Vaccine-preventable diseases and vaccines

6.1 General considerations

Vaccination is the administration of agent-specific, but relatively harmless, antigenic components that in vaccinated individuals can induce protective immunity against the corresponding infectious agent. In practice, the terms “vaccination” and “immunization” are often used interchangeably.

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 abroad. However, satisfactory vaccines have not yet been developed against several of the most life-threatening conditions.

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. For example, vaccination is not a substitute for avoiding potentially contaminated food and water. Consequently all additional precautions against infection should be carefully considered.

6.1.3 Planning before travel

Before departure, travellers should be advised about the risk of disease in the country or countries they plan to visit and the steps to be taken to prevent illness. No single vaccination schedule suits all travellers. Each vaccination schedule must be personalized according to the traveller’s previous immunizations, health status and risk factors, the countries to be visited, the type and duration of travel, and the amount of time available before departure.

A medical consultation before departure is a good opportunity for the health-care provider to review routine immunizations and update them in addition to providing the travel immunizations indicated for the specific itinerary.

Following 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 immunizations.

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. Vaccines 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
		Hepatitis A[b] and/or E
		Japanese encephalitis[b]
		Meningococcal[b]
		Polio (adult booster dose)
		Typhoid fever
		Yellow fever[b]
		Rabies
		Tick-borne encephalitis[b]
2. 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 (OPV or IPV, 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].
3. Routine vaccines for review before travelling	These vaccines are part of most national childhood immunization programmes. However, the pre-travel consultation is a good opportunity for health-care providers to review the immunization status of infants, children, adolescents and adults.	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]

[a] Because of their more comprehensive presentations, vaccines of 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 industrialized countries.

[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.

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 papers1. Summary tables for routine vaccinations can be found on the WHO website at the web page of WHO's recommendations for routine immunization – summary tables[2].

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 for many travellers 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[3]. Temporary country requirements due to exceptional circumstances are also listed on the same WHO website (see latest updates).

6.1.5 Safe injections

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[4]. 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.[5]

6.1.6 Combinations and co-administration of vaccines

Inactivated vaccines do not generally interfere immunologically with other inactivated or live vaccines. However, administration of multiple injections at a single visit requires separate sites (different limbs) for each injection, or spacing of injection sites by at least 2.5 cm (or 1 inch), in order to distinguish the cause of any local reaction. 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,

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[1] Vaccine position papers. See WHO website at: http://www.who.int/immunization/documents/positionpapers/en/.
[2] Recommendations for routine immunization – summary tables. See WHO website at: http://www.who.int/immunization/policy/immunization_tables/en/.
[3] International travel and health. See country list updated yearly on WHO's ITH web page at: http://www.who.int/ith/en/.
[4] 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; http://www.who.int/injection_safety/global-campaign/injection-safety_guidline.pdf, accessed 10 December 2016)).
[5] 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 10 December 2016).

injectable live vaccines. Somewhat lower seroconversion rates for mumps, rubella and yellow fever (but not for measles) have been reported in subjects injected simultaneously with yellow fever vaccine and the measles, mumps and rubella (MMR) vaccine compared with subjects receiving these vaccines 30 days apart.

Several combination vaccines are now available to provide protection against more than one disease, and new combinations are likely to become available in future. For routine vaccination of children, the combined diphtheria, tetanus and pertussis (DTP) and MMR vaccines are in widespread use. Other examples of combination vaccines are HepA+B and HepA + typhoid, IPV + DTP, IPV + DTP + Hib, MMR + varicella (MMRV), IPV + DTP + HepB + Hib[1]. Combination vaccines based on *Haemophilus influenzae* type b and *Neisseria meningitidis* C and Y vaccines (Hib + MenC or Hib + MenCY) are also available in some countries. In adults, the combined diphtheria–tetanus vaccine (with reduced diphtheria toxoid content, Td) is generally used in preference to monovalent tetanus toxoid vaccine. 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. However, the first dose of MMRV vaccine is associated with a slightly elevated risk of post-vaccination febrile seizure compared with the separate co-administration of varicella and MMR.

6.1.7 Choice of vaccines for travel

Vaccines for travellers include: (1) vaccines for certain destinations, (2) vaccines demanded by certain countries, and (3) routine vaccines for review before travelling. Several vaccines that are routinely administered in childhood require one or several booster doses to maintain an effective level of immunity. Adults often neglect the need for booster vaccinations, particularly if the risk of infection is low. Some adults, particularly elderly people, may either have lost immunity over time or were never vaccinated. It is important to realize that diseases such as diphtheria and polio, which have been eliminated in most industrialized countries, may be present in countries frequently visited by travellers. Pre-travel precautions should include booster doses of routine vaccines if the regular schedule has not been followed, or a full course of primary immunization 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/reintroduction of diseases such as polio, yellow fever, measles and rubella.

Administration of other vaccines will be advised on the basis of a travel risk assessment for the individual traveller. 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;
– reactions to previous vaccine doses, allergies;

[1] IPV = inactivated poliovirus vaccine; Hib = *Haemophilus influenzae* type b [vaccine]; HepB = hepatitis B [vaccine].

– risk of infecting others;
– costs.

Nowadays, only yellow fever vaccination is, in certain situations, required by the International Health Regulations. Yellow fever vaccination is carried out for two different reasons: (1) to protect the individual in areas where there is a risk of yellow fever virus infection, and (2) to protect vulnerable countries from importation of the yellow fever virus. Travellers should therefore be vaccinated if they visit a country where there is a risk of exposure to yellow fever. 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 meningococcal disease (tetravalent ACWY polysaccharide or conjugate vaccine) is required by Saudi Arabia for pilgrims visiting Mecca and Medina for the hajj or umrah as well as for seasonal workers.

Some polio-free countries[1] may also require travellers resident in countries or areas reporting wild polioviruses[2] to be immunized 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 using the International Certificate of Vaccination or Prophylaxis (which is required in the case of yellow fever vaccination). The certificate can be accessed on the WHO website.[3]

The International Travel and Health country list[4] provides a summary of country's requirements for incoming international travellers as well as WHO recommendations regarding yellow fever vaccination and malaria prevention. A brief description of the malaria risk situation is provided where appropriate. The country's requirements for other diseases are also mentioned, if any.

6.2 Vaccines for routine and selective use

Recommendations on vaccines for routine use are provided by WHO in regularly updated position papers[5].

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.

Tables[1] summarizing WHO recommendations for routine vaccinations can be found on the WHO website at the web page on WHO's recommendations for routine immunization –

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

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

CHOLERA

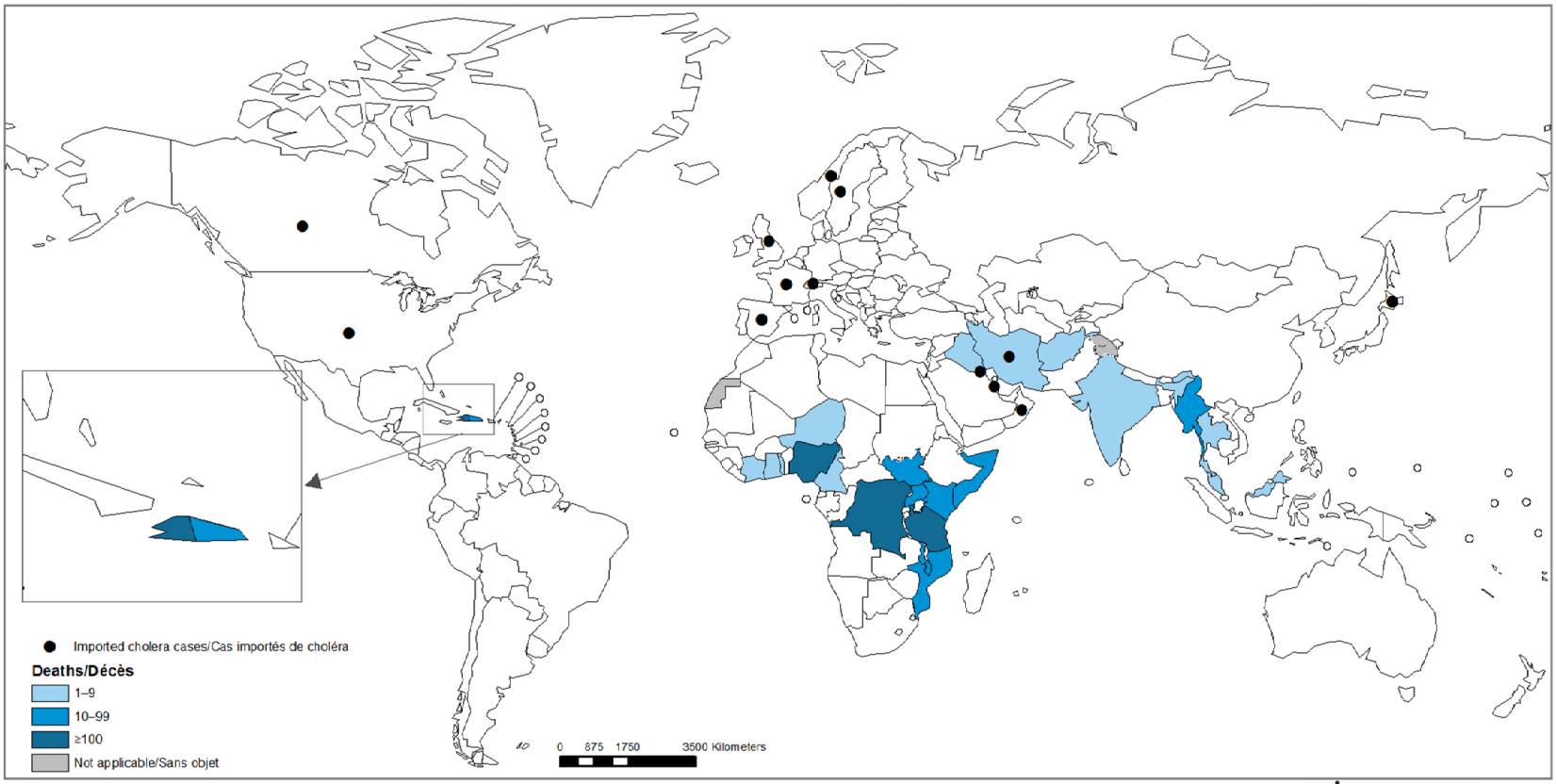
Summary of vaccine data

	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 immunization 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.
	Adverse reactions:	Mild gastrointestinal disturbances.
	Before departure:	2 weeks.
	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. Cholera affects only human beings; there is no insect vector or animal reservoir host.	
Nature of the disease	An acute enteric disease varying in severity. Most infections are asymptomatic (i.e. they do not cause any 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 that lack adequate sanitation and clean drinking-water and in areas affected by armed conflict or catastrophe where the infrastructure may have broken down. Many developing countries are affected, particularly in Africa and Asia and, to a lesser extent, in Central and South America (see map).	

[1] Recommendations for routine immunization - summary tables. See WHO website at: http://www.who.int/immunization/policy/immunization_tables/en/

Risk for travellers	The risk for most travellers is very low, even in countries where cholera epidemics occur, provided that simple precautions 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.
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. Two years after immunization, protective efficacy has dropped to about 60%, and after 3 years the level of protection is only 0–18%. Primary immunization consists of two oral doses ≥ 7 days (but < 6 weeks) apart for adults and children aged 6 years and over. For children aged 2–5 years, three doses are recommended. Intake of food and drinks should be avoided for 1 hour before and after vaccination. If the second dose is delayed for more than 6 weeks, vaccination should be restarted. Following primary immunization, 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 or more, and every 6 months for children aged 2–5 years. The appropriate primary immunization 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 reporting cholera outbreaks, WC/rBS was found also to induce short-term protection against diarrhoea caused by enterotoxigenic *Escherichia coli* in about 50% of those vaccinated. Two closely-related bivalent oral cholera vaccines are available in India and Viet Nam. 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 2 years against clinically significant cholera in countries or areas reporting outbreaks.

Countries reporting cholera deaths and imported cases in 2015
Pays ayant déclaré des décès dus au choléra et des cas importés en 2015



Data Source: Control of Epidemic Diseases Unit
World Health Organization

Map Production: Information Evidence and Research (IER)
World Health Organization

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 not routinely recommended for immunization of travellers from non-endemic countries to endemic countries.
	Number of doses:	Three injections of 0.5 mL administered at 6-month intervals.
	Contraindications:	Severe allergy to components of the vaccine, deficient cell-mediated immunity, advanced HIV infection, pregnancy and breastfeeding.
	Adverse reactions:	Systemic reactions have occurred in 66.5% of CYD-TDV recipients compared to 59% of placebo recipients. The most common systemic reactions were headache (> 50%), malaise (> 40%) and myalgia (> 40%).
	Before departure:	Not applicable (vaccine not routinely recommended for travellers).
	Consider for:	Prevention of dengue fever in individuals ≥ 9 years living in areas highly endemic for this infection.
	Special precautions:	Use of CYD-TDV is not recommended in populations in which seroprevalence is low because of low efficacy and the potential longer-term risks of severe dengue in individuals who are vaccinated prior to having a primary dengue infection.
Cause	Dengue virus (genus: *Flavivirus*) serotypes 1–4.	
Transmission	Dengue virus is primarily maintained in a human-to-mosquito-to-human cycle. Primary vectors are virus-infected *Aedes aegypti* and *Aedes 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 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 disease incidence in the travel destination (such as during the rainy season and during epidemics).	
Precautions	Protection against mosquito bites (appropriate clothing, indoor insecticides, repellents, destruction of mosquito breeding sites).	

Vaccine	To date, only CYD-TDV (Dengvaxia®), has been registered in several dengue-endemic countries. This is a live attenuated (recombinant) tetravalent vaccine. Several other tetravalent candidates are in clinical development. The indication for using CYD-TDV is prevention of dengue illness in individuals aged 9 years and above (specific ages depend on the licence) living in dengue endemic areas. This vaccine is not intended as a routine vaccination for travellers. The vaccination schedule consists of three injections of 0.5 mL administered at 6-month intervals. Trials in different parts of the world have shown that, among persons aged ≥ 9 years, vaccine efficacy reaches about 65% against virologically-confirmed dengue illness, and was more than 80% in persons who were seropositive for dengue infection when first vaccinated. The vaccine was less efficacious in younger children, and efficacy also varied by country, in part probably reflecting differences in baseline seropositivity and circulating serotypes. An increased risk of hospitalized dengue was identified in a younger age group (2–5 years) outside the current licences during the third year of the efficacy trials. Whether this increased risk is due to younger age, the lack of prior exposure to dengue, or both, is currently unknown. This finding together with a year-long vaccination schedule means that the vaccine is probably unsuitable for most travellers. The duration of protection following the 3-dose series is not yet known and is likely to differ by level of dengue endemicity in the population.

DIPHTHERIA/TETANUS/PERTUSSIS

DIPHTHERIA	Protection against diphtheria is not specific to the needs of travellers. In most countries diphtheria vaccine is routinely administered in childhood. Missing vaccinations in travellers should be offered 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 through droplets and close physical contact; *C. ulcerans* by close contact.
Nature of the disease	Clinical manifestations are usually mild but, occasionally, potent bacterial toxins cause obstructive membranes in the upper respiratory tract (croup) or damage to the myocardium and other tissues. Systemic manifestations are less likely to be caused by *C. ulcerans.*
Geographical distribution	Very rare in countries with high coverage with diphtheria/tetanus/pertussis (DTP) vaccine. 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 DTP vaccination coverage.
Vaccine	For primary or booster vaccination, appropriately formulated combined DTP vaccines should be used according to national recommendations. Individuals ≥ 7 years of age should receive combinations with reduced diphtheria toxoid content (diphtheria toxoid or tetanus-diphtheria-acellular pertussis vaccine).

TETANUS	Protection against tetanus is not specific to the needs of travellers. In most countries tetanus vaccine is routinely administered in childhood. Missing vaccinations in travellers should be offered 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 tetanus. 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 acquisition of contaminated injuries. This risk is not necessarily increased when travelling.
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 reduced content of diphtheria toxoid.

PERTUSSIS	Protection against pertussis is not specific to the needs of travellers. In most countries pertussis vaccine is routinely administered in childhood. Missing vaccinations in travellers should be offered according to national recommendations.
Cause	The bacterium *Bordetella pertussis*.
Transmission	*Bordetella pertussis* is transmitted from infected respiratory mucosa through droplets.
Nature of the disease	The *Bordetella* bacteria colonize only ciliated cells of the respiratory mucosa causing whooping cough (pertussis), an acute respiratory infection marked by severe, spasmodic coughing episodes during the paroxysmal phase. 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 rarely seen 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 one should use acellular (aP) or whole-cell (wP) pertussis vaccines in fixed combination with vaccines against diphtheria (D) and tetanus (T). The schedule should be according to national recommendations. Individuals ≥ 7 years of age should receive combinations with reduced diphtheria toxoid content.

HAEMOPHILUS INFLUENZAE TYPE B

	Protection against *Haemophilus influenzae* type b (Hib) is not specific to the needs of travelling children. In many countries Hib vaccine is routinely administered in childhood. Missing vaccinations in travellers < 5 years of age should be offered according to national recommendations.
Cause	The bacterium *Haemophilus influenzae* type b (Hib).
Transmission	Respiratory droplets.
Nature of the disease	Important cause of pneumonia, meningitis, septicaemia, epiglottitis and other potential life-threatening infections primarily in children aged 3 months to 5 years.
Geographical distribution	Prevalent in countries with low coverage of Hib vaccination.
Risk for travellers	The risk is likely to be increased in an environment of low Hib-vaccination coverage
Vaccine	Polysaccharide-protein conjugate vaccine. In infants two or three primary doses should be administered, with the first dose at 6 weeks of age or soon thereafter. Hib vaccine is not required for healthy children older than 5 years.

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.
Schedule:	The minimum age is 1 year for both inactivated and live attenuated hepatitis A virus vaccines. 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. In healthy individuals, a single dose seems to be similarly efficacious and only one dose is recommended for long-term protection. Live vaccine: one dose.
Boosters:	Not necessary.
Contraindications:	Severe allergic reaction to previous dose.
Adverse reactions:	Inactivated vaccine: mild local reaction of short duration, mild systemic reaction. Live vaccine: few reported.
Before departure:	Inactivated and live vaccines: protection is achieved within 2–4 weeks after first dose. Given the long incubation period of hepatitis A

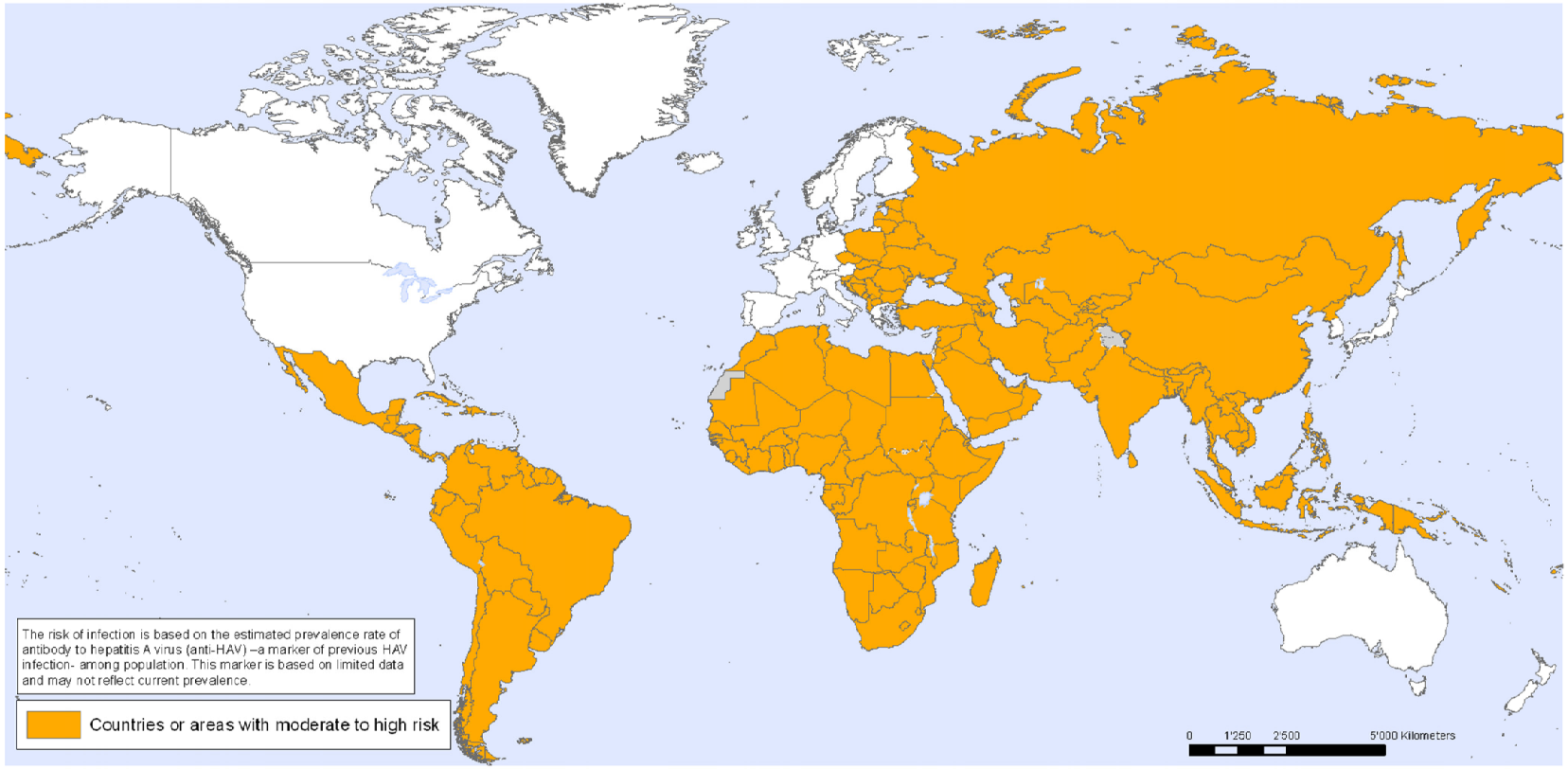
		(average 2–4 weeks), the vaccine can be administered up to the day of departure and still protect travellers.
	Recommended for:	Hepatitis A vaccination should be considered for persons aged ≥ 1 year who are travelling to countries or areas of intermediate or high endemicity. Those at high risk of acquiring 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, those requiring life-long treatment with blood products, and people who inject drugs should be vaccinated.
	Special precautions:	None.
Cause	Hepatitis A virus (HAV).	
Transmission	The virus is acquired through close contact with infected individuals or through 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 greater than 2% for those over 40 years of age and about 4% for those aged 60 years or more.	
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. People born and raised in developing countries, and those born before 1945 in industrialized countries, have usually been infected with HAV in childhood and are likely to be immune.	
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 vaccines are currently used worldwide, namely formaldehyde-inactivated vaccines 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. 1) Formaldehyde-inactivated vaccines: Inactivated hepatitis A virus vaccines are used in most countries. Monovalent inactivated vaccines are available in both paediatric dose (0.5 mL) for children aged 1–15 years and adult dose (1 mL). Traditionally, a two-dose schedule is recommended, particularly for immunocompromised persons. However, in healthy individuals, comparable effectiveness has been achieved with a single dose. A combined hepatitis A/typhoid (ViCPS) vaccine, administered as a single dose, confers high levels of 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 under hepatitis B vaccines).

2) Live attenuated vaccines (based on the H2 or LA-1 strain of HAV):

These vaccines are manufactured in China and are available in several other countries. Presence of anti-HAV (IgG) antibodies was documented after 15 years in 72–88% of the vaccinees, implying that, in most cases, long-term protection against hepatitis A is achieved with live attenuated vaccines.

Hepatitis A, countries or areas at risk



The boundaries and names shown and the designations used on this map do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted and dashed lines on maps represent approximate border lines for which there may not yet be full agreement.

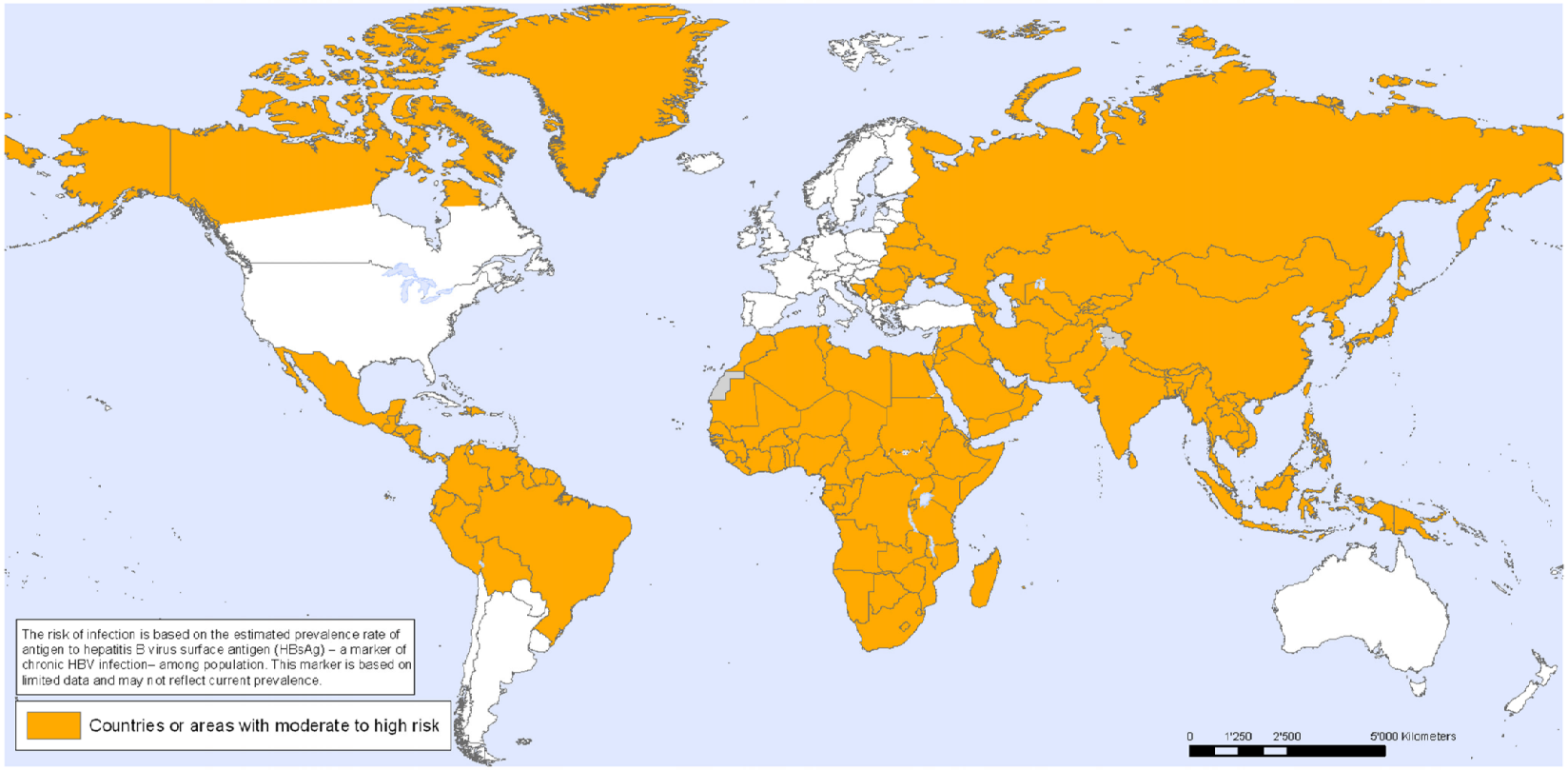
Data Source: World Health Organization.
Jacobsen KH, Wiersma ST. Hepatitis A virus seroprevalence by age and world region, 1990 and 2005. Vaccine 2010 Sep;28(41):6653-7
Map Production: Public Health Information and Geographic Information Systems (GIS)
World Health Organization

World Health Organization

HEPATITIS B

	Protection against hepatitis B is not specific to the needs of most travellers. In many countries hepatitis B vaccine is routinely administered in childhood. Missing vaccinations should be offered to travellers according to national recommendations.
Cause	Hepatitis B virus (HBV).
Transmission	May be transmitted perinatally from infected mothers to babies, through injection or transfusion of contaminated blood products, or through penetration of the skin with contaminated needles. In addition, 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 in older children and adults more often causes acute hepatitis, but rarely chronic liver disease.
Geographical distribution	Prevalence assessments are based on presence of hepatitis B virus surface antigen (HBsAg) in serum. The highest prevalences are found in some African and eastern Asian countries with low coverage of hepatitis B vaccination. In well-vaccinated populations of industrialized countries the prevalence of hepatitis B is mostly low. Globally, very high prevalence rates may be found among certain 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 concerned population. Except for nosocomial infection during emergency admission to poorly equipped health-care facilities, the risk of contracting hepatitis B is unlikely to be increased for the average traveller.
Vaccine	The active ingredient of hepatitis B vaccine is HBsAg. The primary series of vaccination normally 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, using a monovalent or, conveniently, a combined hepatitis A and B vaccine.
Recommended for	Hepatitis B vaccination is recommended for all non-immune persons who by choice of destination and/or lifestyle may be at risk of hepatitis B virus infection.

Hepatitis B, countries or areas at risk



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Data Source: World Health Organization/CDC
Map Production: Public Health Information and Geographic Information Systems (GIS)
World Health Organization

World Health Organization

HEPATITIS E

Summary of vaccine data

	Type of vaccine:	Recombinant vaccine based on genotype 1 capsid protein which cross-protects against all 4 genotypes of hepatitis E virus of human relevance. This vaccine has been developed and is licensed in China, but is not yet available elsewhere.
	Number of doses:	Three (administered intramuscularly at 0, 1 and 6 months). The possible need for booster doses after > 2 years is not yet defined.
	Contraindications:	Not described, except for serious allergy to vaccine components.
	Adverse reactions:	Rare local reactions.
	Before departure:	4 weeks.
	Consider for:	Travellers, health-care and humanitarian relief workers travelling to areas during outbreaks of hepatitis E.
	Special precautions:	So far, no safety data are available on its use in children, older persons, pregnant women, or patients with chronic liver disease or immunodeficiencies.
Cause	Hepatitis E virus (HEV). It has four known genotypes that infect mammalian hosts (genotypes 1, 2, 3 and 4).	
Transmission	The virus is usually acquired through 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	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 reaching 20% or higher. In addition to pregnant women, persons with pre-existing liver disease and immunosuppressed persons are at greater risk for severe disease following HEV infection.	
Geographical distribution	HEV is a leading cause of acute viral hepatitis in developing 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 developing countries may be at risk when exposed to poor conditions of sanitation and drinking-water control.	
Precautions	Travellers should follow the general recommendations for avoiding potentially contaminated food and drinking-water.	
Vaccine	A vaccine against HEV has recently been developed and licensed in China. The vaccine contains a recombinant viral capsid protein corresponding to genotype 1 of HEV, but is 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 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 under 16 years	

	of age, 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, vaccination against HEV may be considered in special situations where the risk of contracting HEV is particularly high. For example, WHO recognizes the high risk of HEV infection for travellers, health-care and humanitarian relief workers deployed or travelling to areas where there is an ongoing outbreak of hepatitis E. In such circumstances, each person should be evaluated individually for risks and benefits of vaccination against HEV.

HUMAN PAPILLOMAVIRUS

	Protection against human papillomavirus is not specific to the needs of most travellers. In many countries vaccine against human papillomavirus is routinely administered in childhood. 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 mostly causing a transient benign mucosal infection, HPV may occasionally lead to the development of anogenital precancerous conditions and cancers. In women, persistent infection with specific 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 southern Asia.
Risk for travellers	Transmission of HPV occurs most commonly through sexual activity.
Vaccines	Three vaccines against HPV infection are available: • 2-valent (types 16 and 18) • 4-valent (types 6, 11, 16 and 18) • 9-valent (above plus 5 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 administered before the start of sexual activity. At least two doses are required, with a minimum interval of 5 months between doses. High vaccination coverage in girls also results in herd protection for boys. The immunization of multiple cohorts of girls aged 9–14 years is recommended when the vaccine is first introduced for faster population-level impact. If resources are available, the age range could be expanded up to 18 years.

SEASONAL INFLUENZA

	Protection against seasonal influenza is not specific to the needs of most travellers. Prior to travelling during the influenza season, travellers should be offered vaccination against influenza according to national recommendations. Travellers should note that influenza seasonality may be different at their destination than within their home countries.
Cause	Influenza viruses of types A and B. Influenza A viruses are further classified according to subtypes based on two surface proteins, the haemagglutinin (HA) and neuraminidase (NA). Influenza A subtypes H1 and H3 are circulating globally and are included in influenza vaccine formulations. Globally, two antigenically distinct influenza B virus lineages are circulating. Current vaccine formulations contain one (trivalent formulations) or both (quadrivalent formulations) of these influenza B lineages.
Transmission	Airborne (droplets) and by direct contact. During the influenza season the annual global attack rate is estimated at 5–10% in adults and 20–30% in children.
Nature of the disease	Acute respiratory infection, mostly 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 the 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 areas seasonality may differ by locality.
Risk for travellers	Travellers are not a particular risk group for influenza, but in some countries appropriate health care may be unavailable or hard to access for non-residents in case of severe disease.
Precautions	Frequent hand-washing and avoiding crowds may be of some help. In some situations, physicians may recommend antiviral prophylaxis with neuraminidase inhibitors, particularly for individuals at high risk.
Vaccine	Seasonal influenza vaccines include prevailing strains of influenza A and influenza B and 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 over 6 months, pregnant women, persons with high-risk medical conditions and older persons. Healthy non-pregnant individuals aged 2–49 years may alternatively receive live attenuated influenza vaccines. Travellers should be vaccinated according to recommendations by 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.
Contraindications and precautions	Vaccination is contraindicated in case of severe egg allergy, including anaphylactic reactions.

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 (chimeric) vaccines. The inactivated mouse brain-derived vaccines are now commonly replaced by cell culture-based vaccines, given 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), generally two doses at 4-week intervals for individuals ≥ 6 months of age. A booster dose is recommended 1–2 years following 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 persons.
Cause	Japanese encephalitis virus.	
Transmission	Pigs and various wild birds represent the natural reservoir of this virus, which is transmitted to new animal hosts and occasionally human beings by mosquitoes of the genus *Culex*. *Culex* mosquitoes are primarily day-biting.	
Nature of the disease	Most human infections are asymptomatic. Severe disease is estimated to occur in about 1 case per 250 JEV infections; severe cases have a rapid onset and progression with headache, high fever and meningeal signs. Permanent neurological sequelae are common among survivors. About 25% of severe clinical cases have a fatal outcome.	
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 appear near or within urban centres. Transmission occurs mainly during the rainy season in south-east Asia but may take place 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 declining in some regions of China, in Japan and the Republic of Korea and more recently in Nepal, Sri Lanka, Thailand and Viet Nam, largely as a result of high coverage in national immunization programmes.
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 is by avoiding mosquito bites and by vaccination.
Vaccine	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. These modern vaccines have acceptable safety profiles and can be used for protection of travellers from non-endemic countries. The more reactogenic inactivated mouse brain-derived vaccines are gradually replaced by modern products. 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 following 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. Adverse reactions: Occasional mild local or systemic reactions.
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 unless there is a high risk of exposure to the infection. Rare, but serious, neurological adverse events attributed to inactivated mouse brain (IMB)-derived vaccine have been reported, but no causal relationship has been confirmed.

Japanese encephalitis, countries or areas at risk*

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Map Production: Public Health Information and Geographic Information Systems (GIS)
World Health Organization

World Health Organization

MALARIA

Cause	Several species of the *Plasmodium* protozoan parasite can infect humans (*P. falciparum, P. vivax, P. ovale, P. malariae* and *P. knowlesi)*. However, almost all cases of serious disease and death are caused by *P. falciparum.*
Transmission	The malaria parasite is transmitted by female *Anopheles* mosquitoes, which bite mainly between dusk and dawn.
Nature of the disease	Morbidity with *P. falciparum* can range from mild febrile illness to life-threatening disease with coma, respiratory distress, severe anaemia or circulatory shock. Young children, pregnant women, people who are immunosuppressed and elderly travellers are particularly at risk of severe disease. In 2015, an estimated 438 000 people died of malaria, with over 90% of these deaths occurring in children < 5 years of age.
Geographical distribution	Currently there is a risk of malaria transmission in 97 tropical and subtropical countries and territories. However, the risk for travellers of contracting malaria is highly variable from country to country and even between areas within a country (see Malaria chapter 7 and country list). The highest risk of contracting *P. falciparum* malaria remains in parts of Africa south of Sahara.
Risk for travellers	More than 125 million international travellers visit malaria-endemic areas every year, and more than 10 000 travellers are annually reported to become ill with malaria after returning home. However, the real figure may be considerably higher.
Precautions	Effective chemoprophylaxis and protection against mosquito bites are essential precautions against malaria.
Vaccine	More than 30 *P. falciparum* malaria vaccine candidates are at either advanced preclinical or clinical stages of evaluation. Only the RTS,S/AS01 vaccine has so far completed a phase III evaluation and received a positive regulatory assessment by the European Medicines Agency (July 2015). RTS,S/AS01 uses recombinant protein antigens targeting different stages of the parasite life cycle. In children aged 5–17 months vaccine efficacy against all episodes of clinical malaria over the 4-year trial period was around 26% with a 3-dose schedule and 39.0% following four doses of the vaccine. There was one identified risk (febrile seizures) for RTS,S/AS01 and three safety signals (meningitis, cerebral malaria and all-cause mortality in girls) that emerged from the phase III trial. WHO concludes that a number of uncertainties need to be resolved in order to assess the advisability of introducing the RTS,S/AS01 vaccine for routine use in malaria-endemic settings in sub-Saharan Africa.

MEASLES

	Protection against measles is not specific to the needs of travellers. In most countries measles vaccine is routinely administered in childhood. Missing vaccinations in travellers should be provided 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 mild disease of young children, characterized by fevers, cough, nasal congestion and a typical rash. The disease tends to be more serious in older children and adults. In infants and in individuals suffering from 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. Following introduction of large-scale measles vaccination, indigenous transmission virtually stopped in many industrialized countries. However, limited outbreaks still occur in countries or segments of populations with insufficient coverage (< 90%) of measles vaccination.
Risk for travellers	For non-immune travellers coming from areas without indigenous transmission of measles virus, the risk of exposure to measles is increased in an environment of insufficient vaccination coverage (rate < 90%).
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 intramuscular doses are administered at an interval of at least 4 weeks.

MENINGOCOCCAL DISEASE

Summary of vaccine data

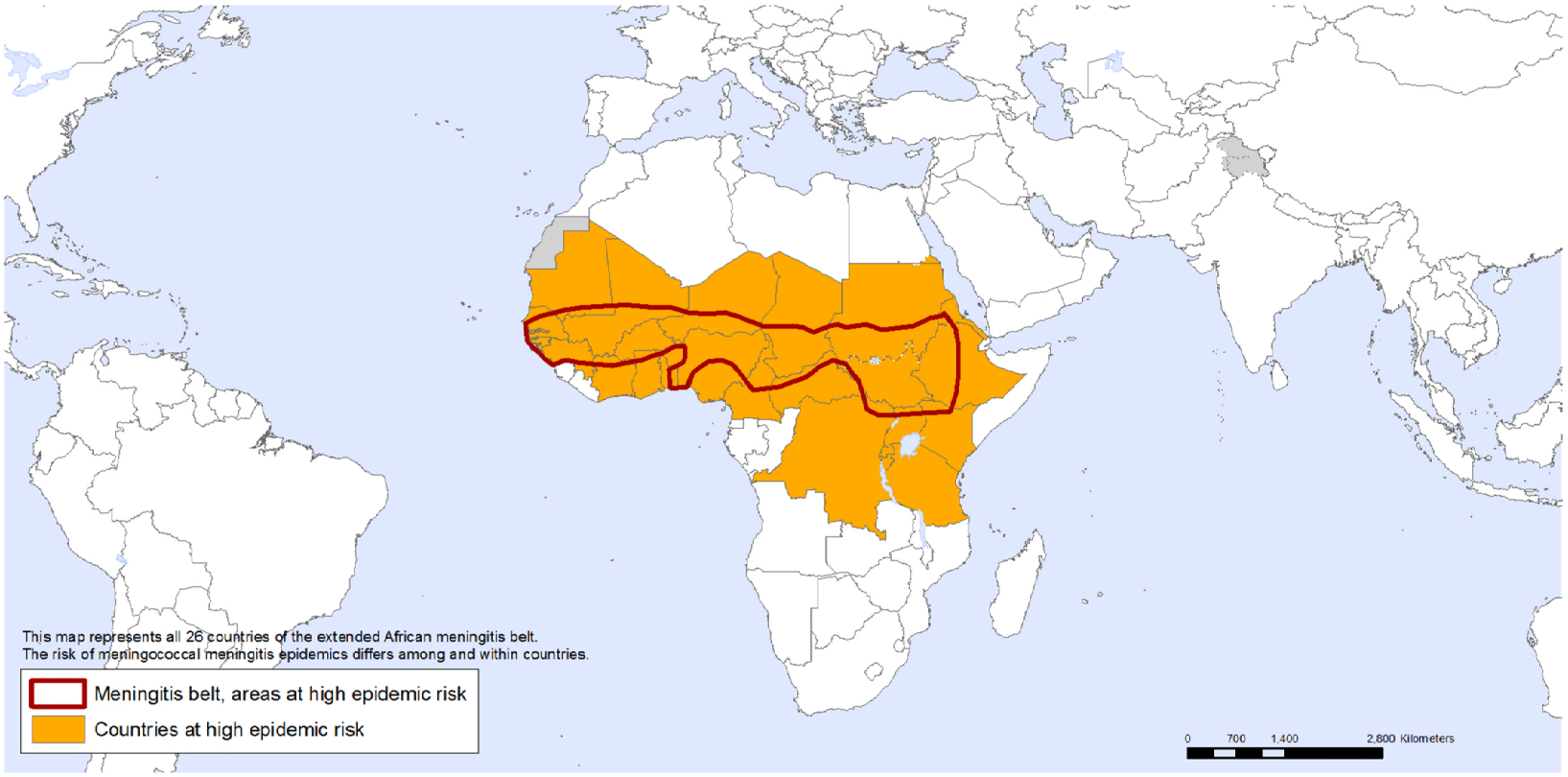
Type of vaccine:	1) Polysaccharide vaccines that include 2–4 meningococcal serogroups: available as 2-valent (A and C), trivalent (A, C and W) and 4-valent (A, C, W and Y) vaccines. Polysaccharide vaccines are now often replaced by: 2) Conjugate vaccines, available as monovalent (A or C or C/Hib combination), 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 intended for persons at particular risk and are not recommended for ordinary travellers.
Number of doses:	For polysaccharide vaccines: a single (mostly subcutaneous) dose to individuals aged 2 years or older. One booster may be required after 3–5 years. For conjugate vaccines: primary series of 1–3 intramuscular doses with subsequent boosters. The schedule depends on choice of vaccine, as well as age and immunological status of the vaccinee.

		For recombinant protein-based vaccines: Although primary series of 2–3 intramuscular doses are now recommended in some countries, WHO recommendations for national programmes have not yet been formulated.
	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 travelling to ensure protection already 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	Transmission occurs 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	As a rule, endemic disease occurs primarily in children and adolescents, with 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 circulatory collapse, haemorrhagic skin rash and 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 which implemented mass vaccination campaigns with group A conjugate vaccine. 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 may be gaining in importance.	
Risk for travellers	The risk of meningococcal disease in travellers is generally low. Those travelling to industrialized 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 comparatively very high 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 overcrowding in confined spaces. Following close contact with an individual suffering from meningococcal disease, medical advice should be sought regarding 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). The vaccines are purified, heat-stable, lyophilized capsular polysaccharides from meningococci of the respective serogroups. Following one single dose, in most cases subcutaneous, these vaccines provide excellent serogroup-specific protection lasting for 2–4 years in adults and children aged over 2 years. Meningococcal polysaccharide vaccines are now often replaced by conjugate meningococcal vaccines. 2) Conjugate meningococcal vaccines Conjugation of the meningococcal polysaccharide to a protein carrier induces a T-cell-dependent immune response characterized by increased immunogenicity among infants, prolonged duration of protection among older children and adults, and reduced nasopharyngeal carriage of meningococci. Conjugate meningococcal vaccines are available as monovalent serogroup A and serogroup C vaccines, 2-valent serogroups A and C or C and Y vaccines and 4-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 who are vaccinated at 2, 3 and 4 months of age. Combined Haemophilus influenzae type b 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, which was designed particularly for use in the African meningitis belt, is licensed for single-dose immunization of persons aged 1–29 years. The vaccine has proved to be safe and highly immunogenic, and mass vaccination campaigns resulted in near-elimination of outbreaks of serogroup A meningococcal disease in sub-Saharan Africa. The vaccine is now being introduced in routine immunization programmes of meningitis belt countries with a single dose at age 9–18 months. Three 4-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 immunization of persons aged 2–55 years. In addition, two of these vaccines offer a 2-dose schedule for children aged 9–23 months. In 2012, a conjugate 4-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 4-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 or 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 demands proof of recent meningococcal vaccination (with a polysaccharide or conjugate tetravalent vaccine) as a visa requirement for pilgrims and guest workers. See section 6.3 on Required vaccinations.

Meningococcal meningitis, countries or areas at high risk, 2014



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Map Production: International Travel and Health
World Health Organization

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MUMPS

	Protection against mumps is not specific to the needs of travelling children. In many countries mumps vaccine is routinely administered in childhood. Travellers missing such vaccination should be offered immunization against mumps according to national recommendations.
Cause	Mumps virus.
Transmission	Airborne 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. It is commonly complicated by benign viral meningitis, but it may provoke orchitis in adolescent or adult males.
Geographical distribution	Following introduction of large-scale vaccination, indigenous transmission of mumps virtually stopped in many industrialized countries. Outbreaks still occur in countries or segments of populations with insufficient coverage of vaccination.
Risk for travellers	For non-immune travellers coming from areas without indigenous 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. Following 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*.
Transmission	Inhalation of respiratory droplets containing *Streptococcus pneumoniae*.
Nature of the 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, older persons and immunodeficient individuals.
Geographical distribution	Worldwide.
Risk for travellers	Before travelling to countries with limited access to modern health-care facilities, vaccination against invasive pneumococcal disease is advisable for children < 2 years of age and for children and adults considered to be at particular risk of serious disease.
Vaccines	1) Conjugate vaccines that include 10 (PCV10) or 13 (PCV13) pneumococcal serotypes. These pneumococcal conjugate vaccines (PCVs) are safe and efficacious and may be used from the age of 6 weeks. PCV10 and PCV13 are licensed for immunization against invasive disease, pneumonia and acute otitis media caused by the

respective vaccine serotypes of *S. pneumoniae*.

2) A pneumococcal polysaccharide vaccine that includes 23 serotypes (PPV23). This vaccine is licensed for individuals aged 2 years or older. It is safe and efficacious against invasive pneumococcal disease and pneumonia in healthy young adults but shows limited efficacy in other age groups, including elderly persons.

POLIOMYELITIS (POLIO)

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 low risk of importation and a high rate of immunization coverage, routine vaccination using 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 (VAPP) and the emergence of vaccine-derived polioviruses (cVDPV). OPV may safely be administered to pregnant women and HIV-infected persons.
	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 persons living in countries with active transmission of poliovirus (including vaccine-derived virus) should 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:	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	Poliovirus types 1 and 3 (type 2 has been eradicated).
Transmission	Polioviruses are spread predominantly by the faecal–oral route although the oral–oral route may also be common.
Nature of the disease	Poliomyelitis, also known as polio or infantile paralysis, is a disease of the central nervous system. Following primary asymptomatic infection of the alimentary tract by poliovirus, paralytic disease develops in less than 1% of cases. In developing countries, 65–75% of cases occur in children under 3 years of age and 95% in children under 5 years of age. 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 polio has fallen from 125 to 3 (Afghanistan, Nigeria and Pakistan). Globally, the last case of poliomyelitis caused by naturally circulating wild-strain polioviruses type 2 occurred in India in 1999. No case due to wild-strain polioviruses type 3 has been detected since November 2012. In 2015, 73 polio cases were reported, all due to wild-strain poliovirus type 1. This represents the lowest number of any calendar year on record. However, despite a continued downward trend in the number of cases in 2016, 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 circulating vaccine-derived polioviruses (cVDPV) should be adequately vaccinated. Updates on currently or recently infected countries can be found on the website of the Global Polio Eradication Initiative[1].
Vaccines	Both orally-administered, live attenuated polio vaccines (OPV) and inactivated poliovirus vaccines (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 persons. However, a rare adverse event associated with OPV is vaccine-associated paralytic poliomyelitis (VAPP), which occurs once in about 2.4 million doses. Outbreaks of polio due to cVDPV continue to be detected occasionally, mainly in areas of low immunization coverage. WHO no longer recommends an OPV-only vaccination schedule. For all countries currently using OPV only, at least one dose of IPV should be added to the schedule. In polio-endemic countries and in countries at high risk of importation and subsequent spread, WHO also recommends an OPV dose at birth (“zero dose”), followed by the primary series of

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

	three OPV doses and at least one IPV dose The primary series consisting of three OPV doses plus one IPV dose can be initiated from the age of 6 weeks with a minimum interval of 4 weeks between the OPV doses. Routine vaccination with a sequential schedule using IPV followed by OPV can also be used in countries with a low risk of importation of poliovirus and a high vaccination coverage rate. Routine vaccination with IPV alone should be used only in countries with high vaccination coverage (> 90%) and at low risk of importation and spread of wild poliovirus. Before travelling to areas with active poliovirus transmission, travellers from polio-free countries should ensure that they have completed the age-appropriate polio vaccination series, according to their respective national immunization schedule. Travellers to polio-infected areas who completed an OPV or IPV vaccine series > 12 months previously should be given another one-time 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, persons of all ages residing 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. persons 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 persons who previously received only IPV, OPV should be the choice for 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).
General	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 being visited. Travellers should preferably use the International Certificate of Vaccination or Prophylaxis, which is available from the WHO website[1].

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

RABIES

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

	Type of vaccine:	Modern cell-culture or embryonated-egg vaccine.
	Number of doses:	Three doses – one on each of days 0, 7 and 21 or 28, given intramuscularly (i.m., 1.0 or 0.5 mL/dose depending on the vaccine) or intradermally (i.d., 0.1 mL/inoculation site).
	Boosters:	Not routinely needed for general travellers.
	Contraindications:	Severe allergy to components of the vaccine.
	Adverse reactions:	Minor local or systemic reactions.
	Before departure:	Pre-exposure prophylaxis at least 3–4 weeks before travelling to an area at risk, especially if the destination is far from centres of appropriate care.
	Consider for:	Persons planning to visit high-risk areas.
	Special precautions:	Travellers should avoid contact with free-roaming animals, especially dogs and cats, and with wild, free-ranging or captive animals. Cavers should be warned not to handle bats.
Cause	Rabies virus.	
Transmission	Rabies is a zoonotic disease affecting domestic and wild mammals, including dogs and bats. The virus is present in saliva. Human infection occurs through bites from infected animals (usually dogs), and occasionally via penetrating scratches or licking of broken skin and mucosa. 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 and invariably fatal viral encephalomyelitis. 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). Most of the estimated tens of thousands of human rabies deaths per year occur in Africa and Asia.	
Risk for travellers	The risk to travellers in areas where rabies occurs (see map) is proportional to the probability of contact with rabid mammals. In most developing countries, an average of 100 suspected rabid dog bites per 100 000 inhabitants are reported annually. Rabies is a lethal disease and immediate care should be sought at a rabies treatment centre or hospital following suspected contact. First aid measures should also be implemented (see post-exposure prophylaxis, below). Travellers should avoid contact with free-roaming animals, especially dogs and cats, and with wild, free-ranging or captive animals. For travellers who participate in caving or spelunking, casual exposure to cave air is not a concern, but cavers should be warned not to handle bats. In most countries, suspected contact with bats should be followed	

	by post-exposure prophylaxis. The map shows WHO's risk categories. Categorization is based on: the presence of animal species in which rabies virus is maintained (e.g. bats, other wildlife and dogs); the availability of reliable laboratory-based surveillance data on these species; access to proper medical care; and the availability of modern rabies vaccines on a country basis. In countries or areas belonging to categories 2–4, pre-exposure immunization against rabies is recommended for travellers with certain characteristics. The country categories are: *Category 1:* no risk. *Categories 2 and 3:* low and medium risk. In countries belonging to category 2 (low risk) and category 3 (medium risk), pre-exposure prophylaxis should be offered to travellers involved in activities that might bring them into direct contact with bats and other wild animals (especially carnivores). Such travellers include wildlife professionals, researchers, veterinarians and those visiting areas where bats and wildlife are commonly found. *Category 4:* high risk. In high-risk countries, travellers spending considerable periods of time in rural areas and involved in activities such as running, cycling, camping or hiking should receive pre-exposure prophylaxis. Prophylaxis is also recommended for people with occupational risks, such as veterinarians and laboratory staff, and for expatriates living in areas with a significant risk of exposure to domestic animals, particularly dogs, and wild carnivores. Children should be immunized as they are at higher risk through playing with animals (e.g. dogs and cats), may receive more severe bites and may be less likely to report suspected contacts (e.g. bites or scratches).
Vaccine	Vaccination against rabies is used to: - protect those at high risk of rabies exposure (pre-exposure prophylaxis); - prevent development of clinical rabies following suspected exposure (post-exposure prophylaxis). Immunization schedules differ, with the additional use of rabies immunoglobulins for post-exposure prophylaxis. Modern cell-culture or embryonated egg vaccines are considered safe and effective, and are available in major urban centres in most developing countries. Rabies immunoglobulin may be unavailable even in major urban centres where canine rabies is prevalent. Pre-exposure vaccination Pre-exposure immunization is recommended for all persons living in or travelling to areas where rabies is highly enzootic, and for those occupationally exposed to rabies – including laboratory staff, veterinarians, animal handlers and wildlife officers. Children in rabies-enzootic regions of developing countries are at greatest risk. Pre-

	exposure vaccination is therefore advisable for children living in or visiting high-risk areas. It is also recommended for persons travelling to isolated areas, to areas where immediate access to appropriate medical care is limited or to countries where modern rabies vaccines are in short supply and locally-available rabies vaccines might be unsafe and/or ineffective. Pre-exposure rabies vaccination consists of three full intramuscular (i.m.) doses of cell-culture-based or embryonated-egg-based vaccine given on days 0, 7 and either 21 or 28 (a few days' variation in the timing is not important). 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 (i.d.) vaccination in doses of 0.1mL on days 0, 7 and either 21 or 28 is less costly but requires appropriately trained staff and qualified medical supervision. Concurrent use of chloroquine can reduce the antibody response to intradermal application of cell-culture rabies vaccines. People who are currently receiving malaria prophylaxis or who are unable to complete the entire 3-dose pre-exposure series before starting malarial prophylaxis should therefore receive pre-exposure vaccination by the intramuscular route. Periodic booster injections are not recommended for general travellers. In the event of exposure through the bite or scratch of an animal known or suspected to be rabid, individuals who have previously received a complete series of pre- or post-exposure rabies vaccine (with cell-culture or embryonated-egg-derived vaccine) should receive two booster doses of vaccine. The first dose should be administered on the day of exposure and the second 3 days later. This should be combined with thorough wound treatment (see Post-exposure prophylaxis, below). Rabies immunoglobulin is not required for patients who have previously received a complete vaccination series.
Precautions and contraindications	Modern rabies vaccines are well tolerated. The frequency of minor adverse reactions (local pain, erythema, swelling and pruritus) varies widely from one report to another. Occasional systemic reactions (malaise, generalized aches and headaches) have been noted after intramuscular or intradermal injections. Post-exposure prophylaxis Suspected contact in areas at risk of rabies may require post-exposure prophylaxis. In this situation, immediate medical advice should be obtained. Strict adherence to the WHO-recommended guidelines for optimal post-exposure rabies prophylaxis 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. Post-exposure prophylaxis depends on the type of contact with the confirmed or suspected rabid animal (see Table 6.2).

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

Category	Type of contact with a suspected or confirmed rabid domestic or wild[a] animal or animal unavailable for testing	Type of exposure	Recommended post-exposure prophylaxis
I	Touching or feeding of animals Licks on intact skin	None	None, if reliable case history is available
II	Nibbling of uncovered skin Minor scratches or abrasions without bleeding	Minor	Administer vaccine immediately[b]. Stop prophylaxis if animal remains healthy throughout an observation period of 10 days[c] or is proved to be negative for rabies by a reliable laboratory using appropriate diagnostic techniques.
III	Single or multiple transdermal bites or scratches, licks on broken skin Contamination of mucous membrane with saliva (i.e. licks) Exposures to bats[d]	Severe	Administer rabies immunoglobulin and vaccine immediately. Stop prophylaxis if animal remains healthy throughout an observation period of 10 days[c] or is proved to be negative for rabies by a reliable laboratory using appropriate diagnostic techniques.

[a] Exposure to rodents, rabbits and hares seldom, if ever, requires specific anti-rabies post-exposure prophylaxis.
[b] If an apparently healthy dog or cat in or from a low-risk country or area is placed under observation, the situation may warrant delaying initiation of treatment.
[c] This observation period applies only to dogs and cats. Except in the case of threatened or endangered species, other domestic and wild animals suspected to be rabid should be humanely killed and their tissues examined for the presence of rabies virus antigen using appropriate laboratory techniques.
[d] Post-exposure prophylaxis should be considered for persons who have been in close contact with bats, particularly following bites or scratches or exposure to mucous membranes.

I. Wound treatment

Thorough washing of the wound with soap/detergent and water, followed by the application of ethanol or an aqueous solution of iodine or povidone.

II. Passive immunization

Human rabies immunoglobulin or equine rabies immunoglobulin or F(ab′)2 products should be used for category III exposures and some category II exposures (see Table 6.2). Passive immunization should be administered just before or shortly after administration of the first dose of vaccine given in the post-exposure prophylaxis regimen. If it is not immediately available, passive immunization

can be administered up to the seventh day after initiation of the primary series of post-exposure prophylaxis (with cell-culture or embryonated-egg rabies vaccine).

Dosage and administration: The dose for human rabies immunoglobulin is 20 IU/kg body weight and for equine rabies immunoglobulin and F(ab′)2 products 40 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. Any remainder should be injected intramuscularly at a site distant from the site of active vaccine administration. 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 be true of a severely bitten individual, it can be diluted in physiological buffered saline to ensure greater wound coverage.

III. Active immunization

Intramuscular or intradermal, cell-culture-based or embryonated-egg-based rabies vaccines should always be used for post-exposure prophylaxis.

Recommended intramuscular regimens include:

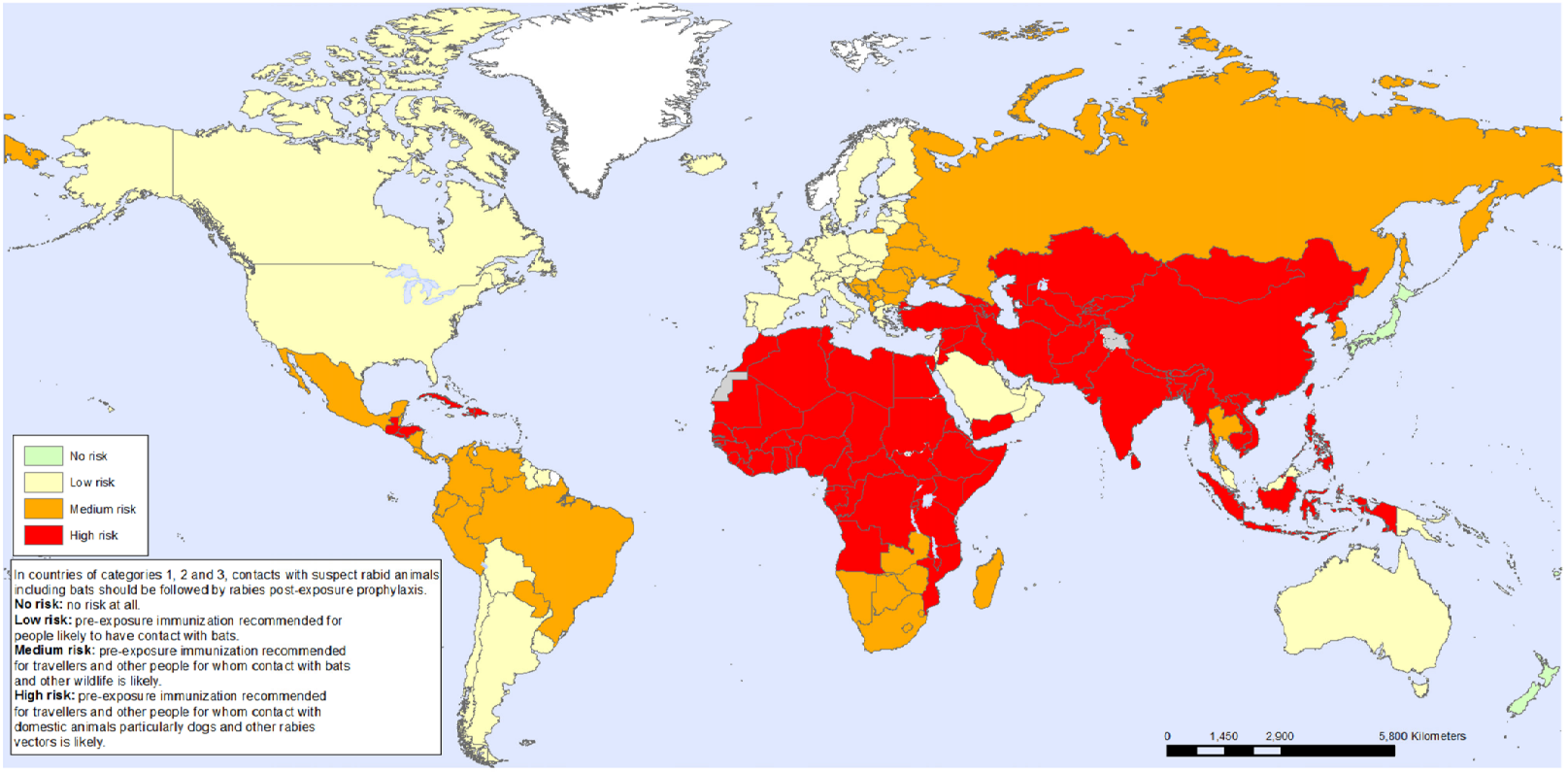
- Five-dose regimen administered on days 0, 3, 7, 14 and 28 into the deltoid muscle. This regimen is the most commonly used.
- Four-dose regimen administered as two doses on day 0 – one dose in the right arm and one in the left arm (deltoid muscles) – and then one dose on each of days 7 and 21 into the deltoid muscle.

An alternative post-exposure regimen for healthy, fully immunocompetent exposed people who receive wound care plus high-quality rabies immunoglobulin plus WHO-prequalified rabies vaccines consists of four doses administered intramuscular on days 0, 3, 7 and 14.

Recommended intradermal regimens:

- Two-site intradermal method: one intradermal injection of 0.1mL purified Vero cell rabies vaccine or purified chick embryo rabies vaccine at two sites on days 0, 3, 7 and 28. This is cost-saving compared to intramuscular regimens.

Rabies, countries or areas at risk



The boundaries and names shown and the designations used on this map do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted and dashed lines on maps represent approximate border lines for which there may not yet be full agreement.

Data Source: WHO Control of Neglected Tropical Diseases (NTD)
Map Production: Health Statistics and Information Systems (HSI)
World Health Organization

World Health Organization

ROTAVIRUS

	Protection against rotavirus diarrhoea is not specific to the needs of travelling children. In countries where vaccination of infants against rotavirus infections is routinely administered, in cases of incomplete or missed vaccination further 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 it 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 in environments of poor hygiene. The risk for older children and adults, most of whom are immune, is negligible.
Vaccines	Two live attenuated oral vaccines are available; one based on a single rotavirus strain (monovalent), the other on five rotavirus strains (pentavalent). When administered according to the respective national recommendations (or following the schedule of routine vaccination against DTP), these vaccines are efficacious and safe.

RUBELLA

	Protection against rubella is not specific to the needs of travellers. In most countries rubella vaccine is routinely administered in childhood. Missing rubella vaccinations in travellers should be offered according to national recommendations.
Cause	Rubella virus.
Transmission	Primarily by airborne 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, but 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 either in monovalent form (rubella component only) or in fixed combinations with one or more of vaccines against mumps, measles and varicella. Two intramuscular doses are administered at an interval of at least 4 weeks.

TICK-BORNE ENCEPHALITIS (TBE)

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 three years. A Chinese TBE vaccine is 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 through 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 developing during this second phase may result in paralysis, permanent sequelae or death. 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 being 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	

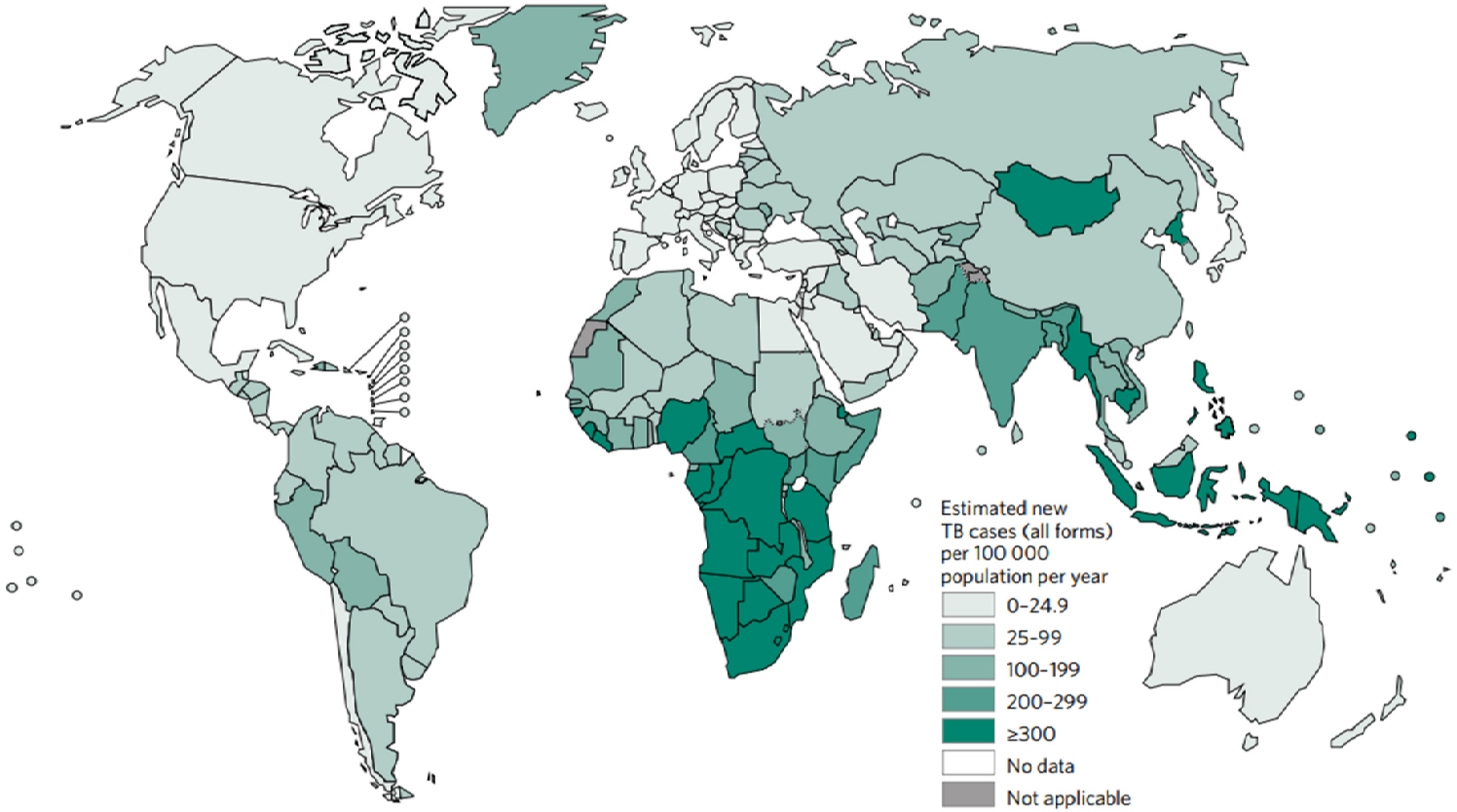
	Albania, Austria, Belarus, Bosnia, Bulgaria, China, Croatia, Denmark, Finland, Germany, Greece, Hungary, Italy, Mongolia, Norway, Poland, Republic of Korea, Romania, Serbia, Slovakia, Slovenia, Sweden, Switzerland, Turkey and Ukraine.
Risk for travellers	Travellers to endemic areas may be at risk during 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. TBE 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 TBE virus. FSME-Immun and Encepur (including FSME-Immun Junior and Encepur-Children) are based on the Western subtype of the TBE 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 also 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. 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; persons who will continue to be at risk should probably have one or more booster doses. Little information is available on the duration of protection following completion of the primary 3-dose immunization series and on the need for, and optimal intervals between, possible booster doses. 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 immunization 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 With the western European vaccines, adverse events are commonly reported, 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 is not specific to the needs of travellers. In many countries, BCG vaccination of newborns and infants is routinely administered. Unvaccinated young children who are brought to an environment of high prevalence for tuberculosis should be offered vaccination according to the respective national recommendations.
Cause	The tubercle bacillus *Mycobacterium tuberculosis*.
Transmission	By inhalation of *M. tuberculosis*-containing microscopic droplets.
Nature of the disease	In most cases, exposure to *M. tuberculosis* results in latent infection, which only occasionally turns into active disease. Tuberculosis 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 poor countries (see map). Tuberculosis is highly prevalent among HIV-infected individuals.
Risk for travellers	Most travellers are at low risk for tuberculosis. Nevertheless, the risk may be considerable for persons from countries where tuberculosis endemicity is low and who come to work in, for instance, emergency relief in countries highly endemic for tuberculosis. Persons with HIV infection are particularly susceptible.
Precautions	Where possible, travellers should avoid prolonged and close contact with people with known or suspected cases of pulmonary tuberculosis. A tuberculin skin test before and after a high-risk mission abroad may be advisable, for example, for health professionals and humanitarian relief workers.
Vaccine	BCG vaccines are based on live attenuated mycobacterial strains descended from the original attenuated bacillus Calmette–Guérin (BCG). Apart from its documented effect against tuberculous meningitis and disseminated disease in infants, BCG vaccination is of very limited value for most travellers.

Estimated TB incidence rates, 2015[1]



TYPHOID FEVER

Summary of vaccine data

	Type of vaccine:	Currently, two typhoid vaccines are available on the international market: 1) The oral vaccine based on the live, attenuated mutant strain of *Salmonella Typhi* Ty21a (Ty21a vaccine). This vaccine is supplied in enteric-coated capsules. Depending on national recommendations, primary vaccination consists of 3 or 4 capsules (one capsule every other day). Revaccination is recommended after 1–7 years. To date, Ty21a has been used primarily to protect travellers. 2) The injectable Vi capsular polysaccharide (ViCPS) vaccine is given intramuscularly in a single dose to individuals aged 2 years or more. 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 vaccines are safe and well tolerated.
	Before departure:	Following primary vaccination, immunity develops after 7–10 days. Ideally, therefore, primary vaccination should be completed at least one week before departure. Following a booster dose, immunity is restored within a few days.
	Consider for:	Long-term (> 1 month) visitors to highly endemic areas, particularly where antibiotic-resistant strains of *S. Typhi* are prevalent.
	Special precautions:	Proguanil, mefloquine and antibiotics should be avoided from 3 days before until 3 days after the administration of Ty21a.
Cause	The typhoid bacillus *S. Typhi*, which infects humans only. Paratyphoid and enteric fevers are caused by other species of *Salmonella*, which infect domestic animals as well as humans.	
Transmission	The typhoid bacillus is transmitted by consumption of 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 through eating raw fruit and vegetables fertilized with human excreta and through ingestion of contaminated milk and milk products. Flies may cause human infection through transfer of the infectious agents to foods. Pollution of water sources may produce 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 white-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 develop gastrointestinal and cerebral complications, which may prove fatal in up to 10–20% of cases. The highest case–fatality rates are reported in children < 4 years of age. Around 2–5% of infected people become chronic carriers, as bacteria persist in the biliary tract after symptoms have resolved.
Geographical distribution	There is a higher risk of typhoid fever in countries or areas with low standards of hygiene 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 northern and western Africa, southern Asia, parts of Indonesia and Peru. Elsewhere, travellers are usually at risk only when exposed to low standards of hygiene. Even vaccinated travellers should take care to avoid consumption of potentially contaminated food and water as the vaccine does not confer 100% protection. There have been reports of increasing antibiotic resistance among *S. Typhi* isolates from highly endemic countries.
General precautions	General precautions against exposure to foodborne and waterborne infections, see travel-related risks web page[1].
Vaccine	Typhoid fever 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 month and/or in locations where antibiotic-resistant strains of *S. Typhi* are prevalent. For previously vaccinated tourists travelling from non-endemic to endemic areas, a booster dose is recommended after 1–7 years, depending on national recommendations. Currently, two typhoid vaccines of demonstrated safety and efficacy are available on the international market: 1) The oral vaccine based on the live, attenuated mutant strain of *S. Typhi* Ty21a (Ty21a vaccine). This vaccine is supplied in enteric-coated capsules. To date, Ty21a has been used primarily to protect travellers and not to control endemic typhoid fever in developing countries. In Australia and Europe, three tablets are given on days 1, 3 and 5; this series is repeated every year for persons travelling from non-endemic to endemic countries, and every 3 years for persons living in countries or areas at risk. In North America, four tablets are given on days 1, 3, 5 and 7 and revaccination is recommended only after 7 years (Canada) or 5 years (USA) for all, regardless of typhoid fever risk in the country or area of residence. The duration of protection following Ty21a immunization is not well defined and may vary with vaccine dose and possibly with subsequent exposures to *S. Typhi* (natural booster). 2) The injectable Vi capsular polysaccharide (ViCPS) vaccine is given

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

	intramuscularly in a single dose. Protection is achieved about 7 days after the injection. In endemic countries, the protective efficacy 1.5 years after vaccination is about 72%, and after 3 years about 50%. The vaccine is licensed for persons aged > 2 years. To maintain protection, revaccination is recommended every 3 years. The Vi polysaccharide vaccine can be co-administered with other vaccines relevant to international travellers – such as yellow fever and hepatitis A vaccines – and with vaccines of the routine childhood immunization programmes. A combined typhoid/hepatitis A vaccine is also available in some countries.
Contraindications and precautions	Both typhoid vaccines are safe and there are no contraindications to their use other than previous severe hypersensitivity reactions to vaccine components. Proguanil, mefloquine and antibiotics should be stopped from 3 days before until 3 days after the administration of Ty21a. These vaccines are not recommended for use in infant immunization programmes because of insufficient information on their efficacy in children under 2 years of age.

VARICELLA AND HERPES ZOSTER

	Protection against varicella and protection against herpes zoster is not specific to the needs of travellers. In some countries varicella vaccine is routinely administered in childhood. Travellers missing such vaccination may be offered immunization according to national recommendations.
Cause	The highly contagious varicella zoster virus.
Transmission	Through droplets, aerosol and by direct and indirect contact.
Nature of the disease	Varicella is mostly 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 persons. Following infection, varicella zoster virus remains latent in neural ganglia and may cause zoster upon subsequent reactivation. Zoster, commonly known as shingles, is a disease affecting mainly immunocompromised persons and elderly people. The usual clinical manifestation is a vesicular rash restricted to a single dermatome and 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 for the prevention of herpes zoster. The varicella vaccine is often available in fixed combination with vaccines against measles, mumps and rubella.

YELLOW FEVER

Summary of vaccine data

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

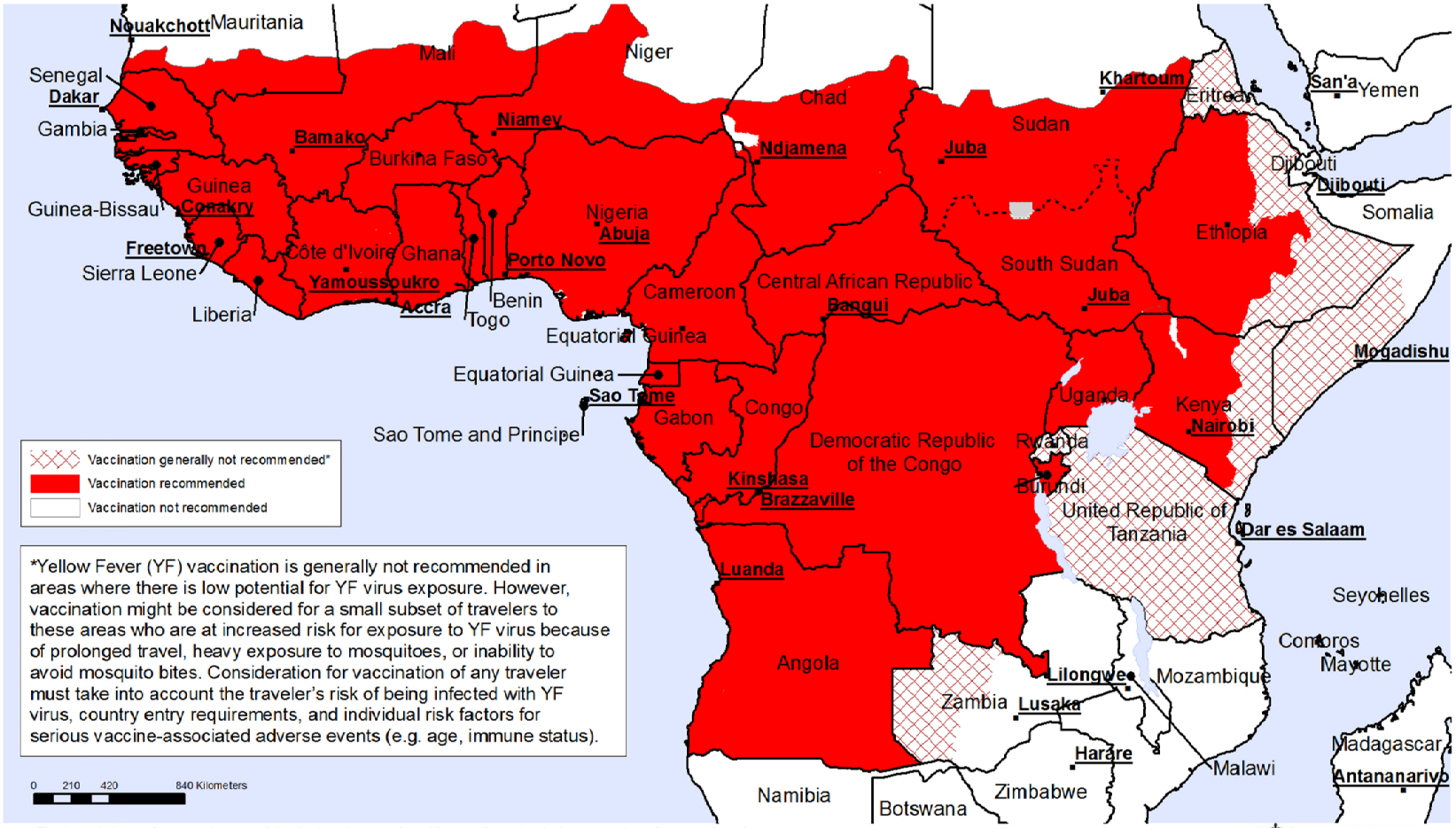
	Type of vaccine:	Live attenuated.
	Number of doses:	One dose of 0.5 mL.
	Boosters:	A single dose of yellow fever vaccine provides life-long immunity to the disease, making boosters unnecessary. From July 2016 the certificate of vaccination against yellow fever is valid for the life of the person (traveller) 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 from medication; disease or symptomatic HIV infection.
	Adverse reactions:	Very rare, neurological (encephalitis, acute disseminated encephalomyelitis, Guillain-Barré syndrome etc.) or multi-organ failure resembling wild-type yellow fever.
	Before departure:	The International Certificate of Vaccination becomes valid 10 days after vaccination.
	Recommended for:	All travellers to countries and areas with risk of yellow fever transmission and when required by countries.
	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.
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 persons 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 metres. The number of countries or areas where yellow fever virus is present far exceeds those officially reported. Some countries may have no reported cases simply because of a high level of vaccine coverage against yellow fever, or because of poor surveillance. The risks classification of countries are illustrated on the maps.
Risk for travellers	Besides areas of high yellow fever endemicity, transmission of yellow fever virus may also take place in areas of low endemicity if the 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 an area at risk of yellow fever 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 yellow fever vaccine is sufficient to confer sustained life-long protective immunity against yellow fever disease; a booster dose is not necessary. Yellow fever vaccine may be administered simultaneously with other vaccines. As a general rule, any live vaccine may be given either simultaneously or at an interval of 4 weeks. Oral polio vaccine may be given at any time in relation to yellow fever vaccination. 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 persons with $CD4^+$ T-cell counts ≥ 200 cells/mm^3. Although there are limited data on safety and immunogenicity of yellow fever vaccine when used in HIV-infected children, yellow fever vaccine 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 following vaccination with yellow fever vaccine fall into three categories, as follows: 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 looks possibly higher in persons aged ≥ 60 years, but the overall risk remains low. The reported rate for yellow fever vaccine-related adverse events following immunization in mass campaigns in endemic regions was 0.05 per 100 000 administrated 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 antigens and severe immunodeficiency. Based on currently available data, caution is recommended in vaccinating persons ≥ 60 years of age against yellow fever. A risk–benefit assessment for yellow fever vaccination should be performed for any person ≥ 60 years of age who has not been vaccinated and for whom the vaccine is normally recommended. Yellow fever vaccination is required for travellers to certain countries and is recommended for all travellers visiting areas subject to endemic and epidemic disease.[1]

[1] 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/.

Yellow Fever Vaccination Recommendations in Africa, 2015



The boundaries and names shown and the designations used on this map do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted and dashed lines on maps represent approximate border lines for which there may not yet be full agreement.

Data Source: World Health Organization
Map Production: International Travel and Health
World Health Organization

World Health Organization

The boundaries and names shown and the designatons used on this map do not impy the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted and dashed lines on maps represent approximate border lines for which there may not yet be full agreement.

Data Sources: World Health Organization
Yellow Fever Working Group

World Health Organization

6.3 Required vaccinations

6.3.1 Yellow fever

Vaccination against yellow fever may be required to prevent the importation of yellow fever virus into countries where the disease does not occur but where the mosquito vector and non-human primate hosts are present. In those settings, vaccination may be an entry requirement for all travellers arriving (including airport transit)[1] from countries where there is a risk of yellow fever transmission.

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.

For information on countries that require proof of yellow fever vaccination as a condition of entry, see the country list on WHO's ITH web page[2].

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 the 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 4-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*[3].

6.3.3 Polio

Some polio-free countries may require a proof of vaccination against polio from travellers from countries or areas reporting the presence of polioviruses[4] in order to obtain an entry visa. Updates are published in the *Weekly Epidemiological Record.*

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[1] A few hours' transit spent 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 persons into non-endemic countries.
[2] International travel and health. See country list updated yearly on WHO's ITH web page at: http://www.who.int/ith/en/.
[3] Weekly Epidemiological Record. 2016;91(26/27):329–40.
[4] Polio Global Eradication Initiative. Where we work, web page at: http://polioeradication.org/.

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 and mosquito bites by means other than vaccination.

Some vaccines can be administered at birth (e.g. BCG, oral polio vaccine, hepatitis B). Others, such as diphtheria/tetanus/pertussis vaccine, cannot be given before a certain age; Japanese encephalitis vaccine cannot be given before the age of 6 months and yellow fever vaccine not before 9 months. Because 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 from 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 or other travel-related infections. They are particularly at risk when travelling on a limited budget and using accommodation of poor standard (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

Persons 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 check that they are adequately vaccinated. Such travellers pose a special problem for health advisers who should, nonetheless, encourage compliance.

6.4.4 Pregnant women

Pregnancy should not deter a woman from receiving vaccines that are safe and will protect both her health and that of her unborn child. However, care must be taken to avoid the inappropriate administration of certain vaccines that could harm the unborn baby. Killed or inactivated vaccines such as influenza vaccine, toxoids, polysaccharides and conjugated vaccines can generally be given during pregnancy. Except for oral polio vaccine, live vaccines are generally contraindicated because of largely theoretical risks to the baby; measles, mumps, rubella, varicella and yellow fever vaccines should therefore be avoided in pregnancy. The risks and benefits should nevertheless be examined in each individual 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.[1]

Table 6.3 Vaccination in pregnancy

Vaccines	Use in pregnancy	Comments
BCG[a]	No	
Cholera	Yes, administer oral inactivated vaccine if indicated	
Hepatitis A (inactivated)	Yes, administer if indicated	
Hepatitis A (live vaccine)	No	
Hepatitis B	Yes, administer if indicated	
Influenza	Yes, administer if indicated	Use inactivated vaccine
Measles[a]	No	
Meningococcal disease	Yes, administer if indicated	
Mumps[a]	No	
Pertussis (Tdap)	Yes, administer if indicated	Only acellular pertussis-containing vaccine
Polio		
OPV[a]	Yes, administer if indicated	
IPV	Yes, administer if indicated	
Rabies	Yes, administer if indicated	
Rubella[a]	No	
Tetanus/diphteria	Yes, administer if indicated	
Typhoid Ty21a[a]		Safety not determined
Varicella[a]	No	
Yellow fever[a]	Yes, administer if indicated	Avoid unless at high risk

[a] Live vaccine

6.4.5. Elderly travellers

Increasing numbers of poorly vaccinated elderly travellers

Persons aged 60 years or over make up an increasingly large proportion of international travellers. As age commonly aggravates infectious diseases it is unfortunate that, in general, vaccine coverage in this age group is low. In most cases, vaccination of healthy elderly travellers does not differ from vaccination of younger adults. Special considerations arise, however, for elderly persons who have not been fully immunized in the past and/or have existing medical problems.

Particularly in the old-age group, people may have vague memories of previous infections and vaccinations. Many have never been vaccinated with the vaccines used in routine childhood immunization programmes. Although most men who served in the army less than 50–60 years ago were vaccinated against tetanus and diphtheria, many older women probably never received any vaccines. Since immunization against poliomyelitis came into effect only in the 1960s, most adults born before that time are not vaccinated against polio, although

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

many may have acquired natural immunity from early contact with wild polio viruses. Also, elderly people worldwide may 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 persons, several functions of cellular immunity are reduced and antibody responses are weaker, develop more slowly and decline faster than in younger vaccinees. On the other hand, the impact of ageing on the immune system shows considerable individual variation and no age limit has been identified above which vaccinations are considered meaningless.

Vaccines designed for elderly people

Improved vaccination strategies, new adjuvants and new vaccines that specifically target the aged immune system will contribute to overcome the limitations of immunosenescence. For example, both zoster and influenza vaccines with increased antigen concentration have been developed specifically for the elderly population. As 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 elderly persons

Of particular relevance to elderly persons are vaccines against diphtheria/tetanus/pertussis, seasonal influenza, pneumococcal disease and herpes zoster. An appropriate formulation of the combination of diphtheria/tetanus/pertussis vaccine is due every 10 years. Even after many years, an interrupted vaccination schedule is simply continued with the next dose that is due.

Seasonal influenza vaccination is recommended for elderly persons who constitute a risk group for severe influenza illness. In healthy persons the pneumococcal polysaccharide vaccine (PPV23) is normally given only once, but 1–2 boosters may be considered in immunocompromised individuals. Unfortunately, protection following vaccination against pneumococcal disease, as well as against seasonal influenza, declines with age; thus the efficacy of these vaccines is lower in older persons than in younger healthy adults.

Most persons born before 1970 experienced natural infection by measles, mumps and rubella 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 or older. Although the vaccine is safe and in the short term (< 4 years) efficacious against herpes zoster and post-herpetic neuralgia, available data suggest that immunity wanes over the long term.

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 reports have suggested that serious adverse events may be associated with primary yellow fever vaccination, particularly in elderly individuals. Therefore, a risk–benefit assessment should precede possible yellow fever vaccination of persons ≥ 60 years of age.

Special considerations arise in the case of elderly travellers with pre-existing 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 following administration of vaccines that contain live organisms. Consequently, it may be advisable for these travellers not to receive measles, oral polio, yellow fever, varicella and 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 people 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. The influenza vaccine used in one hemisphere usually protects against the main viruses that have been circulating in other parts of the world, including in the opposite hemisphere.

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 have an obligation 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 in the future. However, under certain circumstances, the health-care provider may assess the risk of a particular disease to be greater than the risk of an adverse reaction following administration of the vaccine and will therefore advise vaccination.

6.5.2 Common mild vaccine reactions

Most vaccines produce some mild local and/or systemic reactions relatively frequently. These reactions generally occur within a day or two of immunization. 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 background events that are normal events 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 serious adverse reactions

Vaccine	Possible adverse reactions	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	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	1800–6400
Measles	Febrile seizure	333
	Thrombocytopenic purpura	33–45
	Anaphylaxis	1–50
	Encephalitis	1 (unproven)
Meningococcal disease	Anaphylaxis	1
Mumps	Depends 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	Arthralgia/arthritis/arthropathy transient	In non-immune adult women: arthralgias: 25%, arthritis: 12%
Tetanus	Brachial neuritis	5–10
	Anaphylaxis	1–6
Tick-borne encephalitis	None reported (data western European vaccines only)	
Typhoid fever	Parenteral vaccine – various	Very rare
	Oral vaccine – None reported	
Yellow fever	Encephalitis (<6 months)	500–4000
	Allergy/anaphylaxis	5–20
	Viscerotropic disease	0–24

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

6.5.4 Contraindications

The main contraindications to the administration of vaccines are summarized in Table 6.5.

Table 6.5 Contraindications to vaccines

Vaccine	***Contraindications***
All	An anaphylactic reaction[a] following a previous dose of a particular vaccine is a true contraindication to further immunization with the antigen concerned and a subsequent dose should not be given. Current serious illness
MMR, BCG, Japanese encephalitis, Varicella	Pregnancy Severe immunodeficiency
Yellow fever	Severe egg allergy Severe immunodeficiency (from medication or disease, or symptomatic) Pregnancy HIV infection[b]
BCG	HIV infection
Influenza	Severe egg allergy

[a] Generalized urticaria, difficulty in breathing, swelling of the mouth and throat, hypotension or shock.
[b] In many industrialized countries, yellow fever vaccine is administered to individuals who have symptomatic HIV infection or who are suffering from other immunodeficiency diseases, provided that their $CD4^+$ count is at least 200 cells/mm^3 and if they plan to visit countries or areas at risk.

Further reading

Global Influenza Surveillance Network (FluNet)[1]
Information on safety of vaccines from the Global Advisory Committee on Vaccine Safety[2]

WHO information on vaccine-preventable diseases

Vaccines and Diseases[3]
WHO vaccine position papers[4]

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 from 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 .....

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.

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

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[1].

This certificate must be signed in the hand of the clinician, who shall be a medical practitioner or other authorized health worker, supervising the 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.

[1] 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 taken place: Evans Medical is now Novartis Vaccines; Connaught Laboratories and Pasteur Mérieux are now Sanofi Pasteur; and the Robert Koch Institute has ceased production.