with anti-D antibodies in their serum; **interactions:** Appendix 1

RUBELLA VACCINE. Rubella vaccine may be administered in the postpartum period at the same time as anti-D immunoglobulin injection, but only using separate syringes and separate contralateral sites. If blood is transfused, the antibody response to the vaccine may be inhibited and a test for antibodies should be performed after 8 weeks and the subject revaccinated if necessary

Dosage:

NOTE. National recommendations may vary

Following birth of a rhesus-positive infant in rhesus-negative mother, *by intramuscular injection* , **ADULT** 250 micrograms immediately or within 72 hours (see also notes above)

Following any potentially sensitizing episode (for example amniocentesis, still-birth), *by intramuscular injection* , **ADULT** up to 20 weeks' gestation, 250 micrograms per episode (after 20 weeks, 500 micrograms) immediately or within 72 hours (see notes above)

Following Rh_0 (D) incompatible blood transfusion, *by intramuscular injection* , **ADULT** 10–20 micrograms per ml transfused rhesus-positive blood

Adverse effects:

see introductory notes

Antitetanus immunoglobulin (human)

Antitetanus immunoglobulin of human origin is a preparation containing immunoglobulins derived from the plasma of adults immunized with tetanus toxoid. It is used for the management of tetanus-prone wounds in addition to wound toilet and if appropriate antibacterial prophylaxis and adsorbed tetanus vaccine (see section 19.3.1.2).

Antitetanus immunoglobulin (human)

Plasma fractions should comply with the WHO Requirements for the Collection, Processing and Quality Control of Blood, Blood Components and Plasma Derivatives (Revised 1992). WHO Technical Report Series No 840, 1994, Annex 2

Injection , antitetanus immunoglobulin 500 units/vial

Uses:

passive immunization against tetanus as part of the management of tetanus-prone wounds

Contraindications:

see introductory notes

Precautions:

see introductory notes

TETANUS VACCINE.	If schedule requires tetanus vaccine and antitetanus immunoglobulin to be administered at the same time, they should be administered using separate syringes and separate sites

Dosage:

NOTE. National recommendations may vary

Management of tetanus-prone wounds, *by intramuscular injection* , **ADULT** and **CHILD** 250 units, increased to 500 units if wound older than 12 hours or there is risk of heavy contamination or if patient weighs more than 90 kg; second dose of 250 units given after 3–4 weeks if patient immunosuppressed or if active immunization with tetanus vaccine contraindicated (see also section 19.3.1.2)

Adverse effects:

see introductory notes

Diphtheria antitoxin

Diphtheria antitoxin is prepared from the plasma or serum of healthy horses immunized against diphtheria toxin or diphtheria toxoid. It is used for passive immunization in suspected cases of diphtheria without waiting for bacterial confirmation of the infection. A test dose should be given initially to exclude hypersensitivity. Diphtheria antitoxin is not used for prophylaxis of diphtheria because of the risk of hypersensitivity.

Diphtheria antitoxin

Injection , diphtheria antitoxin 10 000 units, 20 000 units/ vial

Uses:

passive immunization in suspected cases of diphtheria

Precautions:

initial test dose to exclude hypersensitivity; observation required after full dose (epinephrine (adrenaline) and resuscitation facilities should be available)

Dosage:

NOTE. National recommendations may vary

Passive immunization in suspected diphtheria (see Precautions), *by intramuscular injection* , **ADULT** and **CHILD** 10 000–30 000 units in mild to moderate cases; 40 000–100 000 units in severe cases (for doses of more than 40 000 units, a portion should be given *by intramuscular injection* followed by the bulk of the dose *intravenously* after an interval of 0.5–2 hours)

Adverse effects:

anaphylaxis with urticaria, hypotension, dyspnoea and shock; serum sickness up to 12 days after injection

Rabies immunoglobulin (human)

Rabies immunoglobulin is a preparation containing immunoglobulins derived from the plasma of adults immunized with rabies vaccine. It is used as part of the management of potential rabies following exposure of an unimmunized individual to an animal in or from a high-risk country. It should be administered as soon as possible after exposure without waiting for confirmation that the animal is rabid. The site of the bite should be washed with soapy water and the rabies immunoglobulin should be infiltrated round the site of the bite and also given intramuscularly. In addition rabies vaccine (see section 19.3.2.4) should be administered at a different site.

Rabies immunoglobulin (human)

Plasma fractions should comply with the WHO Requirements for the Collection, Processing and Quality Control of Blood, Blood Components and Plasma Derivatives (Revised 1992). WHO Technical Report Series No 840, 1994, Annexe 2

Injection , rabies immunoglobulin 150 units/ml, 2-ml vial, 10-ml vial

Uses:

passive immunization either post-exposure or in suspected exposure to rabies in high-risk countries in unimmunized individuals (in conjunction with rabies vaccine)

Contraindications:

see introductory notes; avoid repeat doses after vaccine treatment initiated; intravenous administration

Precautions:

see introductory notes

RABIES VACCINE.	If schedule requires rabies vaccine and rabies immunoglobulin to be administered at the same time, they should be administered using seperate syringes and seperate sites

Dosage:

NOTE. National recommendations may vary

Immunization against rabies: post-exposure (or suspected exposure) treatment, *by intramuscular injection* and *wound infiltration* , **ADULT** and **CHILD** 20 units/kg (half by intramuscular injection and half by wound infiltration)

Adverse effects:

see introductory notes

Antivenom sera

Acute envenoming from snakes or spiders is common in many parts of the world. The bite may cause local and systemic effects.

Local effects include pain, swelling, bruising and tender enlargement of regional lymph nodes. Wounds should be cleaned and pain may be relieved by analgesics.

If significant amounts of toxin are absorbed after a snake bite, this may result in early anaphylactoid symptoms such as transient hypotension, angioedema, abdominal colic, diarrhoea and vomiting, followed by persistent or recurrent hypotension and ECG abnormalities. Spontaneous systemic bleeding, coagulopathy, adult respiratory distress syndrome and acute renal failure may occur. Early anaphylactoid symptoms may be treated with epinephrine (adrenaline). **Snake antivenom sera** are the only specific treatment available but they can produce severe adverse reactions. They are generally only used if there is a clear indication of systemic involvement or severe local involvement or, if supplies are not limited, in patients at high risk of systemic or severe local involvement.

Spider bites may cause either necrotic or neurotoxic syndromes depending on the species involved. Supportive and symptomatic treatment is required and in the case of necrotic syndrome, surgical repair may be necessary. **Spider antivenom sera** , suitable for the species involved, may prevent symptoms if administered as soon as possible after envenomation.

Antivenom sera

Injection , snake antivenom serum and spider antivenom serum

NOTE. There are many antivenom sera each containing specific venom-neutralizing globulins. It is important that the specific antivenom serum suitable for the species causing the envenomation is administered

Uses:

treatment of snake bites and spider bites

Precautions:

resuscitation facilities should be immediately available

Dosage:

Depends on the specific antivenom used; consult manufacturer's literature

Adverse effects:

serum sickness; anaphylaxis with hypotension, dyspnoea, urticaria and shock

Vaccines

All vaccines should comply with the WHO requirements for biological substances. Vaccines may consist of a live attenuated form of a virus (for example, rubella or measles) or bacteria (for example, BCG vaccine); an inactivated preparation of a virus (for example, influenza vaccine) or bacteria; an extract of or detoxified exotoxin produced by a micro-organism (for example, tetanus vaccine).

CONTRAINDICATIONS AND PRECAUTIONS

Recipients of any vaccine should be observed for an adverse reaction. Anaphylaxis though rare, can occur and epinephrine (adrenaline) must always be immediately available whenever immunization is given. If a serious adverse event (including anaphylaxis, collapse, shock, encephalitis, encephalopathy, or non-febrile convulsion) occurs following a dose of any vaccine, a subsequent dose should not be given. In the case of a severe reaction to Diphtheria, Pertussis, and Tetanus vaccine, the pertussis component should be omitted and the vaccination completed with Diphtheria and Tetanus vaccine.

Immunization should be postponed in acute illness which may limit the response to immunization, but minor infections without fever or systemic upset are not contraindications. A definite reaction to a preceding dose is a definite contraindication.

If alcohol or other disinfecting agent is used to wipe the injection site it must be allowed to evaporate, otherwise inactivation of a live vaccine may occur.

The intramuscular route must not be used in patients with bleeding disorders such as haemophilia or thrombocytopenia.

Some viral vaccines contain small quantities of antibacterials such as polymyxin B or neomycin; such vaccines may need to be withheld from individuals who are extremely sensitive to the antibacterial. Some vaccines are prepared using hens' eggs and a history of anaphylaxis to egg ingestion is a contraindication to the use of such vaccines; caution is required if such vaccines are used in persons with less severe hypersensitivity to egg.

When two live virus vaccines are required (and are not available as a combined preparation) they should be given *either* simultaneously at different sites using separate syringes *or* with an interval of at least 3 weeks. Live virus vaccines should normally be given *either at least 2–3 weeks before or at least 3 months after* the administration of immunoglobulin.

Live vaccines should not be routinely administered to pregnant women because of the possible harm to the fetus but where there is significant risk of exposure, the need for immunization may outweigh any possible risk to the fetus.

Live vaccines should not be given to anyone with malignant disease such as leukaemia or lymphomas or other tumours of the reticulo-endothelial system. Live vaccines should not be given to individuals with an impaired immune response caused

by disease, radiotherapy or drug treatment (for example, high doses of corticosteroids).

However, the WHO recommends that immunocompromized individuals who are HIV-positive should, under certain circumstances, be given some live vaccines. *Asymptomatic* and *symptomatic* HIV-positive children and women of child-bearing age should receive diphtheria, pertussis, tetanus, hepatitis B and oral poliomyelitis vaccines (included in the Expanded Programme on Immunization (EPI)). Because of the risk of early and severe measles infection, infants should receive an extra dose of measles vaccine at 6 months of age with the EPI dose as soon after 9 months of age as possible. Individuals with *symptomatic* HIV infection must **not** be given either BCG or yellow fever vaccines. MMR vaccine should not be given to severely immunocompromized children with HIV infection. Individuals with *asymptomatic* HIV infection should only be given BCG or yellow fever vaccines where the prevalence of tuberculosis or yellow fever, respectively, is high. National policies on immunization of HIV-positive individuals may vary.

ADVERSE REACTIONS

Local reactions including inflammation and lymphangitis may occur. Sterile abscess may develop at the injection site; fever, headache, malaise starting a few hours after injection and lasting for 1–2 days may occur. Hypersensitivity reactions can occur including rarely, anaphylaxis.

Vaccines for universal immunization

The WHO Expanded Programme on Immunization (EPI) currently recommends that all countries immunize against diphtheria, hepatitis B, measles, poliomyelitis, pertussis, tetanus and that countries with a high incidence of tuberculosis infections should immunize against tuberculosis. Immunization against yellow fever is recommended in endemic countries. Routine vaccination against *Haemophilus influenzae* type b infection is also recommended in some countries. In geographical regions where the burden of disease is unclear, efforts should be made to evaluate the magnitude of the problem.

Immunization schedule recommended by WHO
Scheme A
Recommended in countries where perinatal transmission of hepatitis B virus is frequent (for example, countries in south-east Asia)

Age	Vaccines
Birth	BCG; Poliomyelitis, oral (1st); Hepatitis B (1st)
6 weeks	Diphtheria, pertussis, tetanus (1st); Haemophilus influenzae (type b)[1] (1st); Poliomyelitis, oral (2nd); Hepatitis B (2nd)
10 weeks	Diphtheria, pertussis, tetanus (2nd); Haemophilus influenzae (type b)[1] (2nd); Poliomyelitis, oral (3rd)
14 weeks	Diphtheria, pertussis, tetanus (3rd); Haemophilus influenzae (type b)[1] (3rd); Poliomyelitis, oral (4th);

9 months	Hepatitis B (3rd) Yellow fever (in countries where yellow fever poses a risk); Measles

Scheme B
Recommended in countries where perinatal transmission of hepatitis B virus is less frequent (for example, countries in sub-Saharan Africa)

Schedule as Scheme A, but hepatitis B (1st) given at 6 weeks and hepatitis B (2nd) given at 10 weeks

- [1] Haemophilus influenzae (type b) vaccine not included on WHO Model List

BCG vaccine (dried)

Where tuberculosis remains highly prevalent, routine immunization of infants within the first year of life with BCG vaccine, derived from bacillus Calmette-Guérin (an attenuated strain of *Mycobacterium bovis*), is highly cost-effective. This has been estimated, in several settings, to reduce the incidence of meningeal and miliary tuberculosis in early childhood by 50 to 90%. However, estimates of its effectiveness in older children have differed greatly from region to region and because efficacy against pulmonary tuberculosis is doubtful, the mainstay of the tuberculosis control programme is case-finding and treatment.

BCG vaccine

BCG vaccine should comply with the recommendations published in the report of the WHO Expert Committee on Biological Standardization, WHO Technical Report Series, No. 745, 1987 and Amendment 1987, WHO Technical Report Series No. 771, 1988

Injection (Powder for solution for injection), live bacteria of a strain derived from the bacillus of Calmette and Guérin

Uses:

active immunization against tuberculosis; see also section 6.2.4

Contraindications:

see introductory notes; generalized oedema; antimycobacterial treatment

Precautions:

pregnancy (Appendix 2); eczema, scabies—vaccine site must be lesion-free; **interactions:** Appendix 1

Dosage:

NOTE. National immunization schedules may vary

Immunization against tuberculosis, *by intradermal injection* , **INFANTS** up to 3 months, 0.05 ml; **ADULT** and **CHILD** over 3 months, 0.1 ml

RECONSTITUTION AND ADMINISTRATION. According to manufacturer's directions

Adverse effects:

see introductory notes; lymphadenitis and keloid formation; osteitis and localized necrotic ulceration; rarely, disseminated BCG infection in immunodeficient patients; rarely anaphylaxis

Diphtheria, pertussis and tetanus vaccines

DIPHTHERIA

Diphtheria is a bacterial infection caused by *Corynebacterium diphtheriae* , transmitted from person to person through close physical and respiratory contact. Diphtheria vaccine is a formaldehyde-inactivated preparation of diphtheria toxin, adsorbed onto a mineral carrier to increase its antigenicity and reduce adverse reactions. Immunized individuals can be infected by toxin-producing strains of diphtheria but systemic manifestations of the disease do not occur.

When administered for primary immunization in infants, diphtheria vaccine is almost always given together with pertussis and tetanus vaccines as part of a *three-component* preparation (DPT).

A *two-component* diphtheria vaccine with tetanus but without pertussis exists in two forms, DT and Td. Diphtheria-tetanus vaccine for children (DT) is used for primary immunization in infants who have contraindications to pertussis vaccine; it is also used in children under the age of 10 years for reinforcing immunization against diphtheria and tetanus in those countries which recommend it. Tetanus-diphtheria vaccine for adults, adolescents and children over 10 years of age (Td), which has a reduced amount of diphtheria toxoid to reduce the risk of hypersensitivity reactions, is used for primary immunization in persons over the age of 10 years; it is also used for reinforcing immunization in persons over the age of 10 years in those countries that recommend it.

PERTUSSIS

Pertussis (whooping cough) is a bacterial respiratory infection caused by *Bordetella pertussis* . Many of the symptoms are thought to be caused by toxins released by *B. pertussis* . Whole cell vaccine composed of whole pertussis bacteria killed by chemicals or heat is effective in preventing serious illness. It causes frequent local reactions and fever and rarely it may be associated with neurological reactions. Neurological complications after pertussis infection are considerably more common

than after the vaccine. It is combined with diphtheria-tetanus vaccine for primary immunization unless immunization against pertussis is contraindicated. Single component pertussis vaccines are available in some countries for use when the pertussis component has been omitted from all or part of the primary immunization schedule. An acellular form of the vaccine is also available.

In some countries it is recommended that children with a personal or family history of febrile convulsions or a family history of idiopathic epilepsy should be immunized. It is also recommended that children with well-controlled epilepsy are immunized. Advice on prevention of fever should be given at the time of immunization. In children with evolving neurological problems, immunization with pertussis should be deferred until the condition is stable; in such children diphtheria and tetanus vaccine should be offered for primary immunization, and there may be an opportunity at a later date to complete immunization with a single-component pertussis vaccine. Where there is doubt advice should be sought from a paediatrician.

TETANUS

Tetanus is caused by the action of a neurotoxin of *Clostridium tetani* in necrosed tissues such as occur in dirty wounds. Tetanus vaccine is available as a single component vaccine for primary immunization in adults who have not received childhood immunization against tetanus and for reinforcing immunization. The vaccine is also used in the prevention of neonatal tetanus and in the management of clean wounds and tetanus-prone wounds. Some countries recommend a maximum of 5 doses of tetanus vaccine in a life-time; for the fully immunized patient reinforcing doses at the time of a tetanus-prone injury should only be required if more than 10 years have elapsed since the last dose.

Neonatal tetanus due to infection of the baby's umbilical stump during unclean delivery is the cause of many deaths of newborn infants. Control of neonatal tetanus may be achieved by ensuring adequate hygiene during delivery and by ensuring protective immunity of mothers in late pregnancy. Tetanus vaccine is highly effective and the efficacy of two doses during pregnancy in preventing neonatal tetanus ranges from 80–100%. Women of child-bearing age may be immunized by a course of 5 doses (3 primary and 2 reinforcing) of tetanus vaccine.

Wounds are considered to be tetanus-prone if they are sustained *either* more than 6 hours before surgical treatment of the wound *or* at any interval after injury and show one or more of the following: a puncture-type wound, a significant degree of devitalized tissue, clinical evidence of sepsis, contamination with soil/manure likely to contain tetanus organisms. All wounds should receive thorough surgical toilet. Antibacterial prophylaxis may also be required for tetanus-prone wounds.

- For *clean wounds* , fully immunized individuals (those who have received a total of 5 doses of tetanus vaccine at appropriate intervals) and those whose primary immunization is complete (with boosters up to date) do not require tetanus vaccine; individuals whose primary immunization is incomplete or whose boosters are not up to date require a reinforcing dose of tetanus vaccine (followed by further doses as required to complete the schedule); non-immunized individuals (or whose immunization status is not known) should be

given a dose of the vaccine immediately (followed by completion of the full course of the vaccine if records confirm the need).

- For *tetanus-prone wounds* , management is as for clean wounds with the addition of a dose of antitetanus immunoglobulin (section 19.2.2) given at a different site; in fully immunized individuals and those whose primary immunization is complete (see above) the immunoglobulin is needed only if the risk of infection is especially high (for example, contamination with manure). Antibacterial prophylaxis (with benzylpenicillin, or amoxicillin with clavulanic acid, or metronidazole) may also be required for tetanus-prone wounds.

Diphtheria, pertussis, and tetanus vaccine (DPT)

DPT vaccine should comply with the recommendations published in the report of the WHO Expert Committee on Biological Standardization, WHO Technical Report Series, No. 800, 1990

Injection , diphtheria and tetanus toxoids and pertussis vaccine adsorbed onto a mineral carrier

Uses:

active immunization against diphtheria, tetanus and pertussis

Contraindications:

see introductory notes and notes above

Precautions:

see introductory notes and notes above; in cases of severe reaction, the pertussis component should be omitted and the primary course of immunization completed with diphtheria and tetanus vaccine

Dosage:

NOTE. National immunization schedules may vary

Primary immunization of children against diphtheria, pertussis and tetanus, *by intramuscular injection* , **INFANT** 0.5 ml at 6, 10 and 14 weeks (see WHO schedule, section 19.3.1)

Adverse effects:

see introductory notes; tetanus component rarely associated with peripheral neuropathy; pertussis component rarely associated with convulsions and encephalopathy

Diphtheria and tetanus vaccine (DT) (for children under 10 years)

DT vaccine should comply with the recommendations published in the report of the WHO Expert Committee on Biological Standardization, WHO Technical Report Series, No. 800, 1990

Injection , diphtheria and tetanus toxoids adsorbed onto a mineral carrier

Uses:

active immunization of children under 10 years against diphtheria and tetanus (see notes above)

Contraindications:

see introductory notes; adults and children over 10 years of age (see notes above)

Precautions:

see introductory notes

Dosage:

NOTE. National immunization schedules may vary

Primary immunization of children against diphtheria and tetanus when pertussis immunization is contraindicated, *by intramuscular injection* , **CHILD** under 10 years 3 doses each of 0.5 ml with an interval of not less than 4 weeks between each dose (see also WHO schedule, section 19.3.1)

Reinforcing immunization of children against diphtheria and tetanus, *by intramuscular injection* , **CHILD** under 10 years of age, 0.5 ml at least 3 years after completion of primary course of DPT or DT immunization

Adverse effects:

see introductory notes; tetanus component rarely associated with peripheral neuropathy

Tetanus and diphtheria vaccine (Td) (for adults, adolescents and children over 10 years)

Td vaccine should comply with the recommendations published in the report of the WHO Expert Committee on Biological Standardization, WHO Technical Report Series, No. 800, 1990

Injection , diphtheria (low dose) and tetanus toxoid adsorbed onto a mineral carrier

Uses:

active immunization of adults and children over 10 years of age against tetanus and diphtheria (see notes above)

Contraindications:

see introductory notes; children under 10 years (see notes above)

Precautions:

see introductory notes

Dosage:

NOTE. National immunization schedules may vary

Primary immunization of unimmunized adults and children over 10 years of age against tetanus and diphtheria, *by intramuscular injection* , **ADULT** and **CHILD** over 10 years of age, 3 doses each of 0.5 ml with an interval of not less than 4 weeks between each dose

Reinforcing immunization of adults and children over 10 years of age against tetanus and diphtheria, *by intramuscular injection* , **ADULT** and **CHILD** over 10 years of age, 0.5 ml 10 years after completing primary course

Adverse effects:

see introductory notes; tetanus component rarely associated with peripheral neuropathy

Tetanus vaccine

Tetanus vaccine should comply with the recommendations published in the report of the WHO Expert Committee on Biological Standardization, WHO Technical Report Series, No. 800, 1990

Injection , tetanus toxoid adsorbed onto a mineral carrier

Uses:

active immunization against tetanus and neonatal tetanus; wound management (tetanus-prone wounds and clean wounds)

Contraindications:

see introductory notes and notes above

Precautions:

see introductory notes and notes above

ANTITETANUS IMMUNOGLOBULIN. If schedule requires tetanus vaccine and antitetanus immunoglobulin to be administered at the same time, they should be administered using separate syringes and separate sites

Dosage:

NOTE. National immunization schedules may vary; some countries recommend a **maximum** of 5 doses of tetanus vaccine in a life-time

Primary immunization of unimmunized adults against tetanus, *by intramuscular injection* , **ADULT** 3 doses each of 0.5 ml with an interval of 4 weeks between each dose

Reinforcing immunization of adults against tetanus, *by intramuscular injection* , **ADULT** 2 doses each of 0.5 ml, the first 10 years after completion of primary course, and the second dose 10 years later

Immunization of women of child-bearing age against tetanus, *by intramuscular injection* , **woman of child-bearing age** , 3 primary doses each of 0.5 ml with an interval of not less than 4 weeks between the first and second doses and 6 months between the second and third doses; 2 reinforcing doses each of 0.5 ml, the first 1 year after completion of the primary course and the second dose 1 year later; **unimmunized pregnant woman** 2 doses of 0.5 ml with an interval of 4 weeks between each dose (second dose at least 2 weeks before delivery) and 1 dose during each of subsequent 3 pregnancies (maximum 5 doses)

Management of tetanus-prone wounds and clean wounds, *by intramuscular or deep subcutaneous injection* , **ADULT** 0.5 ml, the dose schedule being dependent upon the immune status of the patient and the level of contamination of the wound (see also notes above and under Antitetanus Immunoglobulin, section 19.2.2)

Adverse effects:

see introductory notes; tetanus component rarely associated with peripheral neuropathy

Hepatitis B vaccine

Hepatitis B is caused by hepatitis B virus. It is transmitted in blood and blood products, by sexual contact and by contact with infectious body fluids. Persons at increased risk of infection because of their life-style, occupation or other factors include parenteral drug abusers, individuals who change sexual partners frequently, health care workers who are at risk of injury from blood-stained sharp instruments and haemophiliacs. Also at risk are babies born to mothers who are HbsAg-positive (hepatitis B virus surface antigen positive) and individuals who might acquire the infection as the result of medical or dental procedures in countries of high prevalence. The main public health consequences are chronic liver disease and liver cancer rather than acute infection. Routine immunization is recommended and has been implemented in some countries. Plasma-derived hepatitis B vaccine is highly

efficacious. Over 90% of susceptible children develop a protective antibody response. A recombinant DNA vaccine is also available.

Hepatitis B vaccine

Hepatitis B vaccine should comply with the recommendations published in the report of the WHO Expert Committee on Biological Standardization, WHO Technical Report Series, No. 858, 1995

Injection , inactivated hepatitis B surface antigen adsorbed onto a mineral carrier

Uses:

active immunization against hepatitis B

Contraindications:

see introductory notes

Precautions:

see introductory notes

Dosage:

NOTE. National immunization schedules may vary

Immunization of children against hepatitis B, *by intramuscular injection* , **INFANT** 0.5 ml *either Scheme A* at birth and at 6 and 14 weeks of age, *or Scheme B* at 6, 10 and 14 weeks of age (see WHO schedule, section 19.3.1)

Immunization of unimmunized high risk persons against hepatitis B, *by intramuscular injection* , **ADULT** and **CHILD** over 15 years of age, 3 doses of 1 ml, with an interval of 1 month between the first and second dose and 5 months between the second and third doses; **CHILD** under 15 years, 0.5 ml

NOTE. Different products may contain different concentrations of antigen. Consult manufacturer's literature

ADMINISTRATION. The vaccine should be given in the deltoid region in adults and older children; anterolateral thigh is the preferred site in infants and young children; it should not be injected into the buttock (vaccine efficacy reduced); subcutaneous route used for patients with thrombocytopenia or bleeding disorders

Adverse effects:

see introductory notes; abdominal pain and gastrointestinal disturbances; muscle and joint pain, dizziness and sleep disturbance; occasionally cardiovascular effects

Measles vaccines

Measles is an acute viral infection transmitted by close respiratory contact. In some countries routine immunization of children against measles is given as one dose of a single component vaccine; in other areas, a two-dose schedule has been found to be more applicable. In developing countries, clinical efficacy is usually greater than 85%. Convulsions and encephalitis are rare complications. Measles vaccine is administered in many countries as part of a combined preparation with mumps vaccine and rubella vaccine (MMR vaccine); a single-dose primary immunization is followed by a reinforcing dose 2–5 years later.

Single-component vaccines or MMR may be used in the control of outbreaks of measles and should be offered to susceptible children within 3 days of exposure. It is important to note that MMR vaccine is **not** suitable for prophylaxis following exposure to mumps or rubella since the antibody response to the mumps and rubella components is too slow for effective prophylaxis.

Measles vaccine

Measles vaccines should comply with the recommendations published in the reports of the WHO Expert Committee on Biological Standardization, WHO Technical Report Series, No. 840, 1994, and Note, WHO Technical Report Series, No. 848, 1994

Injection (Powder for solution for injection), live, attenuated measles virus

Uses:

active immunization against measles

Contraindications:

see introductory notes; hypersensitivity to any antibiotic present in vaccine—consult manufacturer's literature; hypersensitivity to egg or gelatin

Precautions:

see introductory notes; pregnancy (Appendix 2); **interactions:** Appendix 1

Dosage:

NOTE. National immunization schedules may vary

Immunization of children against measles, *by intramuscular or deep subcutaneous injection* , **INFANT** at 9 months of age, 0.5 ml (see WHO schedule, section 19.3.1)

Prophylaxis in susceptible children after exposure to measles, *by intramuscular or deep subcutaneous injection* within 72 hours of contact, **CHILD** over 9 months of age 0.5 ml

RECONSTITUTION AND ADMINISTRATION. According to manufacturer's directions

Adverse effects:

see introductory notes; rashes sometimes accompanied by convulsions; rarely, encephalitis and thrombocytopenia

Measles, mumps and rubella vaccine (MMR vaccine)

MMR vaccine should comply with the recommendations published in the reports of the WHO Expert Committee on Biological Standardization, WHO Technical Report Series, No. 840, 1994 and Note, WHO Technical Report Series, No. 848, 1994

Injection , live, attenuated measles virus, mumps virus and rubella virus

Uses:

active immunization against measles, mumps and rubella

Contraindications:

see introductory notes; pregnancy (Appendix 2); hypersensitivity to any antibiotic present in vaccine—consult manufacturer's literature; hypersensitivity to egg

Precautions:

see introductory notes; history of convulsions—advice on controlling fever (see below); **interactions:** Appendix 1

POST-IMMUNIZATION FEVER..

Malaise, fever or rash may occur following the first dose of MMR vaccine, most commonly about 1 week after immunization and lasting 2–3 days. Carers should be advised that the child can be given paracetamol to reduce the fever followed if necessary by a second dose 4–6 hours later. If fever persists after the second dose of paracetamol, medical advice should be sought.

After a second dose of MMR vaccine, adverse reactions are considerably less common than after the first dose

Dosage:

NOTE. National immunization schedules may vary

Primary immunization of children against measles, mumps and rubella, *by intramuscular or deep subcutaneous injection* , **CHILD** 12–15 months, 0.5 ml

Reinforcing immunization of children against measles, mumps and rubella, *by intramuscular or deep subcutaneous injection* , **CHILD** 0.5 ml 2–5 years after primary dose

Prophylaxis in susceptible children after exposure to measles (see notes above), *by intramuscular or deep subcutaneous injection* within 72 hours of contact, **CHILD** 12 months of age and older, 0.5 ml

Adverse effects:

see introductory notes; malaise, fever, rash most common after first dose (see above); occasionally parotid swelling; rarely meningoencephalitis, idiopathic thrombocytopenic purpura

Poliomyelitis vaccines

Poliomyelitis is an acute viral infection spread by the faecal-oral route which can cause paralysis of varying degree. There are two types of vaccine against poliomyelitis: oral and injectable. Oral poliomyelitis vaccine (OPV) is composed of three types of live attenuated poliomyelitis viruses. The efficacy of OPV in preventing paralytic polio in developing countries ranges from 72% to 98% and is the vaccine of choice in eradication of the disease. Oral poliomyelitis vaccine may need to be repeated in patients with diarrhoea or vomiting. Those infected wth HIV should receive poliomyelitis vaccine according to the standard schedule but the vaccine is **contraindicated** in those with primary immune deficiency or those who are immunosuppressed. The need for strict personal hygiene must be stressed as the vaccine virus is excreted in the faeces. The contacts of a recently vaccinated baby should be advised particularly of the need to wash their hands after changing the baby's nappies. After primary immunization reinforcing doses may be given. Inactivated polio vaccine (IPV) is injectable and composed of inactivated strains of three types of poliomyelitis virus. It should be used for individuals who are immunosuppressed or for their household contacts.

Poliomyelitis vaccine (OPV) (live attenuated)

OPV should comply with the recommendations published in the report of the WHO Expert Committee on Biological Standardization, WHO Technical Report Series, No. 800, 1990

Oral suspension , live, attenuated poliomyelitis virus, types 1, 2, and 3

Uses:

active immunization against poliomyelitis

Contraindications:

see introductory notes; primary immunodeficiency or immunosuppression; not to be taken with food which contains a preservative; hypersensitivity to any antibiotic present in vaccine—consult manufacturer's literature

Precautions:

see introductory notes; pregnancy (Appendix 2); **interactions:** Appendix 1

Dosage:

NOTE. National immunization schedules may vary

Primary immunization of children against poliomyelitis, *by mouth* , **CHILD** 3 drops at birth and at 6, 10 and at 14 weeks of age (see WHO schedule, section 19.3.1)

Reinforcing immunization of children against poliomyelitis, *by mouth* , **CHILD** 3 drops at least 3 years after completion of primary course and a further 3 drops at 15–19 years of age

Primary immunization of unimmunized adult against poliomyelitis, *by mouth* , **ADULT** 3 doses each of 3 drops with an interval of at least 4 weeks between each dose

Reinforcing immunization of adults against poliomyelitis, *by mouth* , **ADULT** 3 drops 10 years after completion of primary course

NOTE. Some countries consider reinforcing immunization unnecessary in adults unless travelling to endemic areas

Adverse effects:

rarely, vaccine-associated poliomyelitis in recipients of vaccine and contacts of recipients

Poliomyelitis vaccine (IPV) (inactivated)

IPV should comply with the recommendations published in the reports of the WHO Expert Committee on Biological Standardization, WHO Technical Report Series, No. 673, 1982 and Addendum 1985, WHO Technical Report Series, No. 745, 1987

Injection , inactivated poliomyelitis virus, types 1, 2, and 3

Uses:

active immunization against poliomyelitis in patients for whom live vaccine is contraindicated (see notes above) or in persons in countries not wishing to use live vaccine

Contraindications:

see introductory notes

Precautions:

see introductory notes

Dosage:

NOTE. National immunization schedules may vary

Primary immunization of children against poliomyelitis, *by subcutaneous injection* , **child** 0.5 ml at 6, 10 and 14 weeks of age

Reinforcing immunization of children against poliomyelitis, *by subcutaneous (or intramuscular) injection* , **child** 0.5 ml at least 3 years after completion of the primary course and a further 0.5 ml at 15–19 years of age

Primary immunization of unimmunized adults against poliomyelitis, *by subcutaneous injection* , **ADULT** 3 doses each of 0.5 ml with intervals of at least 4 weeks between each dose

Reinforcing immunization of adults against poliomyelitis, *by subcutaneous injection* , **ADULT** 0.5 ml 10 years after completion of primary course

NOTE. Some countries consider reinforcing immunization unnecessary in adults unless travelling to endemic areas

Adverse effects:

see introductory notes

Vaccines for specific groups of individuals

There are several other vaccines available which are used in different countries but are not yet recommended for routine use throughout the world.

Allergic patients require specific immunotherapy.

Influenza vaccine

While most viruses are antigenically stable, the influenza viruses A and B (especially A) are constantly changing their antigenic structure as indicated by changes in the haemagglutinins (H) and neuraminidases (N) on the surface of the viruses. It is essential that **influenza vaccines** in use contain the H and N components of the prevalent strain or strains. The changes are monitored and recommendations are made each year regarding the strains to be included in influenza vaccines for the following season. The recommended vaccine strains are grown on chick embryos and the vaccine is therefore contraindicated in individuals hypersensitive to egg. There are three forms of influenza vaccine; whole virion vaccine (not recommended for use in children because of the increased risk of severe febrile reactions), split-virion vaccine and surface-antigen vaccine.

The vaccines will not control epidemics and they are recommended only for those at high risk. Annual immunization is recommended in the elderly and those of any age with diabetes mellitus, chronic heart disease, chronic renal failure, chronic respiratory disease including asthma, or immunosuppression due to disease or drug treatment.

Influenza vaccine

Influenza vaccine should comply with the recommendations published in the report of the WHO Expert Committee on Biological Standardization, WHO Technical Report Series, No. 814, 1991

Injection , inactivated influenza virus, types A and B

Uses:

active immunization against influenza in individuals at risk

Contraindications:

see introductory notes; whole virion vaccine not recommended in children; hypersensitivity to any antibiotic present in vaccine—consult manufacturer's literature; hypersensitivity to egg

Precautions:

see introductory notes; **interactions:** Appendix 1

Dosage:

NOTE. National immunization schedules may vary

Immunization against influenza (annually for high-risk persons), *by intramuscular or deep subcutaneous injection* , **ADULT** and **CHILD** over 13 years, 0.5 ml as a single dose; **CHILD** 6–35 months, 0.25 ml repeated after at least 4 weeks if child not previously infected or vaccinated; **CHILD** 3–12 years of age, 0.5 ml, with a second dose after at least 4 weeks if child not previously infected or vaccinated

Adverse effects:

see introductory notes; occasionally, severe febrile reactions—particularly after whole virion vaccine in children

Meningococcal polysaccharide vaccine

Meningococcal polysaccharide vaccine is effective against serogroups A and C of *Neisseria meningitidis* but infants respond less well than adults. Immunity to some meningococcal vaccines may be insufficient to confer adequate protection against infection in infants under about 2 years of age and the minimum age recommended by manufacturers varies from 2 months to 2 years. It is indicated for persons at risk of serogroups A and C meningococcal disease in epidemics (where it must be administered early in the course of the epidemic) or endemic areas and as an adjunct to chemoprophylaxis in close contacts of persons with the disease. It is indicated for visits of longer than 1 month to areas of the world where risk of infection is high.

Meningococcal polysaccharide vaccine

Meningococcal polysaccharide vaccine should comply with the recommendations published in the reports of the WHO Expert Committee on Biological Standardization, WHO Technical Report Series, No. 594, 1976 and Addendum 1980 incorporating Addendum 1976 and 1977, WHO Technical Report Series, No. 658, 1981

Injection (Powder for solution for injection), inactivated polysaccharide antigens of *Neisseria meningitidis* (meningococcus) groups A and C

Uses:

active immunization against meningitis and septicaemia caused by *N. meningitidis* group A and C serotypes

Contraindications:

see introductory notes

Precautions:

see introductory notes

Dosage:

NOTE. National immunization schedules may vary

Immunization against infection by *N. meningitidis* groups A and C, *by deep subcutaneous or by intramuscular injection* , **ADULT** and **CHILD** (see notes above and manufacturer's literature), 0.5 ml as a single dose

RECONSTITUTION AND ADMINISTRATION. According to manufacturer's directions

Adverse effects:

see introductory notes

Mumps vaccine

Mumps vaccine is used for active immunization against mumps. In some countries the single antigen vaccine is no longer available and a combined measles, mumps and rubella vaccine (MMR vaccine; section 19.3.1.4) is used for primary immunization.

Mumps vaccine

Mumps vaccine should comply with the recommendations published in the reports of the WHO Expert Committee on Biological Standardization, WHO Technical Report Series, No. 840, 1994 and No. 848, 1994

Injection (Powder for solution for injection), live attenuated strain of mumps virus

Uses:

active immunization against mumps

Contraindications:

see introductory notes; pregnancy (Appendix 2); hypersensitivity to any antibacterial present in the vaccine—consult manufacturer's literature; hypersensitivity to egg

Precautions:

see introductory notes; avoid in children under 1 year

Dosage:

NOTE. National immunization schedules may vary

Immunization of children against mumps, *by subcutaneous injection* , **child** over 1 year 0.5 ml

RECONSTITUTION AND ADMINISTRATION. According to manufacturer's directions

Adverse effects:

parotid swelling; rarely, unilateral nerve deafness, meningitis, encephalitis

Rabies vaccine (inactivated)

Rabies vaccine is used as part of the *post-exposure treatment* to prevent rabies in patients who have been bitten by rabid animals or animals suspected of being rabid. Treatment is dependent upon the individual's immune status and upon the level of risk of rabies in the country concerned (consult national immunization schedule); in certain circumstances such as patients with incomplete prophylaxis or unimmunized individuals *passive immunization* with rabies immunoglobulin may be indicated (see Rabies Immunoglobulin, section 19.2.4). Treatment should also include thorough wound cleansing.

The vaccine is also used for *pre-exposure prophylaxis* against rabies in those at high risk such as laboratory workers, veterinary surgeons, animal handlers and health workers who are likely to come into close contact with infected animals or patients with rabies. Pre-exposure prophylaxis is also recommended for those living or travelling in enzootic areas who may be exposed to unusual risk.

Rabies vaccine (inactivated) (prepared in cell culture)

Rabies vaccine should comply with the recommendations on Rabies Vaccine (inactivated) for Human Use Produced in Continuous Cell Lines, published in the reports of the WHO Expert Committee on Biological Standardization, WHO

Technical Report Series, No. 760, 1987 and Amendment 1992, WHO Technical Report Series, No. 840, 1994

Injection , inactivated rabies virus prepared in cell culture

Uses:

active immunization against rabies; pre-exposure prophylaxis, post-exposure treatment (see notes above)

Contraindications:

see introductory notes

Precautions:

see introductory notes

RABIES IMMUNOGLOBULIN.	If schedule requires rabies vaccine and rabies immunoglobulin to be administered at the same time, they should be administered using separate syringes and separate sites

Dosage:

NOTE. National immunization schedules may vary

Immunization against rabies: pre-exposure prophylaxis, *by deep subcutaneous or by intramuscular injection* , **ADULT** and **CHILD** 1 ml on days 0, 7 and 28, with reinforcing doses every 2–3 years for those at continued risk

Immunization against rabies: post-exposure treatment (in unimmunized individuals), *by deep subcutaneous or by intramuscular injection* , **ADULT** and **CHILD** 5 doses of 1 ml on days 0, 3, 7, 14 and 28 (plus rabies immunoglobulin given on day 0, section 19.2.4; see notes above)

Immunization against rabies: post-exposure treatment (in fully immunized individuals), *by deep subcutaneous or by intramuscular injection* , **adult** and **child** 2 doses of 1 ml separated by 3–7 days (see notes above)

Adverse effects:

see introductory notes; pain, erythema and induration at injection site; nausea, myalgia; hypersensitivity—less likely with vaccines from human sources

Rubella vaccine

Rubella vaccine should be given to women of child-bearing age if they are seronegative to protect them from the risks of rubella in pregnancy. It should not be given in pregnancy and patients should be advised not to become pregnant within one month of vaccination. However, congenital rubella syndrome has not been reported

following inadvertent immunization shortly before or during pregnancy. There is no evidence that the vaccine is teratogenic and routine termination of pregnancy following inadvertent immunization should **not** be recommended. There is no risk to a pregnant woman from contact with recently vaccinated persons as the vaccine virus is not transmitted.

The vaccine may contain traces of antibiotics and if so should not be used in individuals with hypersensitivity to them.

In some countries the policy of protecting women of childbearing age has been replaced by a policy of eliminating rubella in children. Rubella vaccine is a component of the MMR vaccine (see section 19.3.1.4). Countries seeking to eliminate rubella should ensure that women of child-bearing age are immune and that over 80% of children are immunized.

Rubella vaccine

Rubella vaccine should comply with the recommendations published in the report of the WHO Expert Committee on Biological Standardization, WHO Technical Report Series, No. 840, 1994 and Note, WHO Technical Report Series, No. 848, 1994

Injection (Powder for solution for injection), live attenuated rubella virus

Uses:

active immunization against rubella in women of child-bearing age

Contraindications:

see introductory notes; pregnancy (see notes above); hypersensitivity to any antibiotic present in vaccine—consult manufacturer's literature; hypersensitivity to egg

Precautions:

see introductory notes; **interactions:** Appendix 1

Dosage:

NOTE. National immunization schedules may vary

Immunization of women of child-bearing age against rubella, *by deep subcutaneous or by intramuscular injection* , **adult** , 0.5 ml as a single dose

RECONSTITUTION AND ADMINISTRATION. According to the manufacturer's directions

Adverse effects:

see introductory notes; rash, lymphadenopathy; arthralgia and arthritis; rarely, thrombocytopenia, neurological symptoms

Typhoid vaccine

Typhoid vaccine is used for active immunization against typhoid fever and immunization is advised for those travelling to endemic areas. The efficacy of the vaccine is not complete and the importance of maintaining scrupulous attention to food and water hygiene as well as personal hygiene must also be emphasized.

Typhoid vaccine is available as a capsular polysaccharide injection.

In children under 2 years the injection may show sub-optimal response. Immunization is also recommended for laboratory workers handling specimens from suspected cases.

A live oral typhoid vaccine containing an attenuated strain of *Salmonella typhi* (Ty21a) may also be available.

Typhoid vaccine

Typhoid vaccine should comply with the recommendations published in the report of the WHO Expert Committee on Biological Standardization, WHO Technical Report Series, No. 840, 1994

Capsule , live attenuated strain of *Salmonella typhi* (Ty21a)

Injection , Vi capsular polysaccharide typhoid 25 microgram/0.5 ml

Uses:

active immunization against typhoid

Contraindications:

see introductory notes

Precautions:

see introductory notes and notes above

Dosage:

NOTE. National immunization schedules may vary

Immunization against typhoid fever, *by mouth* , **ADULT** and **CHILD** over 6 years, one dose given on days 0, 2, and 4 (total of 3 doses), with reinforcing doses every year for travellers to disease-endemic countries and every 3 years for those living in disease-endemic areas

Immunization against typhoid fever, *by deep subcutaneous or by intramuscular injection* , **ADULT** and **CHILD** (see notes above) 0.5 ml, with reinforcing doses every 3 years for those at continued risk

ADMINISTRATION. According to the manufacturer's directions

Adverse effects:

see introductory notes

Yellow fever vaccine

Yellow fever is a viral haemorrhagic fever endemic in some countries of South America and Africa. The disease is transmitted by *Haemagogus* and *Aedes* mosquito bites. The vaccine is highly immunogenic and offers about 10 years protection. Over 92% of children develop protective antibodies. It is recommended that all countries in which yellow fever is endemic should incorporate this vaccine into their immunization schedule. It is also used for travellers to endemic areas.

Yellow fever vaccine

Yellow fever vaccine should comply with the recommendations published in the reports of the WHO Expert Committee on Biological Standardization, WHO Technical Report Series, No. 872, 1998

Injection (Powder for solution for injection), live, attenuated yellow fever virus

Uses:

active immunization against yellow fever

Contraindications:

see introductory notes; not recommended for infants under 6 months of age; hypersensitivity to any antibiotic present in vaccine—consult manufacturer's literature; hypersensitivity to egg

Precautions:

see introductory notes; pregnancy (Appendix 2); **interactions:** Appendix 1

Dosage:

NOTE. National immunization schedules may vary

Immunization of children against yellow fever, *by subcutaneous injection* , **INFANT** at 9 months of age, 0.5 ml (see WHO schedule, section 19.3.1)

Immunization of travellers and others at risk against yellow fever, *by subcutaneous injection* , **ADULT** and **CHILD** over 9 months of age 0.5 ml; **INFANT** 6–9 months of age 0.5 ml, only if risk of yellow fever is unavoidable (see Adverse Effects)

RECONSTITUTION AND ADMINISTRATION. According to manufacturer's directions

Adverse effects:

see introductory notes; rarely encephalitis, generally in infants under 9 months