International Travel and Health

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Chapter 6 - Vaccine-preventable diseases and vaccines (2019 update)

Vaccine-preventable diseases and vaccines

6.1 General considerations

Vaccination is the administration of agent-specific, but safe, antigenic components that in vaccinated individuals can induce protective immunity against the corresponding infectious agent. Before departure, travellers should have a medical consultation to learn about the risk of disease in the country or countries they plan to visit and the steps to be taken to prevent illness.

6.1.1 Disease prevention

Vaccination is a highly effective method of preventing certain infectious diseases. Vaccines are generally very safe, and serious adverse reactions are uncommon. Routine immunization programmes protect most of the world's children from a number of infectious diseases that previously caused millions of deaths each year. For travellers, vaccination offers the possibility of avoiding some infectious diseases that may be encountered while they are away from home. However, satisfactory vaccines have not yet been developed against several of the most life-threatening conditions; therefore, other precautions, such as avoiding mosquito bites and handwashing, and general precautions should also be followed.

6.1.2 Vaccination and other precautions

Despite their success in preventing disease, vaccines rarely protect 100% of the recipients. No vaccinees, including travellers, should assume that there is no risk of contracting the disease(s) against which they have been vaccinated.

6.1.3 Planning before travel

No single vaccination schedule suits all travellers, and each schedule must be personalized by a physician according to the traveller's previous vaccinations, health status and risk factors, the countries to be visited, the type and duration of travel, types of activities and the time available before departure.

A medical consultation before departure is a good opportunity for a health care provider to review routine vaccinations and provide any vaccines that have been missed, in addition to providing the vaccinations indicated for the specific itinerary.

After vaccination, the immune response of the vaccinated person varies according to the type of vaccine, the number of doses administered and whether the person has been vaccinated previously against the same disease. For this reason, travellers are advised to consult a travel medicine practitioner or physician 4–8 weeks before departure in order to allow sufficient time for optimal immunization schedules to be completed. However, even when departure is imminent, there is still time to provide advice and possibly some vaccinations.

6.1.4 Vaccine schedules and administration

The vaccines that may be recommended or considered for travellers are summarized in Table 6.1.

Table 6.1 Travel-related vaccination

Category	Rationale for vaccination	Vaccine
1. Routine vaccines for review before travelling	These vaccines are part of most national childhood immunization programmes. However, a pre-travel consultation is a good opportunity for health care providers to review the vaccination status of infants, children, adolescents and adults and ensure they have received vaccines as per their own country schedule.	Diphtheria, tetanus and pertussis
		Hepatitis B
		Haemophilus influenzae type b
		Human papillomavirus
		Influenza (seasonal)
		Measles, mumps and rubella
		Pneumococcal
		Polio
		Rotavirus[c]
		Tuberculosis[d]
		Varicella[c]
2. Vaccines recommended for certain destinations[a]	These vaccines are recommended to provide protection against diseases endemic to the country of origin or of destination. They are intended to protect travellers and to prevent disease spread within and between countries.	Cholera[b]
		Hepatitis A[b] and/or E
		Japanese encephalitis[b]
		Meningococcal[b]
		Polio (adult booster dose)
		Typhoid fever[b]
		Yellow fever[b]
		Rabies[b]
		Tick-borne encephalitis[b]
3. Vaccines demanded by certain countries[a]	Some countries require proof of vaccination for travellers wishing to enter or exit the country. For information, see the country list on WHO's International Travel and Health (ITH) web page.[1]	Polio vaccine (oral or inactivated poliovirus, see text on polio in section 6.2)
		Yellow fever vaccine for travellers going to and coming from countries or areas at risk of yellow fever[2]
		Meningococcal vaccine. Specific updates for pilgrims going to Saudi Arabia are available on the WHO web page for the *Weekly Epidemiological Record*[3].

[1] International travel and health. See country list updated yearly on WHO's ITH web page at: http://www.who.int/ith/en/.
[2] International travel and health. See Annex 1 on WHO's ITH web page at: http://www.who.int/ith/en/.
[3] *Weekly Epidemiological Record* (WER). See WHO's WER web page at: http://www.who.int/wer.

	The Ministry of Health in the Kingdom of Saudi Arabia recommends that all visitors arriving for *umrah* or *hajj* or for seasonal work in *hajj* zones to be vaccinated against seasonal influenza.[4]

[a] Because of their more comprehensive presentations, vaccines in categories 1 and 2 are listed with a summary of vaccine data
[b] These vaccines are also included in the routine immunization programmes of several high-risk countries
[c] So far, these vaccines have been introduced into the routine immunization programmes of a limited number of countries.
[d] These vaccines are no longer routine in most high-income countries.

All vaccinations should be completed at least two weeks before departure. Recently, WHO has communicated its advice for international travel in relation to measles. Travellers who are uncertain of their measles vaccination status should receive at least one dose of measles vaccine.

Further information on the schedules for administration of these vaccines can be found in the sections on individual vaccines, as well as in WHO's corresponding vaccine position papers.[5] Summary tables for routine vaccinations can be found on the WHO website on the web page of WHO's recommendations for routine immunization – summary tables.[6]

The sections on individual vaccines and the WHO position papers also provide information on the recommended dose intervals of multidose vaccination schedules, although adjustments can be made to accommodate the needs of travellers who may not be able to complete the schedule exactly as prescribed. In general, it is acceptable to lengthen the intervals between doses, and repeating previous vaccine doses is unnecessary unless this is explicitly stated in the package insert. Significant shortening of the intervals is not recommended. It is important to know that protective immunity is usually achieved 7–10 days after primary vaccination, whereas a booster dose may restore waning immunity within a few days.

The routine country requirements for international travellers are published and updated on the ITH page of the WHO website[7]. Temporary country requirements due to exceptional circumstances are listed on the same WHO website (see latest updates).

Vaccines that are still under use in clinical trial settings only, such as against malaria and against Ebola virus, are currently not recommended for travellers.

6.1.5 Safe injections

[4] International travel and health. Health requirements and recommendations for travellers to Saudi Arabia for hajj and umrah https://www.who.int/ith/ITH-Haj-2019.pdf?ua=1, accessed August 2019.
[5] Vaccine position papers. See WHO website at: http://www.who.int/immunization/documents/positionpapers/en/.
[6] Recommendations for routine immunization – summary tables. See WHO website at: http://www.who.int/immunization/policy/immunization_tables/en/.
[7] International travel and health. See country list updated yearly on WHO's ITH web page at: http://www.who.int/ith/en/.

The administration of vaccines requires the same high standard of injection safety as any other injection. A sterile needle and syringe should be used for each injection, and both should be disposed of safely.

WHO recommends the exclusive use of single-use ("auto-disable") syringes and preferably devices with sharps injury protection features whenever possible.[8] Syringes should not be recapped (to avoid needle-stick injuries) and should be disposed of in a way that is safe for the recipient, the provider and the community[9]

6.1.6 Combinations and co-administration of vaccines

Inactivated vaccines do not generally interfere with other vaccines. However, multiple injections at a single visit should be administered at separate sites (different limbs) for each injection, or injection sites should be by at least 2.5 cm (1 in). Most live vaccines can be given simultaneously if they are administered at different anatomical sites. If injectable live-virus vaccines are not administered on the same day, their administration should be separated by an interval of at least 4 weeks. However, live oral polio vaccine (OPV) and the live oral Ty21a typhoid vaccine can be administered simultaneously with or at any interval before or after injectable live vaccines. For programmatic reasons, co-administration of yellow fever- and measles-containing vaccines is recommended.[10]

Several combination vaccines are now available to provide protection against more than one disease, and new combinations are likely to become available in the future. Combination vaccines offer important advantages for travellers by reducing the number of injections required. In general, licensed combination vaccines are just as safe and effective as the single-disease vaccines.

6.1.7 Choice of vaccines for travel

Vaccines for travellers include: (1) routine vaccines for review before travelling, (2) vaccines for certain destinations and (3) vaccines demanded by certain countries. Pre-travel precautions should include booster doses of routine vaccines if the regular schedule has not been followed or a full course of primary vaccination for people who have never been vaccinated. Inhabitants of areas where vaccine-preventable diseases are endemic who are travelling to non-endemic areas should be adequately vaccinated to prevent introduction or reintroduction of diseases such as polio, yellow fever, measles and rubella.

Travellers will be advised to receive other vaccines on the basis of an individual travel risk assessment. In deciding which vaccines would be appropriate, the following factors should be considered for each vaccine:

– risk of exposure to the disease;
– age, health status and vaccination history of the traveller;

[8] WHO guideline on the use of safety-engineered syringes for intramuscular, intradermal and subcutaneous injections in health-care settings. Geneva: World Health Organization; 2015 (Document WHO/HIS/SDS/2015.5)

[9] WHO best practices for injections and related procedures toolkit. Geneva: World Health Organization; 2010 (Document WHO/EHT/10.02; http://apps.who.int/iris/bitstream/10665/44298/1/9789241599252_eng.pdf, accessed November 2019

[10] WHO SAGE meeting report October 2018.https://apps.who.int/iris/bitstream/handle/10665/276544/WER9349.pdf?ua=1

– reactions to previous vaccine doses, allergies;
– risk of infecting others;
– required vaccinations for entering certain countries and
– cost.

Yellow fever vaccination is, in certain situations, required by the International Health Regulations (2005). In some non-endemic countries, yellow fever vaccination is a prerequisite for entry for those who have recently passed through yellow fever-endemic areas. Vaccination against yellow fever is done for two reasons: (1) to protect individuals in areas of risk for yellow fever virus infection, and (2) to protect vulnerable countries from importation of the yellow fever virus.

Vaccination against meningococcal disease (tetravalent ACWY polysaccharide or conjugate vaccine) is required in Saudi Arabia for pilgrims visiting Mecca and Medina for the *hajj* or *umrah* as well as for guest workers. Selected countries may also recommend vaccination against influenza for pilgrims to Mecca or Medina.

Some polio-free countries[11] may also require travellers resident in countries or areas reported to have wild polioviruses[12] to be vaccinated against polio in order to obtain an entry visa, as in the case of Brunei Darussalam, India and Saudi Arabia.

Travellers should be provided with a written record of all vaccines administered (patient-retained record), preferably on the International Certificate of Vaccination or Prophylaxis (which is required for yellow fever vaccination). The certificate can be accessed on the WHO website.[13]

The International Travel and Health country list[14] provides a summary of countries' requirements for incoming international travellers as well as WHO recommendations regarding yellow fever vaccination

6.2 Vaccines for routine and selective use

Recommendations on vaccines for routine use are provided by WHO in regularly updated position papers.[15] As the information provided in this chapter is limited, readers are encouraged to refer to WHO's vaccine position papers and to national guidelines on routine vaccinations. Travellers should ensure that all routine vaccinations are up to date.

Information on the vaccine-preventable diseases and the relevant vaccines are set out below.

CHOLERA

Summary of vaccine data

[11] International travel and health. See country list updated yearly on WHO's ITH web page at: http://www.who.int/ith/en/
[12] Global Polio Eradication Initiative. See map on website at: http://polioeradication.org
[13] International Certificate of Vaccination or Prophylaxis. See: http://www.who.int/ihr/IVC200_06_26.pdf
[14] International travel and health, see country list link from http://www.who.int/ith/en/
[15] Vaccine position papers. See WHO website at: http://www.who.int/immunization/documents/positionpapers/en/

	Type of vaccine:	(a) Killed oral O1 whole-cell with B-subunit. (b) Killed oral O1 and O139.
	Number of doses:	(a) For individuals ≥ 6 years of age, two doses, and for children aged 2–5 years, three doses. The interval between doses should be ≥ 7 days and < 6 weeks. Booster doses are recommended after 2 years for individuals ≥ 6 years of age and every 6 months for children aged 2–5 years. If recommended intervals between the primary doses or between the last primary dose and a booster dose are exceeded, primary vaccination should be repeated. (b) Two doses 14 days apart for individuals ≥ 1 year. One booster dose is recommended after 2 years for all age groups.
	Contraindications:	Hypersensitivity to previous dose.
	Consider for	Travellers at high risk (e.g. emergency/relief workers).
	Special precautions	None
Cause	*Vibrio cholerae* bacteria of serogroups O1 and O139.	
Transmission	Infection occurs through ingestion of food or water contaminated directly or indirectly by faeces or vomitus of infected individuals.	
Nature of the disease	An acute enteric disease of varying severity. Most infections are asymptomatic (i.e. they do not cause illness). In mild cases, acute watery diarrhoea occurs without other symptoms. In severe cases, there is sudden onset of profuse watery diarrhoea with nausea and vomiting and rapid development of dehydration. In severe untreated cases, death may occur within a few hours due to dehydration, leading to circulatory collapse.	
Geographical distribution	Cholera occurs mainly in low-income countries and areas where the infrastructure may have broken down that lack adequate sanitation and clean drinking-water.	
Risk for travellers	The risk for most travellers is very low, even in countries where cholera epidemics occur, provided that simple precautions such as hygiene[16] are taken. However, humanitarian relief workers in disaster areas and refugee camps may be at risk.	
General precautions	As for other diarrhoeal diseases, the consumption of potentially contaminated food, drinks and water should be avoided. Oral rehydration salts should be carried to combat dehydration and electrolyte depletion in case of severe diarrhoea. Cholera vaccination is not required as a condition of entry to any country.	

[16] Consumption of clean potable water, systematic hand-washing with soap after defaecation and before handling food or eating, as well as safe preparation and conservation of food.

Vaccine	An oral vaccine consisting of killed whole-cell *V. cholerae* O1 in combination with a recombinant B-subunit of cholera toxin (WC/rBS) has been marketed since the early 1990s. This killed vaccine is well tolerated and confers high-level (about 85%) protection for 6 months after the second dose in all vaccinees aged over 2 years. The protective efficacy has dropped to about 60% 2 years after vaccination and is only 0–18% after 3 years. Primary vaccination consists of two oral doses ≥ 7 days (but < 6 weeks) apart for adults and children aged ≥ 6 years. For children aged 2–5 years, three doses are recommended. Intake of food and drinks should be avoided for 1 h before and after vaccination. If the second dose is delayed for more than 6 weeks, vaccination should be restarted. Following primary vaccination, protection against cholera may be expected after about 1 week. Booster doses are recommended after 2 years for adults and for children aged ≥ 6 years and every 6 months for children aged 2–5 years. The appropriate primary vaccination must be repeated for the two groups if > 2 years and > 6 months, respectively, have passed since administration. The vaccine is not licensed for children under 2 years of age. In studies of travellers to areas with reported cholera outbreaks, WC/rBS was found to confer short-term protection against diarrhoea caused by enterotoxigenic *Escherichia coli* in about 50% of those vaccinated. Two closely related bivalent oral cholera vaccines are produced in India and the Republic of Korea. These killed whole-cell vaccines are based on *V. cholerae* serogroups O1 and O139 and do not contain the toxin B-subunit. They are reported to be safe and efficacious in individuals ≥ 1 year of age, providing 66–67% protection for at least 3 years against clinically significant cholera in countries or areas reporting outbreaks.

For global disease distribution, please see map of Cholera outbreaks.

DENGUE

Summary of vaccine data

Type of vaccine:	The only dengue vaccine available is CYD-TDV (Dengvaxia®), a live attenuated (recombinant) tetravalent vaccine. This vaccine is licensed in about 20 dengue-endemic countries, with an age indication ranging from 9 to 45 years in most countries. The vaccine has a different performance in those who have had a past dengue infection (seropositive individuals) and those who are seronegative at the time of vaccination.
Number of doses:	Three injections of 0.5 mL administered at 6-month intervals.

	Contraindications:	Vaccination is contraindicated in individuals with: (1) a history of severe allergic reaction to any component of the dengue vaccine or after prior administration of the dengue vaccine or a vaccine containing the same components; (2) congenital or acquired immune deficiency that impairs cell-mediated immunity; or (3) symptomatic HIV infection or asymptomatic HIV infection when accompanied by evidence of impaired immune function. CYD-TDV is not recommended for pregnant or lactating women.
	Before departure:	Travellers who have already had documented dengue or are seropositive could consider vaccination before travel to settings with high dengue transmission.
	Consider for:	Prevention of dengue fever in children ≥ 9 years living in areas highly endemic for this infection.
	Special precautions:	Use of CYD-TDV is not recommended in populations in which the seroprevalence is low to moderate because of low efficacy and the longer-term risks of severe dengue in individuals who are vaccinated before having a primary dengue infection. For countries considering vaccination as part of their dengue control programme, pre-vaccination screening is recommended.
Cause	Dengue virus (genus: *Flavivirus*) serotypes 1–4.	
Transmission	Dengue virus is maintained primarily in a human-to-mosquito-to-human cycle. Primary vectors are virus-infected *Aedes aegypti* and *Ae. albopictus*.	
Nature of the disease	About 75% of all dengue virus infections are asymptomatic. Symptomatic dengue most commonly presents as a mild-to-moderate, acute febrile illness with headache, retro-orbital pain, generalized myalgia and arthralgia, anorexia, abdominal pain, nausea and a rash. However, as many as 5% of all dengue patients develop severe, life-threatening disease characterized by hypovolaemic shock, respiratory distress, severe bleeding or severe organ impairment.	
Geographical distribution	Dengue is endemic throughout the tropics and subtropics, predominantly in Asia but also in Latin America and Africa.	

Risk for travellers	Dengue is a leading cause of febrile illness among travellers returning from South-East Asia, Latin America and the Caribbean. Sporadic outbreaks with local transmission have also occurred in the USA (in Florida, Hawaii and along the Texas–Mexico border). The risk of infection increases with longer duration of travel and with disease incidence in the travel destination (such as during the rainy season and during epidemics).
General Precautions	Protection against mosquito bites (appropriate clothing, indoor insecticides, repellents, destruction of mosquito breeding sites)
Vaccine	The live attenuated dengue vaccine CYD-TDV has been shown in clinical trials to be efficacious and safe for people who have had a dengue virus infection in the past (seropositive individuals) but poses an increased risk of severe dengue in those who experience their first natural dengue infection after vaccination (seronegative individuals). Travellers who have already had documented dengue or are seropositive could consider vaccination before travel to settings with high dengue transmission. CYD-TDV is recommended as a three-dose series given 6 months apart. Should a vaccine dose be delayed for any reason, it is not necessary to restart the course, and the next dose in the series should be administered as soon as possible. There are currently no data on the use of booster doses. Additional studies to determine the utility of a booster dose and its best timing are in progress. At this time, there is no recommendation concerning a booster dose. Several other candidate tetravalent dengue vaccines are in clinical development.

For disease distribution, please see map of Dengue, countries or areas at risk.

DIPHTHERIA	In most countries, diphtheria vaccine is routinely administered in childhood. Travellers who missed vaccination should be offered the vaccine according to national recommendations.
Cause	Toxigenic *Corynebacterium diphtheriae* and, in tropical climates, occasionally toxigenic *C. ulcerans*
Transmission	*C. diphtheriae* residing in the respiratory tract is transmitted from person to person through droplets and close physical contact; *C. ulcerans* and *C. pseudotuberculosis* can also be transmitted by zoonotic spread.
Nature of the disease	Clinical manifestations are usually mild, but, occasionally, potent bacterial toxins cause obstructive membranes in the upper respiratory tract or damage to the myocardium and other tissues. Systemic manifestations are less likely to be caused by *C. ulcerans* or *C. tuberculosis.*
Geographical distribution	Very rare in countries with high coverage with diphtheria-containing vaccines. Incidence increases in crowded regions where vaccination programmes are insufficient and standards of hygiene are poor.
Risk for travellers	Risk of exposure increases in populations with low coverage of vaccination against diphtheria, tetanus and pertussis (DTP).

Vaccine	For primary or booster vaccination, appropriately formulated combined DTP vaccines or booster tetanus and diphtheria (Td) vaccines should be used according to national recommendations. Individuals ≥ 7 years of age should receive combinations with reduced diphtheria toxoid content.
TETANUS	In most countries, tetanus vaccine is routinely administered in childhood. Unvaccinated travellers should be offered the vaccine according to national recommendations.
Cause	The bacterium *Clostridium tetani*
Transmission	Spores of *C. tetani* may contaminate necrotic, anaerobic tissue and transform into vegetative, toxin-producing bacteria. Tetanus is not communicable.
Nature of the disease	Potent bacterial neurotoxins originating from vegetative *C. tetani* may cause local muscular spasms or generalized muscle spasms and rigidity. Untreated generalized tetanus is often fatal.
Geographical distribution	Spores of *C. tetani* are widespread globally, particularly in the soil.
Risk for travellers	The risk is linked to activities that predispose to dirty or contaminated injuries. This risk is not necessarily increased during travel.
Vaccine	Travellers should be vaccinated with combined diphtheria–tetanus or DTP vaccines according to national recommendations. Individuals ≥ 7 years of age should receive tetanus-containing combinations with a reduced content of diphtheria toxoid.
PERTUSSIS	In most countries, pertussis vaccine is routinely administered in childhood. Unvaccinated travellers should be offered vaccine according to national recommendations.
Cause	The bacterium *Bordetella pertussis*.
Transmission	*B. pertussis* is transmitted from person to person through droplets.
Nature of the disease	The *Bordetella* bacteria colonize only ciliated cells of the respiratory mucosa, causing an acute respiratory infection (also known as whooping cough), marked by severe, spasmodic coughing episodes. In early infancy, pertussis may be atypical and sometimes life-threatening. Disease manifestations are less dramatic with increasing age, including in adults.
Geographical distribution	Pertussis incidence depends on DTP vaccination coverage; the disease is common where coverage is low and seen less commonly in countries with high DTP vaccination coverage.
Risk for travellers	The highest risk is for unvaccinated infants visiting countries with low coverage of DTP vaccination.
Vaccine	For primary as well as booster vaccination, acellular or whole-cell pertussis vaccines should be used in fixed combination with vaccines against diphtheria (D) and tetanus (T). The schedule should follow national recommendations. Individuals ≥ 7 years of age should receive combinations with reduced diphtheria toxoid content.

For the observed rate of reactions to DTP vaccines, see the Global Vaccine Safety Information Sheet.

HAEMOPHILUS INFLUENZAE TYPE B

	In many countries, *Haemophilus influenzae* type b (Hib) vaccine is routinely administered in childhood. Unvaccinated travellers < 5 years of age should be offered vaccine according to national recommendations.
Cause	The bacterium *H. influenzae* type b (Hib)
Transmission	Respiratory droplets
Nature of the disease	Hib is an important cause of pneumonia, meningitis, septicaemia, epiglottitis infection and other potentially life-threatening infections, primarily in children aged 3 months to 5 years.
Geographical distribution	Prevalent in countries with low Hib-vaccination coverage
Risk for travellers	The risk is likely to be increased in an environment of low Hib-vaccination coverage
Vaccine	All licensed Hib vaccines are conjugated. They differ in their carrier protein, method of chemical conjugation, polysaccharide size and adjuvant. Hib vaccine is available in a variety of formulations: liquid Hib conjugate vaccine (monovalent), liquid Hib conjugate combined with DTP and/ or hepatitis B vaccine; Hib conjugate in combination with meningococcal antigens; lyophilized Hib conjugate with saline diluent (monovalent) and lyophilized Hib conjugate for use with liquid DTP, or DTP in combination with other antigens, such as inactivated polio vaccine or hepatitis B vaccine. In infants, one of three schedules can be followed: three primary doses without a booster; two primary doses plus a booster; and three primary doses with a booster, with the first dose as early as possible after 6 weeks of age. Hib vaccine is not required for healthy children > 5 years.

For the observed rate of reactions to Hib vaccines, see the Global Vaccine Safety Information Sheet.

HEPATITIS A

Summary of vaccine data

Type of vaccine:	Inactivated or live attenuated hepatitis A virus vaccines are licensed for intramuscular administration in a two-dose series. In addition, the live attenuated vaccine can be administered as a single subcutaneous dose.
Number of doses	Inactivated vaccine: a complete vaccination schedule as recommended by the manufacturer consists of two doses. The interval between the first (primary) dose and the second (booster) dose is flexible (from 6 months up to 4–5 years) but is usually 6–18 months. Live vaccine: one dose.
Contraindications:	Severe allergic reaction to previous dose.
Before departure:	Inactivated and live vaccines: protection is achieved within 2–4 weeks after the first dose. Because of the long incubation period of hepatitis A (average 2–4 weeks), the vaccine

		can be administered up to the day of departure and still protect travellers.
	Consider for:	Hepatitis A vaccination should be considered for people aged ≥ 1 year who are travelling to countries or areas of intermediate or high endemicity. Those at high risk of acquiring severe disease, such as immunosuppressed patients and patients with chronic liver disease, should be strongly encouraged to be vaccinated regardless of where they travel. In addition, people at increased risk of hepatitis A, including men who have sex with men, people who require life-long treatment with blood products, and people who inject drugs should be vaccinated.
	Special precautions:	None.
Cause	Hepatitis A virus	
Transmission	The virus is acquired through close contact with infected individuals or by consumption of faecally contaminated food or drinking-water. There is no insect vector or animal reservoir.	
Nature of the disease	Acute viral hepatitis is characterized by abrupt onset of fever, malaise, nausea and abdominal discomfort, followed by jaundice a few days later. In very young children, infection is usually mild or asymptomatic, whereas in older children symptomatic disease is common. The disease is often more severe in adults, and full recovery may take several months. The case-fatality rate is > 2% for people > 40 years of age and about 4% for those aged ≥ 60 years.	
Geographical distribution	Worldwide, but most common in areas where sanitary conditions are poor (see map).	
Risk for travellers	Non-immune travellers to developing countries are at significant risk of infection, particularly in settings with poor food and drinking-water control and poor sanitation.	
General Precautions	Avoid or boil potentially contaminated food and water. Short-term protection through injection of human immune globulin is gradually being replaced by hepatitis A vaccination.	
Vaccines	Two types of hepatitis A vaccine are currently used worldwide, namely formaldehyde-inactivated and live attenuated vaccines. Both types are safe and highly immunogenic and provide long-lasting, possibly life-long, protection against hepatitis A in both children and adults. The minimum age to receive the vaccine is 1 year. 1) Formaldehyde-inactivated vaccines: Inactivated hepatitis A virus vaccines are used in most countries. Monovalent inactivated vaccines are available in both a paediatric dose (0.5 mL) for children aged 1–15 years and an adult dose (1 mL). A two-dose schedule is usually recommended, particularly for immunocompromised people. However, in healthy individuals, comparable effectiveness has been achieved with a single dose. A combined hepatitis A/typhoid (ViCPS) vaccine is available to be administered as a single dose, conferring protection against both of these waterborne diseases. A combination vaccine that provides protection against both hepatitis A and hepatitis B should be considered for travellers who may be exposed to both organisms (see hepatitis B vaccines).	

	2) Live attenuated vaccines (based on the H2 or LA-1 strain of hepatitis A virus): These vaccines are manufactured in China and are available in several other countries. The presence of anti-hepatitis A virus (IgG) antibodies was documented after 15 years in 72–88% of vaccinees, implying that, in most cases, long-term protection against hepatitis A is achieved with live attenuated vaccines.

For the observed rate of reactions to hepatitis A vaccines, see the Global Vaccine Safety Information Sheet.

For global disease distribution, please see map of hepatitis A countries and areas at risk.

HEPATITIS B

	Hepatitis B vaccination is universally recommended. Unvaccinated travellers should be offered vaccine according to national recommendations.
Cause	Hepatitis B virus (HBV), genotypes A-G.
Transmission	HBV is transmitted by exposure of mucosal membranes or non-intact skin to infected blood or other body fluids (saliva, semen and vaginal fluid). It may be transmitted perinatally from infected mothers to infants, through injection or transfusion of contaminated blood products or through penetration of the skin with contaminated needles. Hepatitis B is frequently transmitted by sexual intercourse.
Nature of the disease	When contracted perinatally or in early childhood, the infection is rarely symptomatic but is likely to develop into chronic liver disease that may develop into cirrhosis and/or cancer in the course of decades. Infection of older children and adults more often causes acute hepatitis and rarely chronic liver disease. The course of disease might depend on other factors, such as viral genotype.
Geographical distribution	Prevalence assessments are based on the presence of HBV surface antigen (HBsAg) in serum. The highest prevalence is found in some African and eastern Asian countries with low coverage of hepatitis B vaccination. In well-vaccinated populations, the prevalence of hepatitis B is usually low. Globally, very high prevalence rates may be found among certain risk groups such as sex workers and injecting drug users.
Risk for travellers	The risk for non-immune travellers depends mainly on personal risk-taking behaviour and the prevalence of HBsAg in the population visited. An additional risk may be nosocomial infection in poorly equipped health care facilities.
General precautions	Travellers should follow the general recommendations for avoiding potentially contaminated food and drinking-water.
Vaccine	The active ingredient of hepatitis B vaccine is HBsAg. The primary series of vaccinations usually consists of one dose of monovalent vaccine at birth followed by two or three doses of monovalent or combined hepatitis B vaccine at intervals of one to several months. For older children and adults, three doses at appropriate intervals are recommended, with a monovalent or, conveniently, a combined hepatitis A and B vaccine. For travellers, if there is insufficient time to complete the standard vaccination schedule, a three-dose schedule given at 0, 7 and 21 days may be used; in this case, a fourth dose is recommended 12 months after the first dose.

For the observed rate of reactions to hepatitis B vaccines, see the Global Vaccine Safety Information Sheet.

For global and country estimates, see Global and Country Estimates of immunization coverage and chronic HBV infection.

HEPATITIS E

Summary of vaccine data

	Type of vaccine:	Recombinant vaccine based on genotype 1 capsid protein which cross-protects against all four genotypes of hepatitis E virus (HEV) of human relevance. This vaccine was developed and is licensed in China.
	Number of doses:	Three (administered intramuscularly at 0, 1 and 6 months)
	Contraindications:	Not described, except for serious allergy to vaccine components
	Consider for:	Travellers and health care and humanitarian relief workers travelling to areas during outbreaks of hepatitis E, after individual evaluation and weighing of risks and benefits.
	Special precautions:	So far, limited data are available on the safety of its use in children, pregnant women or immunodeficient patients.
Cause	HEV has four known genotypes (1–4) that infect mammalian hosts.	
Transmission	The virus is usually acquired from contaminated drinking-water. Direct faecal–oral transmission from person to person is also possible. There is no insect vector. Various domestic animals, including pigs, may be reservoirs of HEV.	
Nature of the disease	Acute infection is characterized by malaise, anorexia, abdominal pain and tenderness, nausea, vomiting, fever and jaundice.[17] The clinical features and course of the disease are generally similar to those of hepatitis A (see above). However, during the third trimester of pregnancy, HEV infection is more serious and is associated with case–fatality rates ≥ 20%. In addition to pregnant women, people with pre-existing liver disease and immunosuppression are at greater risk for severe disease after HEV infection.	
Geographical distribution	HEV is a leading cause of acute viral hepatitis in low-income countries. Each year, HEV genotypes 1 and 2 may account for about 20.1 million HEV infections, 3.4 million symptomatic cases, 70 000 deaths and 3000 stillbirths.	
Risk for travellers	Travellers to low- and middle-income countries may be at risk when exposed to poor sanitation and drinking-water control.	
General Precautions	Travellers should follow the general recommendations for avoiding potentially contaminated food and drinking-water.	
Vaccine	A vaccine against HEV has been developed and licensed in China. The vaccine contains a recombinant viral capsid protein corresponding to genotype 1 of HEV which is nevertheless likely to protect against all four genotypes. Three doses of the vaccine are given intramuscularly at 0, 1 and 6 months. So far, this vaccine has shown a favourable safety profile as well as excellent immunogenicity and clinical efficacy when	

[17] Hepatitis E fact sheet. Geneva: World Health Organization; 2019 (https://www.who.int/news-room/fact-sheets/detail/hepatitis-e, accessed July 2019).

	used in healthy individuals aged 16–65 years. The duration of protection is at least 2 years. Because of a lack of sufficient information on safety, immunogenicity and efficacy in important target groups such as children < 16 years, pregnant women and people with chronic hepatic disorders, WHO does not currently recommend this vaccine for routine use in the national programmes of endemic countries. However, national authorities may decide to use the vaccine according to local epidemiology. Vaccination against HEV may be considered when the risk of contracting HEV is particularly high, such as during outbreaks and for special risk groups such as pregnant women where the incidence is high. WHO recognizes the high risk of HEV infection for travellers, health care and humanitarian relief workers deployed or travelling to areas where there are ongoing outbreaks of hepatitis E. In such circumstances, each person should be evaluated individually for the risks and benefits of vaccination against HEV.

HUMAN PAPILLOMAVIRUS

	In many countries, vaccine against human papillomavirus (HPV) is routinely administered in early adolescence. When vaccinations are checked before travelling, those who have missed their HPV doses should be offered vaccination according to national recommendations.
Cause	Human papillomavirus (HPV).
Transmission	Sexual contact.
Nature of the disease	Although HPV usually causes a transient, benign mucosal infection, persistent infection with certain oncogenic types of HPV (most frequently types 16 and 18) may lead to precancerous lesions, which, if untreated, may progress to cervical cancer. Some types of HPV may cause anogenital warts and recurrent respiratory papillomatosis.
Geographical distribution	HPV is prevalent globally. The incidence of cervical cancer is highest in Latin America and the Caribbean, sub-Saharan Africa, Melanesia and south-eastern Asia.
Risk for travellers	HPV is transmitted most commonly through sexual activity.
General precautions	Abstaining from sexual activity is the most reliable method for preventing genital HPV infection. Condoms used consistently and correctly can lower the chances of acquiring and transmitting HPV and developing HPV-related diseases (e.g., genital warts and cervical cancer). However, because HPV can infect areas not covered by a condom, condoms might not fully protect against HPV.[18]
Vaccines	Three vaccines against HPV infection are available: • two-valent (types 16 and 18) • four-valent (types 6, 11, 16 and 18) • nine-valent (above plus five additional types: 31, 33, 45, 52 and 58). For protection against cervical cancer, vaccination of girls aged 9–14 years is recommended, as the vaccines are most efficacious when

[18] Human papillomavirus (HPV) infection. Atlanta (GA): Centers for Disease Control and Prevention; 2015 (https://www.cdc.gov/std/tg2015/hpv.htm, accessed September 2019).

	administered before the start of sexual activity. At least two doses are required, with a minimum interval of 6 months between doses. High vaccination coverage in girls also results in herd protection of boys.

SEASONAL INFLUENZA

	The primary target groups for influenza vaccination as defined by WHO are pregnant women, health care workers, children aged 6‑59 months, the elderly and those with high-risk conditions. Before travelling during the influenza season, travellers should be offered vaccination according to national recommendations. Travellers should note that influenza seasonality may be different at their destination from that in their home countries.
Cause	Influenza viruses of types A and B.
Transmission	Infectious droplets dispersed into the air, and by direct contact in particular from hands contaminated with influenza viruses. During the influenza season, the annual global attack rate is estimated to be 5–10% in adults and 20–30% in children.
Nature of the disease	Acute respiratory infection, usually mild but occasionally severe, with high fever, sore throat, cough and aches. Complications include viral pneumonitis and secondary bacterial infections. Elderly people, pregnant women, young children and adults with chronic medical conditions are at greatest risk for severe influenza disease.
Geographical distribution	Worldwide. In the northern hemisphere from November to April; in the southern hemisphere from April to September. In tropical and sub-tropical areas, seasonality may differ by locality.
Risk for travellers	Travellers are not a particular risk group for influenza, but, as for other diseases, in some countries appropriate health care may be unavailable or hard to access for non-residents in case of severe disease. The Ministry of Health in Saudi Arabia requires all domestic pilgrims and health workers in the *hajj* and *umrah* areas to receive the most recently available seasonal influenza vaccine 10 days before their arrival. It also recommends that all visitors arriving for *umrah* or *hajj* or for seasonal work in *hajj* zones be vaccinated against seasonal influenza.[4]
General precautions	Frequent hand-washing and avoiding crowds may lower the risk of transmission.
Vaccine	Seasonal influenza vaccines include prevailing strains of influenza A and B, which are either inactivated or live attenuated. Inactivated influenza vaccines are injected, while live attenuated influenza vaccines are delivered via nasal spray. Inactivated vaccines are used for children aged > 6 months, pregnant women, people with high-risk medical conditions and older people. Healthy non-pregnant individuals aged 2–49 years may alternatively receive live attenuated influenza vaccines. Current vaccine formulations contain one (trivalent formulations) or both (quadrivalent formulations) of the influenza B lineages. Travellers should be vaccinated according to the recommendations of the respective national health authorities but should be aware that a vaccine obtainable in one hemisphere may offer only partial protection against influenza virus infection in the other hemisphere. Because the prevailing influenza strains in the northern and southern hemispheres may differ significantly, the annual composition of the respective influenza vaccines may be different.

For the observed rate of reactions to influenza vaccines, see the Global Vaccine Safety Information Sheet.

JAPANESE ENCEPHALITIS

Summary of vaccine data

	Type of vaccine and schedules:	Japanese encephalitis vaccines include inactivated Vero cell-derived vaccines, live attenuated vaccines and live recombinant (chimaeric) vaccines. The inactivated mouse brain-derived vaccines are now commonly replaced by cell culture-based vaccines, in view of the latter's advantageous safety profile. *Inactivated Vero cell-derived vaccines:* The primary series is given according to the manufacturer's recommendations (these vary by product), which are generally for two doses at 4-week intervals for individuals ≥ 6 months of age. A booster dose is recommended 1–2 years after primary immunization. *Live attenuated vaccine:* A single dose is administered to individuals ≥ 8 months of age. The need for a booster dose has not been established. *Live recombinant vaccine:* A single dose is administered to individuals ≥ 9 months of age. A booster dose is recommended by the manufacturer 12–24 months later for those < 18 years of age.
	Adverse reactions:	Occasional mild local or systemic reactions.
	Contraindications and precautions:	A hypersensitivity reaction to a previous dose is a contraindication. In principle, the live attenuated vaccine should not be given to pregnant women or immunocompromised people.
Cause	Japanese encephalitis virus	
Transmission	Pigs and various wild birds are the natural reservoirs of this virus, which is transmitted to new animal hosts and occasionally humans by mosquitoes of the genus *Culex*. *Culex* mosquitoes are primarily night-biting. There is no human-to-human transmission.	
Nature of the disease	Most human infections are asymptomatic. Severe disease is estimated to occur in about one case per 250 infections; severe cases have a rapid onset and progression, with headache, high fever and meningeal signs. Permanent neurological sequelae are common among survivors. About 20% of severe clinical cases have a fatal outcome. No treatment is available.	

Geographical distribution	Japanese encephalitis virus is the leading cause of viral encephalitis in Asia and occurs in almost all Asian countries (see map). Transmission occurs principally in rural agricultural locations where flooding irrigation is practised, although cases may also occur near or within urban centres. Transmission occurs mainly during the rainy season in South-East Asia but may occur all year round, particularly in tropical climate zones. In the temperate regions of China, Japan, the Korean peninsula and eastern parts of the Russian Federation, transmission occurs mainly during the summer and autumn. The disease is also reported from Bangladesh, parts of India and Pakistan, and from Cambodia, the Lao People's Democratic Republic, the Philippines and other countries in the region. However, the incidence of Japanese encephalitis has been decreasing in some regions of China, Japan and the Republic of Korea and more recently in Nepal, Sri Lanka, Thailand and Viet Nam, largely as a result of high vaccination coverage.
Risk for travellers	The risk of Japanese encephalitis is very low for most travellers to Asia, particularly for short-term visitors to urban areas. However, the risk varies according to season, destination, duration of travel and activities. Vaccination is recommended for travellers with extensive outdoor exposure (such as camping and hiking) during the transmission season, particularly in endemic countries or areas where farming involves irrigation by flooding. In areas at risk, Japanese encephalitis is primarily a disease of children, but it can occur in travellers of any age. Prevention consists of avoiding mosquito bites and vaccination.
Vaccines	Vaccination against Japanese encephalitis is recommended for travellers to endemic areas who will have extensive outdoor exposure during the transmission season. Inactivated Vero cell-derived, live attenuated and live recombinant vaccines are available, but they are not licensed in all countries. These vaccines have excellent safety profiles and can be used to protect travellers from non-endemic countries. Vaccination schedules: *Inactivated Vero cell-derived vaccines:* The primary series is given according to the manufacturers' recommendations (these vary by product), generally two doses at 4-week intervals for individuals ≥ 6 months of age. A booster dose is generally recommended 1–2 years after primary immunization. *Live attenuated vaccine:* A single dose is administered to individuals ≥ 8 months of age. The need for a booster dose has not been established. *Live recombinant vaccine:* A single dose is administered to individuals ≥ 9 months of age. Although not recommended by WHO, a booster dose is recommended by the manufacturers 12–24 months later for those < 18 years of age.
Contraindications and precautions	A hypersensitivity reaction to a previous dose is a contraindication. As occasional allergic reactions to components of the vaccine may occur up to 2 weeks after administration, it is advisable to ensure that the complete course of vaccination is administered well in advance of departure. In principle, the live attenuated and live recombinant vaccines should be avoided in pregnancy, and inactivated vaccine should be used instead. Rare, but serious,

	neurological adverse events attributed to inactivated mouse brain-derived vaccine have been reported, but no causal relationship has been confirmed.

For the observed rate of reactions to Japanese encephalitis vaccines, see the Global Vaccine Safety Information Sheet.

For global disease distribution, please see Japaneses encephalitis countries and areas at risk.

MEASLES

	Measles vaccine is routinely administered in childhood. Unvaccinated travellers should be given the vaccine according to national recommendations.
Cause	Measles virus
Transmission	Primarily by airborne respiratory droplets. The virus is highly contagious.
Nature of the disease	Measles is mostly a disease of young children, characterized by fevers, cough, nasal congestion and a typical maculopapular rash. The disease tends to be more serious in older children and adults. In infants and in individuals with chronic diseases, impaired immunity or severe malnutrition, measles may be serious or even fatal.
Geographical distribution	In the pre-vaccination era, measles epidemics occurred worldwide. While measles is targeted for elimination in all regions, outbreaks continue to occur in countries or segments of populations with insufficient coverage (< 95%) of vaccination. In 2017, the most recent year for which estimates are available, measles caused approximately 110 000 deaths. Even in high-income countries, complications result in hospitalization in up to a fourth of cases and can lead to lifelong disability, ranging from brain damage and blindness to hearing loss. Recently, case numbers have spiked, including in countries with high overall vaccination coverage, as the disease has spread among clusters of unvaccinated people.
Risk for travellers	Any non-immune traveller (i.e. who has not been vaccinated with two doses of measles-containing vaccine) can become infected. Infected travellers may spread the disease to non-immune individuals.
Vaccine	Live attenuated vaccine: available either in monovalent form (measles component only) or in fixed combinations with one or more of vaccines against mumps, rubella and varicella. Two subcutaneous doses are administered at an interval of at least 4 weeks. Travellers who are uncertain of their measles vaccination status should receive at least one dose of measles vaccine. WHO recommends that travellers be vaccinated against measles at least 15 days before travel. WHO recommends that infants from 6 months of age receive a supplementary dose of measles vaccine if they are travelling to countries experiencing measles outbreaks. Children aged 6–9 months of age who receive a supplementary dose of measles vaccine should also receive two doses of measles vaccine at the recommended ages according to the national immunization schedule. Measles vaccine can be co-administered with other vaccines recommended for travellers, such as yellow fever vaccine.

For the observed rate of reactions to measles, mumps and rubella vaccines, see the Global Vaccine Safety Information Sheet.

For global disease distribution, please see map of Number of Reported Measles Cases

MENINGOCOCCAL DISEASE

Summary of vaccine data

Type of vaccine:	1) Polysaccharide vaccines that include two to four meningococcal serogroups: available as two-valent (A and C), trivalent (A, C and W) and four-valent (A, C, W and Y) vaccines. Polysaccharide vaccines are now often replaced by: 2) conjugate vaccines, available as monovalent (A or C or C/Hib combination), bivalent (A and C, or C and Y/Hib combination) and tetravalent (A, C, W and Y) vaccines. 3) Although recombinant protein-based vaccines against serogroup B infections are now available internationally, these vaccines are recommended by only specific countries. There is no general recommendation to vaccinate travellers with serogroup B vaccine.
Number of doses:	For polysaccharide vaccines: a single (usually subcutaneous) dose to individuals aged ≥ 2 years. One booster may be required after 3–5 years. For conjugate vaccines: primary series of one to three intramuscular doses with subsequent boosters. The schedule depends on the vaccine as well as the age and immunological status of the vaccinee. For recombinant protein-based vaccines: Although primary series of two to three intramuscular doses are now recommended in some countries, WHO has not yet formulated recommendations for national programmes.
Contraindications:	Severe allergic reaction to vaccine components.

	Adverse reactions:	Apart from transient local reactions, all meningococcal vaccines have an excellent safety record.
	Before departure:	Preferably given 10–14 days before travel to ensure protection at departure.
	Consider for:	Travellers from low-endemic regions visiting countries that are highly endemic for meningococcal disease. In Africa's meningitis belt, the risk of acquiring infection is greatest in the dry season and for people in close contact with the local population.
	Special precautions:	None.
Cause	*Neisseria meningitidis* bacteria; in most cases serogroups A, B, C, W, X and Y.	
Transmission	By direct person-to-person contact and through respiratory droplets from patients or asymptomatic meningococcal carriers. Human beings are the only reservoir.	
Nature of the disease	Endemic disease occurs primarily in children and adolescents, with the highest attack rates in infants aged 3–12 months. Meningococcal meningitis has a sudden onset of intense headache, fever, nausea, vomiting, photophobia and stiff neck, plus various neurological signs. Permanent neurological sequelae are common, and the disease is fatal in 5–10% of cases. Meningococcal septicaemia is characterized by hypovolaemic shock, haemorrhagic skin rash and a high fatality rate.	
Geographical distribution	Sporadic cases are found worldwide. In temperate zones, most cases occur in the winter months. Localized outbreaks occur in enclosed crowded spaces (e.g. dormitories and military barracks). In the meningitis belt of sub-Saharan Africa, large outbreaks may take place during the dry season (November to June). Outbreaks due to "serogroup A" have virtually disappeared in all countries in which mass vaccination campaigns with group A conjugate vaccine were implemented. Recent meningococcal outbreaks due to serogroup Y (USA), serogroup W (Saudi Arabia and sub-Saharan Africa), serogroup C and serogroup X (sub-Saharan Africa) suggest that these serogroups are gaining in importance.	
Risk for travellers	The risk of meningococcal disease in travellers is generally low. Those travelling to high-income countries may be exposed to sporadic cases, mostly of A, B or C. Outbreaks of meningococcal C disease occur in schools, colleges, military barracks and other places where large numbers of adolescents and young adults congregate. Travellers to the sub-Saharan meningitis belt may be exposed to outbreaks, most commonly of serogroup A, C and W, with much higher incidence rates during the dry season. Long-term travellers living in close contact with the indigenous population and pilgrims visiting Mecca for the *hajj* or *umrah* are at particular risk.	

General precautions	Avoid overcrowded, confined spaces. After close contact with an individual with meningococcal disease, medical advice should be sought as soon as possible about possible chemoprophylaxis and vaccination.
Vaccines	1) Polysaccharide vaccines Internationally marketed meningococcal polysaccharide vaccines are bivalent (A and C), trivalent (A, C and W) or tetravalent (A, C, W and Y). After a single dose, usually subcutaneous, these vaccines provide excellent serogroup-specific protection for 2–4 years in adults and children > 2 years. Meningococcal polysaccharide vaccines are now often replaced by conjugate meningococcal vaccines. 2) Conjugate meningococcal vaccines Conjugate meningococcal vaccines are available as monovalent serogroup A and serogroup C vaccines, two-valent serogroups A and C or C and Y vaccines and four-valent serogroups A, C, W and Y vaccines. The conjugate vaccines are serogroup-specific and highly immunogenic (> 90%). In contrast to group C polysaccharide vaccines, the group C conjugate vaccine elicits adequate antibody responses and immunological memory even in infants vaccinated at 2, 3 and 4 months of age. Combined Hib and *Neisseria meningitidis* serogroup C (HibMenC) or serogroup C and Y-tetanus toxoid conjugate (and HibMenCY) vaccines are also marketed. A conjugated serogroup A meningococcal vaccine designed particularly for use in the African meningitis belt is licensed for single-dose vaccination of people aged 1–29 years. The vaccine has proved to be safe and highly immunogenic, and mass vaccination campaigns have resulted in near-elimination of outbreaks of serogroup A meningococcal disease in sub-Saharan Africa. The vaccine is now being introduced into routine immunization programmes of meningitis belt countries, with a single dose at age 9–18 months. Three four-valent conjugate vaccines against serogroups A, C, W and Y meningococci are now licensed internationally. They differ in the conjugate carrier protein, but all are administered intramuscularly and show similar immunogenicity. These vaccines are licensed for single-dose vaccination of people aged 2–55 years. In addition, two of these vaccines offer a two-dose schedule for children aged 9–23 months. In 2012, a conjugate four-valent vaccine that can be administered as a single dose from the age of 1 year was licensed in Europe. All conjugate vaccines can be administered to adults aged over 55 years. Although four-valent vaccines offer the widest range of protection, they do not protect against meningococci of serogroups B and X, which are common causes of meningococcal disease in some countries. In recent years, recombinant protein-based vaccines against serogroup B infections have been licensed internationally for infants and for age groups ≥ 10 years. The use of these vaccines is limited to certain high-risk individuals and particular outbreak situations and is not recommended for ordinary travellers. So far, no vaccine is available against meningococci of serogroup X.

	Apart from transient local reactions, all meningococcal conjugate vaccines have an excellent safety record.
Required vaccinations	Saudi Arabia requires proof of recent meningococcal vaccination (with a polysaccharide or conjugate tetravalent vaccine) as a visa requirement for pilgrims to *hajj* and *umrah* and people in close contact with the local population. See section 6.3 on Required vaccinations.

For global disease distribution, please see meningococcal meninigits, countries and areas at high risk.

MUMPS

	In many countries, mumps vaccine is routinely administered in childhood. Travellers that have missed vaccination should be offered vaccine against mumps according to national recommendations.
Cause	Mumps virus
Transmission	Droplets from the upper respiratory tract of infected individuals.
Nature of the disease	Mostly a mild disease of children, characterized by transient swelling of the salivary glands. The mumps virus can also infect adolescents and adults, and, when it does, complications are more likely to be serious. Complications of mumps can include meningitis (in ≤ 15% of cases), orchitis and deafness.
Geographical distribution	After the introduction of wide-scale vaccination, endemic transmission of mumps stopped in many industrialized countries. Outbreaks still occur in countries or segments of populations, in particular in close-contact settings and in settings with insufficient vaccination coverage. Outbreaks have also been reported in fully or partially vaccinated populations.
Risk for travellers	For non-immune travellers from areas with limited transmission, the risk of exposure to mumps virus is increased in an environment of insufficient vaccination coverage.
Vaccine	Live attenuated vaccine normally in fixed combination with vaccines against rubella and measles, or rubella, measles and varicella. The vaccine is efficacious and safe. After primary immunization (two doses in children aged 1–2 years), protection against mumps is likely to extend into adulthood.

PNEUMOCOCCAL DISEASE

	Although travellers are not at increased risk of acquiring pneumococcal disease, access to optimal health care may be limited during travel.

Cause	Many serotypes of the bacterium *Streptococcus pneumoniae* (pneumococcus).
Transmission	Respiratory droplets containing *S. pneumoniae*.
Nature of the disease	Pneumococcus can cause invasive and non-invasive disease. The most common non-invasive pneumococcal infections include diseases of the upper respiratory tract and non-bacteraemic pneumonia. Pneumonia with empyema and/or bacteraemia, febrile bacteraemia and meningitis are the commonest manifestations of invasive pneumococcal infection. Resistance of these bacteria to commonly used antibiotics is of increasing concern. Both non-bacteraemic pneumonia and invasive pneumococcal infections are associated with considerable mortality, particularly in young children and older and immunodeficient people.
Geographical distribution	Worldwide.
Risk for travellers	Paediatric vaccination with pneumococcal conjugate vaccine (PCV) is universally recommended. Before children < 2 years of age and children and adults considered to be at particular risk of serious disease travel to countries with limited access to modern health care facilities, they should be advised to be vaccinated against invasive pneumococcal disease.
Vaccines	1) Conjugate vaccines that include 10 (PCV10) or 13 (PCV13) pneumococcal serotypes. These PCVs are safe and effective and may be used in a three-dose schedule of two to three primary doses with or without a booster from the age of 6 weeks. PCV10 and PCV13 are licensed for vaccination against invasive disease, pneumonia and acute otitis media caused by the respective vaccine serotypes of *S. pneumoniae*. PCV13 is also licensed for adults. 2) A pneumococcal polysaccharide vaccine that contains 23 serotypes (PPV23). This vaccine is licensed for individuals aged ≥ 2 years. It is safe, although the efficacy and effectiveness of PPV23 in children and adults remain poorly defined.

For the observed rate of reactions to pneumococcal vaccines, see the Global Vaccine Safety Information Sheet.

POLIOMYELITIS

Summary of vaccine data	Type of vaccine:	Orally administered, live attenuated polio vaccine (OPV) and inactivated poliovirus vaccine (IPV) for intramuscular (or subcutaneous) injection
	Number of doses:	The primary series consists of three doses of OPV plus one of IPV. In countries at high risk of importation and subsequent spread of poliovirus, WHO also recommends an OPV dose at birth ("zero dose"). Provided that there is a low risk of importation and a high rate of vaccination coverage, routine vaccination with IPV followed by OPV can be used. Routine vaccination with

		IPV alone is recommended only in countries with immunization coverage > 90% and a low risk of wild poliovirus importation. WHO no longer recommends an OPV-only vaccination schedule.
	Contraindications:	Severe allergy to vaccine components
	Adverse reactions:	The only serious adverse events associated with OPV are the rare occurrence of vaccine-associated paralytic poliomyelitis and the emergence of vaccine-derived polioviruses. OPV may safely be administered to pregnant women and HIV-infected people.
	Before departure:	Travellers from polio-free to polio-endemic countries should have completed polio vaccination according to their national immunization schedule. Incomplete polio vaccinations should be completed. It is particularly important that people living in countries with active transmission of poliovirus (including vaccine-derived virus) be fully vaccinated. In addition, travellers from such countries should receive a dose of OPV or IPV at least 4 weeks before (and within 12 months of) departure.
	Special precautions:	All travellers are advised to carry their written vaccination record (patient-retained record) in case evidence of polio vaccination is requested for entry into countries. Travellers should preferably use the International Certificate of Vaccination or Prophylaxis, which is available from the WHO website.[19] Before issuing an entry visa, some polio-free countries require a certificate of recent polio vaccination from travellers coming from polio-affected countries. In some cases, an additional dose of polio vaccine is provided on arrival (for requirements and list of countries, see section 6.1).
Cause	Polioviruses	
Transmission	Polioviruses are spread predominantly by the faecal–oral route, although transmission through the oral–oral route may also occur.	
Nature of the disease	Poliomyelitis, also known as polio or infantile paralysis, is a disease of the central nervous system. After primary asymptomatic infection of the alimentary tract by poliovirus, paralytic disease develops in < 1% of cases. In low-income countries, 65–75% of cases occur in children < 3 years of age and 95% in children < 5 years. The resulting paralysis is permanent, although some recovery of function is possible. There is no cure.	
Geographical distribution	Worldwide, sustained use of polio vaccines since 1988 has led to a > 99% drop in the global incidence of poliomyelitis, and the number of countries with endemic	

[19] International Certificate of Vaccination or Prophylaxis. See WHO website at: http://www.who.int/ihr/IVC200_06_26.pdf

	polio has fallen from 125 to 3 (Afghanistan, Nigeria and Pakistan). Globally, the last case of polio caused by naturally circulating wild-type PV2 occurred in India in 1999. No case due to wild-strain PV3 has been detected since November 2012. In 2018, 33 polio cases were reported, all due to wild-strain PV1. The risk of new outbreaks following virus importation into polio-free countries with low population immunity persists as long as transmission continues in the remaining endemic countries.
Risk for travellers	Until the disease has been certified as eradicated globally, the risks of acquiring polio (for travellers to infected areas) and of reinfection of polio-free areas (by travellers from infected areas) remain. All travellers to and from countries and areas infected by wild poliovirus or vaccine-derived polioviruses should be adequately vaccinated. Updates on currently or recently infected countries can be found on the website of the Global Polio Eradication Initiative.[20]
Vaccines	Both OPV and IPV for intramuscular (or subcutaneous) injection are widely used internationally. IPV is considered very safe, and, although OPV is a live attenuated vaccine, it may safely be administered to pregnant women and HIV-infected people. A rare adverse event associated with OPV is vaccine-associated paralytic poliomyelitis, which occurs once in about 2.4 million doses. Before travelling to areas with active poliovirus transmission, people from polio-free countries should ensure that they have completed the age-appropriate polio vaccination series, according to their respective national immunization schedules. Travellers to polio-infected areas who completed an OPV or IPV vaccine series > 12 months previously should be given another booster dose of polio vaccine. Travellers to polio-infected areas who have not received any polio vaccine previously should complete a primary schedule of polio vaccination before departure. Before travelling abroad, people of all ages who reside in polio-infected countries (i.e. those with active transmission of a wild or vaccine-derived poliovirus) and long-term visitors to such countries (i.e. people who spend more than 4 weeks in the country) should have completed a full course of vaccination against polio in compliance with the national schedule. Travellers from infected areas should receive an additional dose of OPV or IPV within 4 weeks to 12 months of travel in order to boost intestinal mucosal immunity and reduce the risk of poliovirus shedding, which could lead to reintroduction of poliovirus into a polio-free area. For people who previously received only IPV, OPV should be preferentially given as the booster dose, if available and feasible. In case of unavoidable last-minute travel, travellers who have not received a documented dose of polio vaccine within the previous 12 months should still receive one dose of OPV or IPV before departure. Some polio-free countries require resident travellers and long-term visitors from polio-infected countries to provide documentation of recent vaccination against polio in order to obtain an entry visa, or they may require travellers to receive an additional dose of polio vaccine on arrival, or both (see the list of countries in section 6.1).

For the observed rate of reactions to polio vaccines, see the Global Vaccine Safety Information Sheet.

[20] Global Polio Eradication Initiative. See: http://polioeradication.org/polio-today/polio-now/.

RABIES

Summary of pre-exposure vaccination
(For post-exposure vaccination, see full text below)

	Type of vaccine:	Modern, inactivated cell-culture or embryonated-egg vaccine.
	Number of doses:	Pre-exposure vaccination: Two doses, one each on days 0 and 7, given intramuscularly (1.0 or 0.5 mL/dose depending on the vaccine brand) or intradermally (0.1 mL/injection site).
	Boosters:	Not routinely required for general travellers.
	Contraindications:	Severe allergy to components of the vaccine.
	Adverse events:	Minor local or systemic reactions.
	Before departure:	Start pre-exposure prophylaxis (PrEP) at least 1 week before departure to an area at risk, especially if the destination is far from centres of appropriate care.
	Consider for:	People planning to visit high-risk areas.
	Special precautions:	Travellers should avoid contact with free-roaming animals, especially dogs and cats, and with free-ranging or captive wild animals. They should not handle bats. Wild animals, particularly monkeys, will bite when people feed them or handle their food and when the animal is threatened, cornered or trapped.
Cause	Lyssaviruses	
Transmission	Rabies is a zoonotic disease that affects domestic and wild mammals. Human infection occurs from bites of infected animals (usually dogs) and occasionally via penetrating scratches or licking of broken skin and mucosa. Domestic dogs, wild carnivore species and bats (*Carnivora* and *Chiroptera*) present a higher risk for rabies transmission than other mammals, as they are the reservoirs of the virus. Although monkeys, like any other mammal, are susceptible to rabies, the risk of rabies transmission from monkeys is extremely low. The transmission risk should be evaluated in the context of the local epidemiology. Infected animals may not appear rabid. Laboratory-confirmed person-to-person transmission has not been reported other than through organ transplant.	
Nature of the disease	Rabies is an acute, invariably fatal viral encephalitis. Initial signs include apprehension, headache, fever, malaise and sensory changes around the bite area. Excitability, hallucinations and abnormal fear of drafts of air (aerophobia) are common, followed in some cases by fear of water (hydrophobia) due to spasms of the swallowing muscles. Days after onset, the disease progresses to delirium, convulsions and death. Paralytic rabies is less common and is characterized by paralysis and loss of sensation, weakness and pain.	

Geographical distribution	Rabies is present in mammals in most parts of the world (see map). The large majority of the estimated 59 000 human deaths from rabies per year occur in Africa and Asia, with 80% in rural areas.
Risk for travellers	Assessment of individual risk of exposure to rabies virus is recommended for travellers. It should take into consideration: the remoteness of the destination, the prevailing rabies epidemiology and the cumulative duration of the stay(s) in endemic setting(s). In both no- and low-risk areas, proper medical care, rabies vaccine and immunoglobulins should be accessible in a timely manner, and reliable, laboratory-based surveillance of domestic, reservoir and wild species should be available. The map shows the risk of humans for contracting rabies by country. The level of risk is based on: the presence of animal species in which lyssaviruses are maintained (e.g. dogs, bats or other wildlife); the availability of reliable laboratory-based surveillance data on these species; access to proper medical care; and the availability of modern rabies vaccines. In countries or areas belonging to risk levels 2–4, PrEP against rabies is recommended for travellers with certain characteristics. The country risk levels are: *Level 1:* no risk. No PrEP *Level 2:* low risk. In both, no- and low-risk areas, proper medical care, rabies vaccine and immunoglobulins should be accessible in a timely manner, and reliable, laboratory-based surveillance of domestic, reservoir and wild species should be available. In countries in category 2 (low risk), PrEP should be offered to travellers involved in activities that are likely to bring them into direct contact with bats and wild carnivores. Such travellers include wildlife professionals, cavers, spelunkers, researchers, veterinarians and those visiting areas where bats and wild carnivores are commonly found. For people who regularly visit caves inhabited by bats, casual exposure to cave air is not a concern, but cavers should be warned not to handle bats. *Levels 3 and 4:* medium and high risk. In medium- and high-risk areas, access to proper medical care, rabies vaccines and immunoglobulins depends on the local setting. Timely access is not guaranteed everywhere because of a short supply of recent rabies vaccines or the local availability of older-generation rabies vaccines, which are no longer recommended by WHO. Partial laboratory-based surveillance data may be available but may not cover all reservoir species or geographical settings in the country. PrEP should therefore be considered for travellers who will undertake considerable outdoor activities in remote rural areas or activities that lead to probable contact with bats. PrEP is also recommended for people with occupational risks, such as veterinarians, dog vaccinators and laboratory staff, and for expatriates living in remote areas with a significant risk of exposure to rabid domestic animals, particularly dogs, bats and wild carnivores.

Vaccine	Vaccination against rabies is used to: - protect those at high risk of rabies exposure (PrEP); - prevent development of clinical rabies after suspected exposure (post-exposure prophylaxis (PEP)). The vaccination schedules for the two uses differ, with the addition of rabies immunoglobulins for PEP. Recent inactivated vaccines are considered safe and effective and are available in major urban centres in most low-income countries. Rabies immunoglobulin may be unavailable even in major urban centres, where canine rabies is prevalent. *Pre-exposure vaccination* Pre-exposure vaccination is recommended for people living in or travelling to countries classified by WHO as risk levels 2–4, as specified above. Children in regions of low-income countries enzootic for rabies have a higher risk of contracting rabies because of their size and behaviour (e.g. playing with animals, not reporting exposure). In 2018, WHO updated its position on rabies vaccination to recommend regimes that are more cost-, dose- and time-sparing.[21] Previous regimens are still valid. Pre-exposure rabies vaccination consists of two full intramuscular doses of inactivated vaccine given on day 0 and the second dose at the earliest on day 7 (a delay in administration of the second dose for up to 28 days is acceptable). For adults and children aged ≥ 2 years, the vaccine should always be administered in the deltoid area of the arm; for children aged < 2 years, the anterolateral area of the thigh is recommended. Rabies vaccine should never be administered in the gluteal area as this results in lower neutralizing antibody titres. Intradermal vaccination in doses of 0.1 mL on days 0 and 7 is less costly but requires appropriately trained staff and qualified medical supervision. Both the intradermal and the intramuscular route of vaccine administration can be used, but, as with other co-administered drugs, pre-exposure vaccination should be completed before chloroquine or hydroxychloroquine treatment is initiated. Receiving treatment with chloroquine or hydroxychloroquine is not a contraindication for rabies vaccination. In case of a time constraint, a single pre-exposure rabies vaccination of one intramuscular dose or two intradermal doses will probably confer some protection for up to 1 year. Those who have received pre-exposure rabies vaccination only on day 0 should receive a second dose as soon as possible and within 1 year. Periodic booster injections are not recommended for general travellers. In the event of exposure through a bite or scratch of an animal known or suspected of being rabid, individuals who have previously received a complete series of pre- or at least two sessions of post-exposure rabies vaccine (with cell-culture or embryonated-egg-derived vaccine) are considered immunized and should receive either two booster doses of

[21] http://www.who.int/rabies/resources/who_wer9316/en/

	vaccine intramuscularly or intradermally. The first dose should ideally be administered on the day of exposure or as soon as possible and the second 3 days later. Alternatively, four intradermal doses should be given on the day of exposure or the first visit. This should be combined with thorough wound treatment (see PEP, below). Rabies immunoglobulin is not required for patients who have previously attended at least two vaccination sessions. *Post-exposure vaccination* Suspected contact in areas at risk of rabies may require PEP. In this situation, immediate medical advice should be obtained. The category of exposure determines the indicated PEP procedure: Category I: touching or feeding animals, animal licks on intact skin (no exposure); Category II: nibbling of uncovered skin, minor scratches or abrasions without bleeding (exposure); Category III: single or multiple transdermal bites or scratches, contamination of mucous membrane or broken skin with saliva from animal licks, exposures due to direct contact with bats (severe exposure). Indications for PEP depend on the type of contact with the confirmed or suspected rabid animal (see Table 6.2). Strict adherence to the WHO-recommended guidelines for optimal PEP virtually guarantees protection from the disease. Administration of vaccine, and immunoglobulin if required, must be conducted by, or under the direct supervision of, a physician.
Precautions and contraindications	Modern rabies vaccines are highly purified and well tolerated. Mild systemic adverse events following vaccination, such as transient fever, headache, dizziness and gastrointestinal symptoms, have been observed in 5–15% of vaccinees. Serious adverse events after vaccination occur seldom, and no causality has been established in cases of neurological symptoms.

Table 6.2. Type of contact, exposure and recommended post-exposure prophylaxis

	Category I exposure	Category II exposure	Category III exposure
Immunologically naive individuals of all age groups	Washing of exposed skin surfaces. No PEP required.	Wound washing and immediate vaccination: • Two sites ID on days 0, 3 and 7[1] **or** • One site IM on days 0, 3, 7 and between days 14 and 28[2] **or**	Wound washing and immediate vaccination • Two sites ID on days 0, 3 and 7[1] **or** • One site IM on days 0, 3, 7 and between days 14 and 28[2] **or**

		• Twosites IM on days 0 and one site IM on days 7 and 21[3] • RIG is not indicated.	• Two sites IM on days 0 and one site IM on days 7 and 21[3] • RIG administration is recommended.
Previously vaccinated individuals of all age groups	Washing of exposed skin surfaces No PEP required.	Wound washing and immediate vaccination:* • One site ID on days 0 and 3 **or** • At four sites ID on day 0 **or** At one site IM on days 0 and 3) • RIG is not indicated.	Wound washing and immediate vaccination:* • One site ID on days 0 and 3 **or** • At four sites ID on day 0 **or** At one site IM on days 0 and 3 • RIG is not indicated.

* Immediate vaccination is not recommended if complete PEP was received within < 3 months.

ID: intradermal; IM: intramuscular; RIG: rabies immunoglobulin.

[1] One-week, two-site ID regimen (Institut Pasteur of Cambodia regimen; 2-2-2-0-0); duration of entire PEP course: 7 days.

[2] Two-week IM PEP regimen (four-dose Essen regimen; 1-1-1-1-0); duration of entire PEP course: 14–28 days.

[3] Three-week IM PEP regimen (Zagreb regimen; 2-0-1-0-1); duration of entire PEP course: 21 days.

I. Wound treatment

Thorough washing of the wound for 15 min with soap or detergent and water, followed by application of ethanol or an aqueous solution of iodine or povidone. Depending on the characteristics of the wound, antibiotics, analgesics and a tetanus vaccination may be indicated.

II. Passive immunization

Human rabies immunoglobulin or equine rabies immunoglobulin or F(ab′)2 products are considered clinically equivalent and should be used for category III exposures (see Table 6.2). Passive immunization should be conducted just before or shortly after administration of the first dose of vaccine in the PEP regimen. If the product is not immediately available, passive immunization can be conducted up to the seventh day after initiation of the series of post-exposure vaccine (cell-culture or embryonated-egg rabies vaccine).

Dosage and administration: The dose of equine rabies immunoglobulin and F(ab′)2 products is 40 IU/kg body weight, and that of human rabies immunoglobulin is 20 IU/kg body weight. The full dose of rabies immunoglobulin, or as much as is anatomically feasible, should be administered into and around the wound site(s). The remaining immunoglobulin dose may be given to other patients, after aseptic retention. This practice is particularly useful if immunoglobulin is in short supply. Skin testing before administration of equine immunoglobulin product has been abandoned as it does not reliably predict adverse effects. Multiple

needle injections into the wound should be avoided. If the correct dose of rabies immunoglobulin is too small to infiltrate all wounds, as might occur in a severely bitten individual, it can be diluted in physiological buffered saline to ensure greater wound coverage. Suturing of wounds should be delayed after immunoglobulin infiltration, or, if unavoidable, sutures should be loose to allow optimal immunoglobulin diffusion.

III. Active immunization

PEP should always consist of intramuscular or intradermal administration of rabies vaccine. WHO updated its position on rabies vaccination in 2018 to regimens that are more cost-, dose- and time-sparing. Formerly WHO-recommended regimens such as the five-dose intramuscular (five-dose Essen) or the two-site intradermal (updated Thai Red Cross) regimens are still valid.

Recommended intramuscular regimens include:

a) Immunologically naïve individuals

- Four-dose regimen administered on days 0, 3, 7 and the last dose between days 14 and 28 into the deltoid muscle.
- Four-dose regimen administered as two doses on day 0 – one dose into the right arm and one into the left arm (deltoid muscles) – and then one dose on each of days 7 and 21 into the deltoid muscle.

b) Previously vaccinated individuals

- Two-dose regimen on days 0 and 3 into the deltoid muscle. The first dose should ideally be administered on the day of exposure or as soon as possible and the second 3 days later.

Recommended intradermal regimens:

a) Immunologically naïve individuals

- Two-site regimen: one intradermal injection of 0.1 mL vaccine at two sites (deltoid area of the arm) on days 0, 3 and 7. This spares cost, dose and time as compared to intramuscular regimens.

b) Previously vaccinated individuals

- One-site regimen: one intradermal injection of 0.1 mL vaccine on days 0 and 3 at one site in the deltoid area of the arm. The first dose should ideally be administered on the day of exposure or as soon as possible and the second 3 days later.

- Four-site intradermal regimen: injection of 0.1 mL vaccine at four sites (deltoid areas of the arms and either the anterolateral thigh or suprascapular regions) on day 0.

For the observed rate of reactions to rabies vaccines, see the Global Vaccine Safety Information Sheet.

For global disease distribution, please see risk levels for humans contacting rabies.

ROTAVIRUS

	In countries where infants are routinely vaccinated against rotavirus infections and in cases of incomplete or missed vaccination, vaccination should be offered according to the age of the child and national recommendations.
Cause	Strains of highly contagious rotaviruses.
Transmission	Mainly by the faecal–oral route and by direct or indirect contact.
Nature of the disease	Rotavirus infection is characterized by watery diarrhoea, vomiting and fever, mainly in children aged < 2 years. Severe cases may require rapid rehydration therapy, especially in young infants.
Geographical distribution	Worldwide, rotavirus infection is a leading cause of dehydrating diarrhoea, but fatal outcomes occur predominantly in low-income countries.
Risk for travellers	Unvaccinated children < 2 years of age are likely to be at increased risk of rotavirus infection. The risk of severe disease for older children and adults, most of whom are immune, is negligible.
Vaccines	When administered according to the respective national recommendations (or the schedule of routine vaccination against DTP), these vaccines are effective and safe.

For the observed rate of reactions to rotavirus vaccines, see the Global Vaccine Safety Information Sheet.

RUBELLA

	In most countries, rubella vaccine is routinely administered in childhood. Unvaccinated travellers should be offered vaccine according to national recommendations.
Cause	Rubella virus
Transmission	Primarily by respiratory droplets.
Nature of the disease	Rubella is usually a mild childhood disease characterized by moderate fever, lymphadenopathy and a rash. In adults, transient arthralgia and arthritis may occur. Rubella infection in early pregnancy often results in miscarriage, stillbirth or multiple fetal defects (congenital rubella syndrome).
Geographical distribution	Worldwide, except in the Region of the Americas, where endemic rubella transmission has been eliminated. Incidence depends on coverage of rubella vaccination.
Risk for travellers	Non-immune travellers may be at risk when visiting countries with insufficient vaccination coverage. Particular attention should be paid to

	ensuring the protection of women in early pregnancy or who may become pregnant during the period of travel.
Vaccine	Live attenuated vaccine, available in fixed combinations with one or more of vaccines against mumps, measles and varicella. For protection against rubella, one dose of rubella-containing vaccine is sufficient.

TICK-BORNE ENCEPHALITIS

Summary of vaccine data

	Type of vaccine:	Inactivated vaccine.
	Number of doses:	*Western European vaccines*: Three doses at an interval of 1–3 months between the first two doses and 5–12 months between the second and third doses. In urgent cases, the first interval may be reduced to 1–2 weeks. When needed, booster doses are offered at intervals of 3–5 years (in some endemic areas at intervals of up to 10 years). *Russian vaccines:* The recommended intervals are 1–7 months between the first two doses and 12 months between the second and third doses. When needed, booster doses are recommended every 3 years. *Chinese vaccines*: Not available internationally
	Contraindications:	Hypersensitivity to any vaccine component; adverse reaction to previous dose.
	Before departure:	Second dose 2 weeks before departure.
	Recommended for:	High-risk destinations only.
	Special precautions:	Prevent blood-feeding ticks from becoming attached to the skin by use of appropriate clothing and repellents; remove ticks as soon as possible.
Cause	Tick-borne encephalitis virus. Three subtypes of the causative agent are known: the European (Western), the Far Eastern (spring-and-summer encephalitis) and the Siberian.	

Transmission	Tick-borne encephalitis virus is transmitted by the bite of infected ticks (which often remain firmly attached to the skin for days) or occasionally by ingestion of unpasteurized milk. There is no direct person-to-person transmission.
Nature of the disease	Infection may induce an influenza-like illness followed, in about 30% of cases, by high fever and signs of central nervous involvement. Encephalitis that develops during the second phase may result in paralysis, permanent sequelae or death. The severity of illness increases with the age of the patient.
Geographical distribution	Tick-borne encephalitis tends to occur focally even within endemic areas. Currently, the highest incidences of clinical cases are reported from foci in the Baltic States, the Russian Federation and Slovenia. High incidences are also reported from foci in the North-Western Federal Area of the Russian Federation. Other countries that have reported cases within their territories, or that are considered to be at risk because of focally high prevalence of the virus in ticks, include Albania, Austria, Belarus, Bosnia, Bulgaria, China, Croatia, Denmark, Finland, Germany, Greece, Hungary, Italy, Mongolia, Norway, Poland, Republic of Korea, Romania, Serbia, Slovakia, Slovenia, Sweden, Switzerland, Turkey and Ukraine.
Risk for travellers	Travellers to endemic areas may be at risk mainly during April to November. The risk is highest for people who hike or camp in forested areas up to an altitude of about 1500 m.
Precautions	Prevent blood-feeding ticks from becoming attached to the skin by wearing appropriate clothing, including long trousers and closed footwear, when hiking or camping in countries or areas of risk. Repellents containing diethyltoluamide provide relative protection for several hours. The whole body should be inspected daily, and attached ticks should be removed as soon as possible. Vaccination should be offered to people travelling from non-endemic areas to endemic areas if their visits will include extensive outdoor activities.
Vaccine	Currently, there are four widely used vaccines of assured quality, all based on cell-cultured, formaldehyde-inactivated strains of the tick-borne encephalitis virus. FSME-Immun and Encepur (including FSME-Immun Junior and Encepur-Children) are based on the Western subtype of the virus and manufactured in Austria and Germany, respectively. TBE-Moscow and EnceVir, based on the Far Eastern subtype, are manufactured in the Russian Federation. The two vaccines manufactured in western Europe are considered to be safe and efficacious for individuals aged ≥ 1 year. Both vaccines are available in adult and paediatric formulations. The two vaccines manufactured in the Russian Federation are considered safe and efficacious for individuals aged ≥ 3 years, although supporting data are more limited for the Russian products. In addition, one vaccine is manufactured and commercialized in China. The current vaccines appear to protect against all tick-borne encephalitis virus subtypes circulating in endemic areas of Asia and Europe. Vaccination against the disease

	requires a primary series of three doses; people who will continue to be at risk should probably have one or more booster doses. In healthy individuals aged < 50 years, booster doses are conventionally offered at intervals of 3–5 years, although, in some endemic areas, intervals ≤ 10 years are now used. Outside countries or areas at risk, tick-borne encephalitis vaccines may not be licensed and will have to be obtained by special request. As the incidence of tick-borne encephalitis may vary considerably between and even within geographical regions, public vaccination strategies should be based on risk assessments conducted at country, regional or district level and should be appropriate to the local endemic situation. *Adverse reactions* Adverse events are commonly reported with the western European vaccines, including transient redness and pain at the site of injection in ≤ 45% of cases and fever ≥ 38 °C in ≤ 5–6% of cases. However, none of these events is life-threatening or serious. Both the Russian vaccines have been reported to be moderately reactogenic. No information is available on the Chinese product.

TUBERCULOSIS

Vaccination of young children against tuberculosis (TB) is not specific to the needs of travellers. In countries or settings with a high incidence of TB and/or a high leprosy burden, a single dose of bacille Calmette-Guérin (BCG) vaccine should be given routinely to all healthy neonates at birth, for prevention of TB and leprosy.[22] Unvaccinated young children who are brought to an environment of a high prevalence of TB should be offered vaccination according to the respective national recommendations.

Cause	*Mycobacterium tuberculosis*.
Transmission	By inhalation of *M. tuberculosis*-containing airborne droplets.

[22] There is evidence that BCG vaccination can each provide a degree of primary prevention against leprosy, see BCG vaccines: WHO position paper- February 2018.

Nature of the disease	In most cases, exposure to *M. tuberculosis* results in latent infection, which only occasionally progresses to active disease. TB may affect any organ but, from a public health perspective, active pulmonary disease with mycobacterial dissemination is the most important manifestation. In infants, tuberculous meningitis or disseminated disease may occur. Multidrug resistance of *M. tuberculosis* is a rapidly increasing problem.
Geographical distribution	Worldwide among deprived populations but most common in low-income countries (see map). TB is highly prevalent among HIV-infected individuals.
Risk for travellers	The risk of travel-associated TB depends on several factors, including the TB incidence in the country visited, the duration of travel, the degree of contact with the local population and, in particular, the age of the traveller. An individual risk assessment based on duration of travel and the TB incidence in the country to be visited should be considered before vaccination of unvaccinated travellers negative by the tuberculin skin test and the interferon γ release assay from countries that are not endemic for TB. Young unvaccinated children travelling to countries with a high incidence of TB, particularly those likely to travel repeatedly during childhood, should be vaccinated.
Precautions	When possible, travellers should avoid prolonged, close contact with people with known or suspected pulmonary TB. A tuberculin skin test before and after a high-risk mission abroad may be advisable, for example, for health professionals and humanitarian relief workers. Travellers who have prolonged exposure to people with bacteriologically confirmed TB should have access to preventive treatment.
Vaccine	BCG vaccines are based on live attenuated mycobacterial strains descended from the original attenuated BCG. Apart from its documented effect against tuberculous meningitis and disseminated disease in infants, BCG vaccination is of very limited value for most travellers.

For global disease distribution, please see estimated TB incidence rates.

For the observed rate of reactions to BCG vaccine, see the Global Vaccine Safety Information Sheet.

TYPHOID FEVER

Summary of vaccine data

Type of vaccine:	Currently, three types of typhoid vaccine are licensed for use: 1) The newer generation typhoid conjugate vaccine (TCV), consisting of Vi polysaccharide antigen linked to a carrier protein. Currently, the only licensed TCVs are linked to tetanus toxoid protein (other TCVs

	with different carrier proteins are in clinical development and expected to be licensed in the coming years). TCV is currently recommended as a single intramuscular dose in infants and children from 6 months of age and in adults ≤ 45 years. 2) The oral Ty21a vaccine is based on a live attenuated strain of *Salmonella* Typhi. It is supplied in enteric-coated capsules for use in people aged ≥ 6 years. Depending on national recommendations, primary vaccination consists of three or four capsules (one capsule every other day). Revaccination is recommended after 1–7 years. Ty21a has been used primarily to protect travellers. 3) The injectable unconjugated Vi capsular polysaccharide (ViPS) vaccine is given intramuscularly or subcutaneously in a single dose to people aged ≥ 2 years. To maintain protection, revaccination is recommended every 3 years. A combined typhoid–hepatitis A vaccine is also available in some countries.
Contraindications:	Serious allergy to any of the vaccine components.
Adverse reactions:	Both the Ty21a and unconjugated ViPS vaccines are safe and well tolerated over three decades of use. To date, the newer-generation TCV has a good safety profile (similar to that of ViPS), and no serious adverse events have been reported.
Before departure:	Immunity develops 7–10 days after primary vaccination with ViPS and Ty21a. Ideally therefore, primary vaccination should be completed at least 1 week before departure. Immunity is restored within a few days of a booster dose of ViPS and Ty21a. Currently, there is no evidence for use of booster vaccination with TCV.
Consider for:	Long-term (> 1 month) visitors from non-endemic to endemic areas, particularly where antibiotic-resistant strains of *S.* Typhi are prevalent.
Special precautions:	Ty21a should not be administered to people who are taking antibiotics. Ty21a may be taken with chloroquine but should not be taken until 8–24 h after administration of mefloquine. There is inconclusive evidence

	regarding co-administration of proguanil and Ty21a.
Cause	Typhoid fever is a severe, potentially life-threatening, acute, generalized infection caused by *Salmonella* Typhi. *S.* Paratyphi A and *S.* Paratyphi B (and uncommonly *S.* Paratyphi C) cause paratyphoid fever, particularly in parts of Asia, which is clinically indistinguishable from typhoid fever. Both *S.* Typhi and *S.* Paratyphi infect humans only. Typhoid fever and paratyphoid fever are collectively referred to as "enteric fever".
Transmission	The typhoid bacillus is transmitted through contaminated food or water. Occasionally, direct faecal–oral transmission may occur. Shellfish taken from sewage-polluted areas are an important source of infection; transmission also occurs from eating raw fruit and vegetables fertilized with human excreta and ingestion of contaminated milk and milk products. Flies may cause human infection by transferring the infectious agents to foods. Pollution of water sources may result in epidemics of typhoid fever when large numbers of people use the same source of drinking-water.
Nature of the disease	Typhoid fever is a systemic disease of varying severity. Severe cases are characterized by gradual onset of fever, headache, malaise, anorexia and insomnia. Constipation is more common than diarrhoea in adults and older children. Without treatment, some patients develop sustained fever, bradycardia, hepatosplenomegaly, abdominal symptoms and, occasionally, pneumonia. In light-skinned patients, pink spots, which fade on pressure, appear on the skin of the trunk in up to 20% of cases. In the third week, untreated cases may have gastrointestinal and cerebral complications, which may prove fatal in up to 10–20% of untreated cases. The highest case-fatality rates are reported in children < 4 years of age. Around 2–5% of infected people become chronic carriers, as the bacteria persist in the biliary tract after symptoms have resolved.
Geographical distribution	The risk of typhoid fever is higher in countries or areas with low standards of hygiene, sanitation and water supply.
Risk for travellers	All travellers to endemic areas are at potential risk of typhoid fever, although the risk is generally low in tourist and business centres where standards of accommodation, sanitation and food hygiene are high. Areas of high endemicity include parts of sub-Saharan Africa and South and South-East Asia. Elsewhere, travellers are usually at risk only when exposed to low standards of hygiene. Even vaccinated travellers should take care to avoid consuming potentially contaminated food and water, as the vaccine does not confer 100% protection. There is a continuing increase in the emergence and spread of antibiotic resistance among *S.* Typhi isolates in typhoid endemic countries.
General precautions	For general precautions against exposure to foodborne and waterborne infections, see "travel-related risks" on the website.[23]
Vaccine	Vaccination may be offered to travellers to destinations where the risk of typhoid fever is high, especially to those staying in endemic areas for > 1

[23] International travel and health web site, travel-related risks page, http://www.who.int/ith/precautions/travel_related/en/.

	month and/or in locations in which antibiotic-resistant strains of *S.* Typhi are prevalent. For previously vaccinated travellers from non-endemic to endemic areas, a booster dose of the Ty21a vaccine is recommended after 1–7 years, depending on national recommendations, and after 3 years for the ViPS vaccine.
Contraindications and precautions	All three typhoid vaccines are safe, and there are no contraindications to their use other than previous severe hypersensitivity reactions to any of the vaccine components. Ty21a should not be administered to people who are taking antibiotics. Ty21a may be taken with chloroquine but should not be taken until 8–24 h after administration of mefloquine. There is inconclusive evidence regarding co-administration of proguanil and Ty21a.

For the observed rate of reactions to typhoid vaccine, see the Global Vaccine Safety Information Sheet.

VARICELLA AND HERPES ZOSTER

	In some countries, varicella vaccine is routinely administered in childhood. Further, some countries routinely administer herpes zoster vaccine to older adults. Travellers who have not received such vaccination may be offered vaccination according to national recommendations.
Cause	The highly contagious varicella zoster virus
Transmission	Primarily by airborne respiratory droplets and by direct and indirect contact
Nature of the disease	Varicella is usually a mild disease of childhood but may be more serious in adults. The disease is characterized by fever and malaise followed by an itchy, vesicular rash. Varicella may be severe or fatal in newborns and in immunocompromised people. After infection, varicella zoster virus remains latent in neural ganglia and may cause zoster upon subsequent reactivation. Zoster, commonly known as "shingles", is a disease that affects mainly immunocompromised and elderly people. The usual clinical manifestation is a vesicular rash restricted to a single dermatome, accompanied by radicular pain.
Geographical distribution	Worldwide
Risk for travellers	As for the general population
Vaccine	Live attenuated vaccines are available for the prevention of varicella and of herpes zoster. The varicella vaccine is often available in fixed combination with vaccines against measles, mumps and rubella.

For the observed rate of reactions to varicella vaccine, see the Global Vaccine Safety Information Sheet.

YELLOW FEVER

Summary of vaccine data
(For the International Certificate of Vaccination or Prophylaxis, see section 6.3 under Required vaccinations)

Type of vaccine:	Live attenuated
Number of doses:	One dose of 0.5 mL
Boosters:	A single dose of yellow fever vaccine provides life-long immunity to the disease, making boosters unnecessary. Since July 2016, a certificate of vaccination against yellow fever is valid for the life of the person (traveller) vaccinated.
Contraindications:	Infants aged < 6 months; history of severe allergy to egg or to any of the vaccine components or hypersensitivity to a previous dose of the vaccine; thymoma or history of thymectomy; immunodeficiency due to medication, disease or symptomatic HIV infection.
Adverse reactions:	Mostly mild, nonspecific general signs such as low-grade fever or myalgia; very rarely, neurological (e.g. encephalitis, acute disseminated encephalomyelitis, Guillain-Barré syndrome) or multi-organ failure resembling wild-type yellow fever.
Before departure:	The International Certificate of Vaccination becomes valid 10 days after vaccination.
Required and recommended for:	Yellow fever vaccination is required for travellers to certain countries and is recommended for all travellers to areas subject to endemic and epidemic disease.[24]
Special precautions:	Not recommended for infants aged 6–8 months, except during epidemics when the risk of yellow fever virus transmission may be very high. The risks and benefits of vaccination in this age group should be carefully considered before vaccination. The vaccine should be used with precaution during pregnancy or breastfeeding; however, pregnant or breastfeeding women may be vaccinated during epidemics or if travel to a country or area with risk of transmission is unavoidable.

[24] International travel and health. See Annex 1 and country list updated yearly on WHO's ITH web page at: http://www.who.int/ith/en/.

Cause	Yellow fever virus
Transmission	Yellow fever occurs in urban and rural areas of Africa and Central and South America. In jungle and forest areas, monkeys are the main reservoir of the infection, which is spread by mosquitoes from monkey to monkey and, occasionally, to human beings. In urban settings, mosquitoes transmit the virus from person to person, and introduction of infection into densely populated urban areas can lead to large epidemics of yellow fever. In Africa, an intermediate pattern of transmission is common in humid savannah regions, where mosquitoes infect both monkeys and human beings, causing localized outbreaks.
Nature of the disease	Although most infections are asymptomatic, some lead to an acute illness characterized by two phases. Initially, there is fever, muscular pain, headache, chills, anorexia, nausea and/or vomiting, often with bradycardia. About 15% of infected people progress to a second phase after a few days, with resurgence of fever, development of jaundice, abdominal pain, vomiting and haemorrhagic manifestations; up to half of these patients die 10–14 days after the onset of illness.
Geographical distribution	In tropical areas of Africa and Central and South America (see maps). Yellow fever virus cannot be transmitted at altitudes > 2300 m. The number of countries or areas in which yellow fever virus is present far exceeds that officially reported. Some countries may have no reported cases simply because of high vaccine coverage or because of poor surveillance. The risk classification of countries is illustrated on the maps.
Risk for travellers	Yellow fever virus may be transmitted not only in areas of high endemicity but also in areas of low endemicity if a traveller's itinerary results in heavy exposure to mosquitoes (e.g. during prolonged travel in rural areas). A valid certificate of vaccination against yellow fever may be required for visitors to and from areas at risk of transmission (see section 6.3).
General precautions	Avoid mosquito bites; the highest risk for transmission of yellow fever virus is during the day and early evening.
Vaccine	Yellow fever vaccine is highly effective (approaching 100%). A single dose of vaccine is sufficient to confer sustained, life-long protective immunity against the disease; a booster dose is not necessary. Yellow fever vaccine may be administered simultaneously with other vaccines, including measles and measles-containing vaccines. As a general rule, any live vaccine may be given either simultaneously or at an interval of 4 weeks. OPV may be given at any time in relation to yellow fever vaccination. A fractional-dose yellow fever vaccine is currently used in certain countries because of vaccine supply shortages. A fractional dose is not recommended for travellers and is not compliant with international travel regulations. Vaccine should be offered to all unvaccinated travellers aged > 9 months travelling to and from at-risk areas, unless they belong to the group of individuals for whom yellow fever vaccination is

	contraindicated. Vaccination is recommended, if indicated, for pregnant or breastfeeding women travelling to endemic areas when such travel cannot be avoided or postponed. Yellow fever vaccine may be offered to asymptomatic HIV-infected people with a $CD4^+$ T-cell count ≥ 200 cells/mm^3. Although there are limited data on the safety and immunogenicity of yellow fever vaccine when used in HIV-infected children, it may be administered to all clinically healthy children. HIV testing is not a prerequisite for vaccination.
Adverse reactions	Non-serious adverse events, such as headache, myalgia, low-grade fever, discomfort at the injection site, pruritus, urticaria and rash were reported by 7–25% of vaccinees in endemic countries. Very rare but serious adverse events after vaccination with yellow fever vaccine fall into three categories: 1) Immediate severe hypersensitivity or anaphylactic reactions 2) Yellow fever vaccine-associated neurological disease, a group of neurological conditions caused either by direct viral invasion of the central nervous system by the vaccine virus, resulting in meningitis or encephalitis, or by an autoimmune reaction resulting in conditions such as Guillain-Barré syndrome or acute disseminated encephalomyelitis. 3) Yellow fever vaccine-associated viscerotropic disease, which is caused by replication and dissemination of the vaccine virus in a manner similar to the natural virus. People with this condition typically develop multi-organ system dysfunction or failure, and > 60% of cases have been fatal. The risk of adverse effects is possibly higher in people aged ≥ 60 years, but the overall risk remains low. The reported rate of yellow fever vaccine-related adverse events after vaccination in mass campaigns in endemic regions was 0.05 per 100 000 administered doses.
Contraindications and precautions	The vaccine is contraindicated in children aged < 6 months and is not recommended for those aged 6–8 months, except during epidemics when the risk of infection with yellow fever virus may be very high. Other contraindications for yellow fever vaccination are severe hypersensitivity to egg and severe immunodeficiency. Caution is recommended before vaccinating people aged ≥ 60 years against yellow fever, and a risk–benefit assessment should be performed for any person ≥ 60 years of age who has not been vaccinated and for whom the vaccine is normally recommended.

For global disease distribution, please see Yellow Fever Risk Africa and Americas

6.3 Required vaccinations

6.3.1 Yellow fever

Vaccination against yellow fever may be required to prevent importation of the virus into countries in which the disease does not occur, but the mosquito vector and non-human

primate hosts are present. In these settings, vaccination may be an entry requirement for all travellers arriving (including airport transit)[25] from countries in which there is a risk of yellow fever transmission.

For information on countries that require proof of yellow fever vaccination as a condition of entry, see the list on WHO's ITH web page.[26]

If yellow fever vaccination is contraindicated for medical reasons, a letter of medical exemption is necessary.

International certificates of vaccination against yellow fever become valid 10 days after primary vaccination and remain valid for the duration of the life of the person vaccinated. A booster dose after 10 years is not necessary for protection and can no longer be required for international travellers as a condition of entry into a country.

Travellers should be aware that the absence of a requirement for vaccination does not imply that there is no risk of exposure to yellow fever in the country.

Explanatory notes on the International Certificate of Vaccination or Prophylaxis are included at the end of this chapter.

6.3.2 Meningococcal disease

Vaccination against meningococcal disease is required by Saudi Arabia for pilgrims visiting Mecca for the *hajj* or for *umrah*. The same requirements apply to guest workers. Following the occurrence of cases of meningococcal disease associated with *Neisseria meningitidis* W-135 among pilgrims in 2000 and 2001, the current requirement is for vaccination with four-valent vaccine (A, C, Y and W-135). Vaccine requirements for *hajj* pilgrims are issued each year and are published in the *Weekly Epidemiological Record*.[27]

6.3.3 Polio

Some polio-free countries may require proof of vaccination against polio from travellers from countries or areas in which the presence of polioviruses[28] has been reported in order to obtain an entry visa. Updates are published in the *Weekly Epidemiological Record*.

6.4 Special groups

6.4.1 Infants and young children

Because not all vaccines can be administered to very young children, it is especially important to ensure their protection against health hazards such as foodborne illnesses

[25] A few hours' transit in an air-conditioned international airport in an endemic area should not be considered a realistic risk of contracting yellow fever and hence should not be seen as an indication for yellow fever vaccination or restriction of entry of non-vaccinated people into non-endemic countries.
[26] International travel and health. See country list updated yearly on WHO's ITH web page at: http://www.who.int/ith/en/.
[27] *Weekly Epidemiological Record*. 2016;91(26/27):329–40.
[28] Polio Global Eradication Initiative. Where we work, web page at: http://polioeradication.org/.

(including use of contaminated water to make formula) and mosquito bites by means other than vaccination.

Some vaccines can be administered at birth (e.g. BCG, OPV, hepatitis B vaccine). Others, such as DTP vaccine, cannot be given before 6 weeks of age; Japanese encephalitis and yellow fever vaccines cannot be given before the age of 6 months. As it may be difficult to reduce children's exposure to environmental dangers, it is particularly important to ensure that their routine vaccinations are fully up to date. A child who travels abroad before completing the full schedule of routine vaccines is at risk of vaccine-preventable diseases.

6.4.2 Adolescents and young adults

Adolescents and young adults make up the largest group of travellers and the group most likely to acquire sexually transmitted and other travel-related infections. They are particularly at risk when travelling on a limited budget and using accommodation of poor standards (e.g. when backpacking) or when their lifestyle includes risky sexual behaviour and other risks taken under the influence of alcohol or drugs. Because risk reduction through behaviour modification may not be reliable, this age group should be strongly encouraged to accept all appropriate vaccines before travel and to adhere to other precautions for avoiding infectious diseases.

6.4.3 Frequent travellers

People who travel widely, usually by air, often become lax about taking precautions regarding their health. Having travelled numerous times without major health upsets, they may neglect to ensure that they are adequately vaccinated. Such travellers pose a special problem for health advisers who should, nonetheless, encourage compliance.

6.4.4 Pregnant and lactating women

Pregnancy and lactation should not deter a woman from receiving vaccines that are safe and will protect both her health and that of her child. However, care must be taken to avoid inappropriate administration of certain vaccines that could harm the infant. Killed or inactivated vaccines, such as influenza vaccine, toxoids, polysaccharides and conjugated vaccines, can generally be given during pregnancy and lactation. Except for OPV, live vaccines are generally contraindicated because of largely theoretical risks to the infant; measles, mumps, rubella, varicella and yellow fever vaccines should therefore be avoided in pregnancy, although the risks and benefits should be examined in each case. Vaccination against yellow fever may be considered in early pregnancy, depending on the risk (see Table 6.3). For more detailed information, see WHO's specific vaccine position papers.[29]

Table 6.3 Vaccination in pregnancy

Vaccine	Use in pregnancy	Use in lactating women	Comments
BCG[a]	No	No	

[29] Vaccine position papers. See WHO website at: http://www.who.int/immunization/documents/positionpapers/en/.

Cholera	Yes, administer oral inactivated vaccine if indicated	Yes, administer oral inactivated vaccine if indicated	Vaccination is not generally recommended for long-term or short-term travellers to cholera-affected countries but should be guided by specific travel risks.
Hepatitis A (inactivated)	Yes, administer if indicated	Yes, administer if indicated	
Hepatitis A (live vaccine)	No	Safety not determined	
Hepatitis B	Yes, administer if indicated	Yes, administer if indicated	
Hepatitis E	Yes, administer if indicated	Yes, administer if indicated	
Influenza	Yes, administer if indicated	Yes, administer if indicated	Use inactivated vaccine
Measles[a]	No	Safety not determined	
Meningococcal disease	Yes, administer if indicated	Yes, administer if indicated	Data are not available for lactating women; however, there is no evidence that bacterial vaccines or toxoids given to lactating women can harm a developing child, and lactation is not considered a contraindication for administration of MenA conjugate vaccine.
Mumps[a]	No	No	
Pertussis (Tdap)	Yes, administer if indicated	Yes, administer if indicated	Only acellular pertussis-containing vaccine
Polio			
OPV[a]	Yes, administer if indicated	Yes, administer if indicated	
IPV	Yes, administer if indicated	Yes, administer if indicated	
Rabies	Yes, administer if indicated	Yes, administer if indicated	
Rubella[a]	No	Safety not determined	
Tetanus–diphtheria	Yes, administer if indicated	Yes, administer if indicated	
Typhoid Ty21a[a]	No	Safety not determined	Use of live attenuated Ty21a vaccine during pregnancy should be avoided.

TCV/ViPS	Safety not determined	Safety not determined	No theoretical concern about the safety of TCV and ViPS for pregnant and lactating women
Varicella[a]	No	Safety not determined	Contraindicated during pregnancy, and pregnancy should be delayed for 4 weeks after vaccination. Limited data on infants born to women who were inadvertently vaccinated during pregnancy do not indicate any cases of congenital varicella syndrome. Termination of pregnancy is not indicated for women inadvertently vaccinated during pregnancy.
Yellow fever[a]	Yes, administer if indicated	Yes, administer if indicated	A risk-benefit assessment should be conducted before vaccinating pregnant and lactating women. Vaccination is recommended, if indicated, for pregnant or lactating women travelling to endemic areas when such travel cannot be avoided or postponed. Avoid, unless at high risk.

[a] Live vaccine

6.4.5. Elderly travellers

Increasing numbers of poorly vaccinated elderly travellers

People aged ≥ 60 years constitute an increasingly large proportion of international travellers. It is unfortunate that, in general, vaccine coverage in this age group is low, as age commonly aggravates infectious diseases. In most cases, vaccination of healthy elderly travellers does not differ from vaccination of younger adults.

Individuals over the age of 60 years may have never been vaccinated with the vaccines now used in routine childhood immunization programmes. Although most men who served in the army fewer than 50–60 years previously were vaccinated against tetanus and diphtheria, many older women probably never received any vaccines. As vaccination against polio came into effect only in the 1960s, most adults born before that time were not vaccinated, although many

may have acquired natural immunity by early contact with wild polio viruses. Elderly people worldwide may also have acquired natural immunity to hepatitis A.

The ageing immune system

With increasing age, the human immune system undergoes characteristic changes (immunosenescence) that may result in increased incidence and severity of infectious diseases. In addition, ageing has a significant impact on the immunological outcome of vaccination. In older people, several functions of cellular immunity are reduced, and antibody responses are weaker, develop more slowly and decrease faster than in younger vaccinees. The impact of ageing on the immune system nevertheless varies considerably, and advanced age is not a limitation to receiving vaccination.

Vaccines designed for older adults

Improved vaccination strategies, new adjuvants and new vaccines that specifically target the aged immune system will contribute to overcoming the limitations of immunosenescence. For example, zoster and influenza vaccines with increased antigen concentrations have been developed specifically for older adults. As the duration of protection is commonly reduced in elderly vaccinees, the recommended booster intervals may be shortened for this age group, as is the case with vaccines against tick-borne encephalitis.

Vaccines of particular relevance to older adults

Of particular relevance to older adults are vaccines against diphtheria–tetanus–pertussis, seasonal influenza, pneumococcal disease and herpes zoster. Primary vaccination and the appropriate number booster doses of DTP vaccine should be offered. Even after many years, an interrupted vaccination schedule may be simply continued with the next dose that is due.

Seasonal influenza vaccination is recommended for elderly people, who constitute a risk group for severe influenza. Several countries recommend the pneumococcal polysaccharide vaccine (PPV23) for healthy individuals, usually given only once, potentially with one or two boosters doses, mainly to immunocompromised individuals. One pneumococcal conjugate vaccine (PCV13) is also licensed for adults (no WHO policy at this time), and travellers may consult their health care provider. Unfortunately, protection after vaccination against pneumococcal disease and seasonal influenza decreases with age, so that the effectiveness of these vaccines is lower in older than in younger healthy adults.

Most people born before 1970 experienced natural infection with measles, mumps and rubella viruses and are considered to have life-long immunity against these diseases. Most adults are also naturally immune against varicella; however, the protection against varicella does not extend to zoster. About 30% of all people develop zoster during their lifetime, mainly because of immunosenescence and age-related immunosuppressive conditions. For this reason, some countries recommend zoster vaccination for all adults aged ≥ 60 years.

For travellers to certain countries in Africa or Central or South America, yellow fever vaccination is required. Although in general this live attenuated vaccine is considered very safe, a few serious adverse events have been reported after primary yellow fever vaccination, particularly in elderly individuals. Therefore, a risk–benefit assessment should precede possible yellow fever vaccination of people ≥ 60 years of age.

Special considerations arise in the case of elderly travellers with chronic health problems (see below).

6.4.6 Travellers with chronic medical problems

Travellers with chronic medical conditions associated with impaired immunity, including cancer, diabetes mellitus, HIV infection and treatment with immunosuppressive medicines, may be at risk of severe complications after administration of vaccines that contain live organisms. Consequently, it may be advisable that these travellers not receive measles, oral polio, yellow fever, varicella or BCG vaccines. For travel to a country where yellow fever vaccination is required, a letter of medical exemption should be issued.

Groups at risk of serious complications of influenza are those with chronic medical problems such as cardiovascular and/or respiratory conditions, immunosuppressive conditions or diabetes mellitus. Annual influenza vaccination is therefore recommended for these groups by WHO and many national public health institutions. The risk to travellers of developing influenza depends on the time of year and destination of travel. People who have not received the influenza vaccine for the current season and are travelling to parts of the world where there is current influenza activity should be vaccinated against influenza to protect themselves during their trip.

For people who lack a functional spleen, additional vaccinations are advised. Hib vaccine, meningococcal vaccine (conjugate C or tetravalent conjugate vaccine) and possibly pneumococcal vaccine should be considered, in addition to regular vaccination against influenza.

6.5 Adverse reactions and contraindications

(see Tables 6.4 and 6.5)

6.5.1 Reactions to vaccines

Vaccines are generally both effective and safe, but no vaccine is totally safe for all recipients. Vaccination may sometimes cause mild side-effects: local reaction, slight fever and other systemic symptoms may develop as part of the normal immune response. In addition, certain components of the vaccine (e.g. aluminium adjuvant, antibiotics or preservatives) occasionally cause reactions. A successful vaccine reduces these reactions to a minimum while inducing maximum immunity. Serious reactions are rare. Health care workers who administer vaccines are obliged to inform recipients of known adverse reactions and the likelihood of their occurrence.

A known contraindication should be clearly marked on a traveller's vaccination card, so that the vaccine may be avoided. However, under certain circumstances, a health care provider may assess the risk of a particular disease to be greater than the risk of an adverse reaction after administration of the vaccine and will therefore advise vaccination.

6.5.2 Common mild vaccine reactions

Most vaccines cause some mild local and/or systemic reaction relatively frequently. These reactions generally occur within a day or two of vaccination. The systemic symptoms (mainly

fever and/or rash) that are reported in 5–15% of recipients of measles or measles, mumps and rubella vaccine 5–12 days after vaccination are commonly attributable to normal background illnesses during childhood.

6.5.3 Uncommon, serious adverse reactions

Most of the rare vaccine reactions (Table 6.4) are self-limiting and do not lead to long-term problems. Anaphylaxis, for instance, although potentially fatal, can be treated and has no long-term effects.

All serious reactions should be reported immediately to the relevant national health authority and should be marked on the vaccination card. In addition, the patient and relatives should be instructed to avoid the vaccine in the future.

Table 6.4 Uncommon severe adverse reactions

Vaccine	**Possible adverse reaction**	**Expected rate[a] per million doses**
BCG	Suppurative lymphadenitis	100–1000 (mostly in immunodeficient individuals)
	Osteitis	1–700 (rarely with current vaccines)
	Disseminated BCG infection	0.19–1.56
Cholera	None reported	
DTP	Persistent crying	1000–60 000
	Seizures	570
	Hypotonic–hyporesponsive episode	570
	Anaphylaxis	20
Haemophilus influenzae type b	None reported	
Hepatitis A	None reported	
Hepatitis B[b]	Anaphylaxis	1–2
Influenza	Guillain–Barré syndrome	< 1
Japanese encephalitis	Neurological event (mouse-brain vaccine only)	Rare
	Hypersensitivity (mouse-brain vaccine only)	1800–6400
Measles	Febrile seizure	333
	Thrombocytopenic purpura	33–45
	Anaphylaxis	1–50
	Encephalitis	1 (unproven)
Meningococcal disease	Anaphylaxis	1
Mumps	Depending on strain: aseptic meningitis	0–500
Pneumococcal disease	Anaphylaxis	Very rare
Polio (OPV)	Vaccine-associated paralytic poliomyelitis	1.4–3.4
Polio (IPV)	None reported	
Rabies	Animal brain tissue only: neuroparalysis	17–44
	Cell-derived: allergic reactions	Rare
Rubella	Transient arthralgia, arthritis or arthropathy	In non-immune women: arthralgia: 25%, arthritis: 12%

Tetanus	Brachial neuritis	5–10
	Anaphylaxis	1–6
Tick-borne encephalitis	None reported (data for western European vaccines only)	
Typhoid fever	Parenteral vaccine: various	Very rare
	Oral vaccine: none reported	
Yellow fever	Neurotropic disease	Very rare
	Allergy or anaphylaxis	5–20
	Viscerotropic disease	0–24

[a] The precise rate may depend on the survey method used.
[b] Although there have been anecdotal reports of demyelinating disease after vaccination with hepatitis B vaccine, there is no scientific evidence of a causal relationship.

6.5.4 Contraindications

The main contraindications to administration of vaccines are available online: https://vaccine-safety-training.org/contraindications.html

Further reading

Global Influenza Surveillance Network (FluNet)[30]
Information on safety of vaccines from the Global Advisory Committee on Vaccine Safety[31]

WHO information on vaccine-preventable diseases

Vaccines and diseases[32]
WHO vaccine position papers[33]

International Certificate of Vaccination or Prophylaxis

A revision of the International Health Regulations, referred to as the International Health Regulations (2005), was unanimously adopted on 23 May 2005 by the World Health Assembly, and these Regulations entered into force in June 2007 (see Annex 2). As of 15 June 2007, the previous "International Certificate of Vaccination or Revaccination against Yellow Fever" has been replaced by the "International Certificate of Vaccination or Prophylaxis", as follows:

International Certificate of Vaccination or Prophylaxis

Model International Certificate of Vaccination or Prophylaxis

This is to certify that [name].....

date of birth ..... sex .....

[30] Global Influenza Surveillance Network (FluNet). Accessible via the WHO Global Health Atlas at: http://www.who.int/GlobalAtlas/.
[31] Global Vaccine Safety. See WHO website at: http://www.who.int/vaccine_safety/committee/en/.
[32] Vaccines and Diseases. See WHO website at: http://www.who.int/immunization/diseases/en/.
[33] Vaccine position papers. See WHO website at: http://www.who.int/immunization/documents/positionpapers/en/.

nationality .....

national identification document, if applicable .....

whose signature follows .....

has on the date indicated been vaccinated or received prophylaxis against

[name of disease or condition].....

in accordance with the International Health Regulations (2005).

Vaccine or prophylaxis	Date	Signature and professional status of supervising clinician	Manufacturer and batch no. of vaccine or prophylaxis	Certificate valid from..... until.....	Official stamp of administering centre
1.					
2.					

This certificate is valid only if the vaccine or prophylaxis used has been approved by the World Health Organization.[34]

This certificate must be signed by the clinician, who shall be a medical practitioner or other authorized health worker, who is supervising administration of the vaccine or prophylaxis. The certificate must also bear the official stamp of the administering centre; however, this shall not be an accepted substitute for the signature.

Any amendment of this certificate, or erasure or failure to complete any part of it may render it invalid. The validity of this certificate shall extend until the date indicated for the particular vaccination or prophylaxis. The certificate shall be fully completed in English or in French. The certificate may also be completed in another language on the same document, in addition to either English or French.

[34] List of prequalified vaccines. See WHO website at: http://www.who.int/immunization_standards/vaccine_quality/PQ_vaccine_list_en/en/.
Note: Since this list was issued, the following changes have occurred: Evans Medical is now Novartis Vaccines; Connaught Laboratories and Pasteur Mérieux are now Sanofi Pasteur; and the Robert Koch Institute has ceased production.