# International travel and health

## Module 4: Vaccine-preventable diseases and vaccines

World Health Organization

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Cover photo: Credit: WHO / Loan Tran
Mrs La holds her COVID-19 vaccination certificate after getting her second dose at the Health Station of Nan Ma Commune, Xin Man District, Ha Giang Province. She lives near the Viet Nam-China border, Viet Nam, 2021.

# Contents

# Foreword

Depending on the health profile of the traveller, the type of travel to be undertaken, and the place of transit and destination, travellers may face various health risks during travel. The *International travel and health collection is an update of* International travel and health (2012) and serves as an entry point for other World Health Organization (WHO) publications that provide further information. Its primary target audience is travel health practitioners and travel health professionals, who provide health advice to travellers on appropriate precautions to be taken to minimize any travel-related health risks in unfamiliar environments, before, during and after travel. The guidance may also be of interest to health authorities who intend to support travel health professionals in their jurisdiction or develop health advice for their population. It may also be of interest to travellers who wish to obtain such information for themselves as well as those working in the travel industry, such as agents and organizers, airlines and shipping companies.

Module 4 provides a summary of vaccine data (including the cause, transmission and description of the disease), as well as the geographical distribution of the diseases, risk for travellers and general precautions. Note that this document lists vaccines for which WHO has vaccine position statements.

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# Declaration of interest

All external contributors of the International Travel and Health Editorial Peer Review Group (EPRG) completed a WHO declaration of interests form in accordance with WHO policy for experts. The declarations of interest and the results of a web-based search for each member were reviewed by the WHO staff. No conflict of interest was declared by any of the EPRG members.


Credit: WHO / Billy Miaron
Sylvia, a vaccinator joins a group from Isinya Primary in a Maasai traditional dance at the launch of the Oral Cholera Vaccination Campaign on 3rd August 2023, atIsinya Primary Shool, Kajiado, Kenya.

# Module 4: Vaccine-preventable diseases and vaccines

# 1 General considerations

Vaccination is the administration of agent-specific, but safe, antigenic components that in vaccinated individuals can induce protective immunity against the corresponding infectious agent. Before departure, travellers should consult a health provider to learn about the disease risks in the country or countries they plan to visit and the steps to be taken to reduce the risk of contracting an infectious disease.

## 1.1. Disease prevention

Vaccination is a highly effective method of preventing certain infectious diseases. Vaccines are generally very safe, and serious adverse reactions are uncommon. Routine immunization programmes protect most of the world's children from a number of infectious diseases that previously caused millions of deaths each year.

For travellers, vaccination offers the possibility of avoiding some infectious diseases that may be encountered while they are away from home. Equally important is avoiding importation of a vaccine-preventable disease into the destination country or host population.

However, although vaccines are highly effective, they do not entirely eliminate the risk of acquiring a vaccine-preventable disease. Furthermore, not all infectious diseases are vaccine-preventable. Therefore, other important preventive measures are necessary, such as avoiding mosquito bites, hand-washing and diligently following general precautions.

## 1.2. Planning before travel

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

A medical consultation before departure is a good opportunity for a health care provider to review routine vaccinations and provide any vaccines that have been missed, in addition to providing the vaccinations indicated for the traveller's specific itinerary. Vaccinations are often recorded in the International Certificate of Vaccination or Prophylaxis (ICVP), also known as the *carte jaune* or yellow card.

Travellers are advised to consult their physician or travel medicine practitioner as early as possible, ideally at least 6 months before departure to allow sufficient time for optimal immunization schedules to be completed. Ideally, all vaccines should be given at least 2 weeks before travelling. However, even when the date of departure approaches or becomes imminent, a health care provider should be consulted for advice on disease prevention and vaccination.

## 1.3. Vaccine schedules and administration

The vaccines that may be required, recommended or considered for travellers are summarized in Table 1.

Further information on the schedules for administration of these vaccines can be found in the relevant WHO vaccine position papers. Further information on vaccine-preventable diseases (including pipeline vaccines) is also available from WHO. Summary tables for routine vaccinations can be found in WHO's recommendations for routine immunization – summary tables.

The details of individual vaccines and the WHO vaccine position papers also provide information on the recommended dose intervals for multidose vaccination schedules. However, adjustments can be made to accommodate the needs of travellers who may not be able to complete the schedule exactly as prescribed. It is generally acceptable to lengthen the intervals between doses, and repeating previous vaccine doses is unnecessary unless the need to do so is explicitly stated in the package insert. Significant shortening of the intervals between doses is not recommended. It is important to bear in mind that protective immunity is usually achieved at a minimum 7–10 days after primary vaccination, whereas a booster dose may restore waning immunity more quickly.

The routine country requirements for international travellers are published and updated on the WHO travel advice webpage, which also provides information on temporary country requirements due to exceptional circumstances.

### Table 1 Routine and travel-related vaccination

| Category | Rationale for vaccination | Vaccine |
|---|---|---|
| 1. Routine vaccines for review before travelling | These vaccines may be part of national immunization programmes[a,b] and the traveller may therefore have already received them.<br>Nevertheless, a pre-travel consultation is always a good opportunity for health care providers to review the vaccination status of infants, children, adolescents and adults and ensure they have received vaccines in accordance with their national immunization schedule.[c] | Bacillus Calmette–Guérin (BCG) |
| | | COVID-19 (SARS-CoV-2) |
| | | Diphtheria, tetanus and pertussis (DTP) |
| | | Hepatitis B (HepB) |
| | | *Haemophilus influenzae* type b (Hib) |
| | | Herpes zoster (shingles) |
| | | Human papillomavirus (HPV) |
| | | Influenza (seasonal) |
| | | Measles |
| | | Meningococcal[d] |
| | | Mumps |
| | | Pneumococcal |
| | | Polio |
| | | Rotavirus |
| | | Respiratory syncytial virus (RSV)[e] |
| | | Rubella |
| | | Varicella |

**Table 1 Contd.**

| | | |
|---|---|---|
| 2. Vaccines recommended for travel to certain destinations and/or for certain high-risk populations | Where these vaccines are not part of the recommended national immunization schedule, they should be considered based on the destination and risk profile of the traveller (e.g. underlying health conditions, length of stay, humanitarian worker).<br>These vaccines may be intended to protect the individual travellers as well as to prevent disease spread within and between countries. | Chikungunya[f]<br>Cholera<br>Dengue<br>Ebola[g]<br>Hepatitis A<br>Hepatitis E<br>Japanese encephalitis (JE)<br>Malaria<br>Meningococcal<br>Mpox<br>Polio (adult booster dose)<br>Rabies<br>Tick-borne encephalitis (TBE)<br>Typhoid<br>Yellow fever (YF) |
| 3. Vaccines demanded by certain countries | Some countries require proof of vaccination for travellers wishing to enter or exit the country (e.g. for *Hajj* and *Umrah* pilgrims).[h] For information, see the country list on WHO's International travel and health web page. | COVID-19<br>*Haemophilus influenzae*<br>Influenza vaccines<br>Meningococcal<br>Polio<br>Yellow fever |

[a] These vaccines have only been introduced into the routine immunization programmes of a limited number of countries.
[b] See WHO recommendations for routine immunization – summary tables.
[c] More information on interrupted and delayed vaccination can be found in the Recommendations for interrupted or delayed routine immunization – summary of WHO position papers.
[d] Available meningococcal vaccines include meningococcal A, B, C, quadrivalent and pentavalent conjugate vaccine.
[e] WHO's Strategic Advisory Group of Experts (SAGE) recommended that all countries introduce products for the prevention of severe RSV disease in infants (see https://iris.who.int/bitstream/handle/10665/379717/WER9949-eng-fre.pdf?sequence=1). Some national immunization schedules include RSV vaccines for older adults or certain risk groups.
[f] Chikungunya vaccine has been approved by some regulatory agencies for use in adolescents and/or adults and is recommended by certain countries. WHO has not yet issued policy recommendations on the use of Chikungunya vaccine.
[g] See: Extraordinary meeting of the Strategic Advisory Group of Experts on Immunization on Ebola vaccination, May 2024: conclusions and recommendations.
[h] This list is not comprehensive and may be subject to change.

## 1.4. 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 whenever possible these should be devices with sharps injury protection features *(1)*. 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 *(2)*.

## 1.5. Combinations and co-administration of vaccines

Inactivated vaccines do not generally interfere with other vaccines. However, if multiple injections are to be given at a single visit, they should be administered at separate sites (preferably different limbs for each injection), or if in the same limb, injection sites should be least 2.5 cm apart. Most live vaccines can be given simultaneously if they are administered at different anatomical sites. If injectable live-virus vaccines are not given on the same day, their administration should be separated by an interval of at least 4 weeks. However, live oral polio vaccine (OPV) and the live oral Ty21a typhoid vaccine can be administered simultaneously with, or at any interval before or after, injectable live vaccines.

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

## 1.6. Choice of vaccines for travel

Vaccines for travellers include: (1) routine vaccines that should be reviewed before travelling, (2) vaccines recommended in certain destinations, (3) vaccines demanded by certain countries and (4) additional vaccines for consideration (see Table 1). Pre-travel precautions should include booster doses of routine vaccines if the regular schedule has not been followed, or a full course of primary vaccination for people who have never been vaccinated. Inhabitants of areas where vaccine-preventable diseases are endemic who are travelling to non-endemic areas should be adequately vaccinated to prevent introduction or reintroduction of diseases such as polio, yellow fever, measles and rubella.

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

- risk of exposure to the disease;
- age, health status and vaccination history of the traveller;
- reactions to previous vaccine doses including allergies;
- risk of infecting others; and
- whether vaccination is required for entry to certain countries.

Yellow fever vaccination is, in certain situations, required by the International Health Regulations (2005) *(3)*. In some non-endemic countries, this is a prerequisite for entry for those who have recently passed through yellow fever-endemic areas. Vaccination against yellow fever is done for two reasons: (1) to protect individuals in areas of risk for yellow fever virus infection, and (2) to protect vulnerable countries from importation of the yellow fever virus.

Vaccination against yellow fever, meningococcal meningitis, poliomyelitis and seasonal influenza is required in the Kingdom of Saudi Arabia for pilgrims visiting Mecca and Medina for the *Hajj* or *Umrah* as well as for guest workers. Selected countries may also recommend vaccination against influenza for pilgrims to Mecca or Medina.

Some polio-free countries may require travellers resident in countries or areas reported to have wild polioviruses to be vaccinated against polio before they can be granted a visa.

Travellers should be provided with a written record of all vaccines administered (patient-retained record), preferably on the ICVP, also known as the yellow card (which is required for yellow fever vaccination).

The WHO travel advice webpage summarizes countries' requirements for incoming international travellers, as well as WHO recommendations regarding yellow fever vaccination.

## References

1. WHO guideline on the use of safety-engineered syringes for intramuscular, intradermal and subcutaneous injections in health care settings. Geneva: World Health Organization; 2016 (https://iris.who.int/bitstream/handle/10665/250144/9789241549820-eng.pdf?sequence=1).

2. WHO best practices for injections and related procedures toolkit. Geneva: World Health Organization; 2010 (https://iris.who.int/bitstream/handle/10665/44298/9789241599252_eng.pdf?sequence=1).

3. International Health Regulations (2005), third edition. Geneva: World Health Organization; 2005 (https://iris.who.int/bitstream/handle/10665/246107/9789241580496-eng.pdf?sequence=1).

## Further information

- Immunization, Vaccines and Biologicals: Vaccine-preventable diseases (including pipeline vaccines) [webpage]. Geneva: World Health Organization (https://www.who.int/teams/immunization-vaccines-and-biologicals/diseases).
- Strategic Advisory Group of Experts on Immunization (SAGE): WHO Vaccine position papers [webpage]. Geneva: World Health Organization (https://www.who.int/teams/immunization-vaccines-and-biologicals/policies/position-papers).
- Immunization, Vaccines and Biologicals: WHO recommendations for routine immunization – summary tables [webpage]. Geneva: World Health Organization (https://www.who.int/teams/immunization-vaccines-and-biologicals/policies/who-recommendations-for-routine-immunization---summary-tables).
- Poliomyelitis (polio) [overview]. Geneva: World Health Organization (https://www.who.int/health-topics/poliomyelitis/#tab=tab_1).
- Where we work [web page]. Geneva: Global Polio Eradication Initiative (https://polioeradication.org/about-polio/where-we-work/).
- Travel advice [web page]. Geneva: World Health Organization (https://www.who.int/travel-advice).
- Travel and health [overview]. Geneva: World Health Organization (https://www.who.int/health-topics/travel-and-health/#tab=tab_1).

# 2 Vaccines for routine and selective use

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

Information on vaccines and vaccine-preventable diseases is set out in the tables below.


Credit: WHO / Michael Duff
Mobile health teams bring COVID-19 vaccination to hard-to-reach communities in Sierra Leone

# Bacillus Calmette–Guérin (BCG)

| Summary of vaccine data | | |
|---|---|---|
| | Type of vaccine | Live attenuated vaccine |
| | Number of doses | One dose |
| | Contraindications | BCG vaccination is contraindicated for individuals known to be allergic to any component of the vaccine. |
| | Before departure | 2 weeks before departure |
| | Recommended for | Unvaccinated tuberculin skin testing (TST)- or interferon-gamma (ɣ) (IFN-ɣ) release assay (IGRA)-negative travellers from non-tuberculosis (TB)-endemic countries who are travelling to TB-endemic countries should consider vaccination after an individual risk assessment based on duration of travel, and the TB incidence in the country to be visited.<br>Young unvaccinated children travelling to countries with a high TB incidence, particularly those likely to travel to such destinations frequently during childhood, should be vaccinated. |
| | Special precautions | None |
| Cause | | *Mycobacterium tuberculosis* |
| Transmission | | By inhalation of *M. tuberculosis*-containing airborne droplets |
| Nature of the disease | | In most cases, exposure to *M. tuberculosis* results in latent infection, which only occasionally progresses to active disease. TB may affect any organ but, from a public health perspective, active pulmonary disease with mycobacterial dissemination is the most important manifestation. In infants, tuberculous meningitis or disseminated disease may occur. Multidrug resistance of *M. tuberculosis* is a rapidly increasing problem. |
| Geographical distribution | | Worldwide among deprived populations but most common in low-income countries. TB is highly prevalent among HIV-infected individuals. |
| Risk for travellers | | The risk of travel-associated TB depends on several factors, including the TB incidence in the country visited, the duration of travel, the degree of contact with the local population and, in particular, the age of the traveller. A risk assessment should be conducted for unvaccinated travellers who test negative on the tuberculin skin test and interferon-gamma (IFN-ɣ) release assay. This assessment should consider the duration of travel and the incidence of the disease in the destination country, particularly if travelling from a country that is not endemic for TB. Young unvaccinated children travelling to countries with a high incidence of TB, particularly those likely to travel to such countries repeatedly during childhood, should be vaccinated. |
| Precautions | | When possible, travellers should avoid prolonged, close contact with people known or suspected to have pulmonary TB. A tuberculin skin test before and after a high-risk mission abroad may be advisable, for example, for health professionals and humanitarian relief workers. Travellers who have prolonged exposure to people with bacteriologically confirmed TB should have access to preventive treatment. |
| Vaccine | | BCG vaccines are based on live attenuated mycobacterial strains descended from the original attenuated BCG. Apart from its documented effect against tuberculous meningitis and disseminated disease in infants, BCG vaccination is of very limited value for most travellers. |

## Reference

1. World Health Organization. BCG vaccines: WHO position paper – February 2018. Wkly Epidemiol Rec. 2018 23;93:73–96. PMID: 29474026 WER9308.pdf.

## Further information

- Global tuberculosis report 2023. Geneva: World Health Organization; 2023 (https://iris.who.int/bitstream/handle/10665/373828/9789240083851-eng.pdf).
- Immunization, Vaccines and Biologicals: Vaccine-preventable diseases [webpage]. Geneva: World Health Organization (https://www.who.int/teams/immunization-vaccines-and-biologicals/diseases).

# Cholera

| Summary of vaccine data *(1)* | | |
|---|---|---|
| | Type of vaccine | Oral cholera vaccine |
| | Number of doses | 1. Killed whole-cell vaccine containing inactivated strains of *Vibrio cholerae* and a recombinant cholera toxin B subunit (WC-rBS): 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.<br>2. Killed modified whole cell vaccine (WC): Two doses 14 days apart for individuals ≥ 1 year. One booster dose is recommended after 2 years for all age groups. |
| | Contraindications | Hypersensitivity to previous dose |
| | Consider for | Travellers at high risk (e.g. emergency/relief workers) |
| | Special precautions | None |
| Cause | | *Vibrio cholerae* bacteria of serogroups O1 and O139 |
| Transmission | | Infection occurs through ingestion of food or water contaminated directly or indirectly by faeces or vomitus of infected individuals. |
| Nature of the disease | | An acute enteric disease of varying severity. Most infections are asymptomatic (i.e. they do not cause illness). In mild cases, acute watery diarrhoea occurs without other symptoms. In severe cases, there is sudden onset of profuse watery diarrhoea with nausea and vomiting and rapid development of dehydration. In severe untreated cases, death may occur within a few hours due to dehydration leading to circulatory collapse. |
| Geographical distribution | | Cholera occurs mainly in low-income countries, as well as in areas where the infrastructure may have broken down, leading to a lack of adequate sanitation and clean drinking-water. |
| Risk for travellers | | The risk for most travellers is very low, even in countries where cholera epidemics occur, provided that simple precautions are taken, such as practising good hygiene.[a] 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 *(2, 3)*. |
| Vaccine | | An oral vaccine consisting of killed whole-cell *V. cholerae* O1 in combination with a recombinant B-subunit of cholera toxin (WC/rBS) has been marketed since the early 1990s. This killed vaccine is well tolerated and confers high-level (about 85%) protection for 6 months after the second dose in all vaccinees aged over 2 years. The protective efficacy drops to about 60% 2 years after vaccination and is only 0–18% after 3 years.<br><br>Primary vaccination consists of two oral doses ≥ 7 days (but < 6 weeks) apart for adults and children aged ≥ 6 years. For children aged 2–5 years, three doses are recommended. Intake of food and drinks should be avoided for 1 hour before and after vaccination. If the second dose is delayed for more than 6 weeks, vaccination should be restarted.<br><br>Following primary vaccination, protection against cholera may be expected after about 1 week. Booster doses are recommended after 2 years for adults and for children aged ≥ 6 years and every 6 months for children aged 2–5 years. The appropriate primary vaccination must be repeated if > 2 years for adults and > 6 months for children aged 2–5 years, have passed since administration. The vaccine is not licensed for children under 2 years of age.<br><br>In studies of travellers to areas with reported cholera outbreaks, WC/rBS was also found to confer short-term protection against diarrhoea caused by enterotoxigenic *Escherichia coli* in about 50% of those vaccinated.<br><br>Two closely related bivalent oral cholera vaccines are produced in India and the Republic of Korea. These killed whole-cell vaccines are based on *V. cholerae* serogroups O1 and O139 and do not contain the cholera toxin B subunit. They are reported to be safe and efficacious in individuals ≥ 1 year of age, providing 66–67% protection for at least 3 years against clinically significant cholera in countries or areas reporting outbreaks. |

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

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- For vaccine information, see Immunization, Vaccines and Biologicals: Vaccine-preventable diseases [webpage]. Geneva: World Health Organization (https://www.who.int/teams/immunization-vaccines-and-biologicals/diseases).

# COVID-19 (SARS-CoV-2)

| Summary of vaccine data | | |
|---|---|---|
| | Type of vaccine | • inactivated<br>• protein subunit<br>• mRNA<br>• non-replicating viral vector (no longer commercially available) |
| | Number of doses | *Initial doses*: One dose (mRNA or protein subunit vaccines) or two doses for inactivated vaccines<br>*Revaccination*: interval is 6 or 12 months after previous dose depending on age or health status (see priority-use groups *(1)*) |
| | Contraindications | History of anaphylaxis to any component of the vaccine<br>People who have had thrombosis with thrombocytopenia syndrome after receiving one dose of non-replicating viral vector COVID-19 vaccine should not receive a subsequent dose of the same vaccine. |
| | Consider for | Travellers in high-priority use groups (such as older adults with or without comorbidities and immunocompromised individuals) |
| | Special precautions | Anyone with an acute febrile illness (body temperature over 38.5 °C) should postpone vaccination until they are afebrile.<br>As a small number of anaphylactic reactions have been reported in vaccinees without a history of anaphylaxis, WHO recommends that COVID-19 vaccines be administered only in settings where anaphylaxis can be treated.<br>Rare cases of myocarditis and pericarditis have been observed among adolescent and young adult males within 7 days after receiving the second dose of an mRNA COVID-19 vaccine. Cases have also been observed in females, in other age groups and after other doses *(2)*. |
| Cause | | SARS-CoV-2 virus |
| Transmission | | SARS-CoV-2 virus spreads mainly from person to person. The most common transmission is via droplets or aerosols when an infected person coughs, sneezes or talks. |
| Nature of the disease | | COVID-19 disease varies in severity. Most people infected with the virus will experience mild-to-moderate respiratory illness and recover without requiring special treatment. However, some will become seriously ill and require medical attention. Older people and those with underlying medical conditions like cardiovascular disease, diabetes, chronic respiratory disease or cancer are more likely to develop serious illness. Anyone can fall ill with COVID-19 and become seriously ill or die at any age. |
| Geographical distribution | | Worldwide |

## **COVID-19 (SARS-CoV-2)** Contd.

| | |
|---|---|
| Risk for travellers | There may be a risk of infection with SARS-CoV-2 while travelling, so standard prevention measures should be taken.<br>Travellers should consult the national policies of their destination country, as well as policies set by their transport provider prior to travel. |
| General precautions | Standard prevention measures should be followed to reduce the risk of infection with SARS-CoV-2. These measures include: 1) do not travel if exhibiting symptoms of acute respiratory infection compatible with COVID-19 disease; 2) practise physical distancing (1–2 metres from others); 3) practise respiratory etiquette (coughing and sneezing into a tissue or elbow) and good hand hygiene (washing hands with soap and water regularly or using alcohol-based hand sanitizers); 4) wear a face mask in situations where physical distancing cannot be maintained. |
| Vaccines | Inactivated COVID-19 vaccines cannot replicate; they are formulated with an adjuvant to increase immunogenicity and usually require more than one dose to elicit a durable immune response.<br>Protein subunit COVID-19 vaccine platforms contain vaccines made from recombinantly produced fragments of proteins from SARS-CoV-2, which elicit an immune response.<br>mRNA COVID-19 vaccines are made of genetically engineered RNA, which encodes proteins that safely activate an immune response. |

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2. COVID-19 subcommittee of the WHO Global Advisory Committee on Vaccine Safety (GACVS) reviews cases of mild myocarditis reported with COVID-19 mRNA vaccines. Geneva: World Health Organization; 2021 (https://www.who.int/news/item/26-05-2021-gacvs-myocarditis-reported-with-covid-19-mrna-vaccines).

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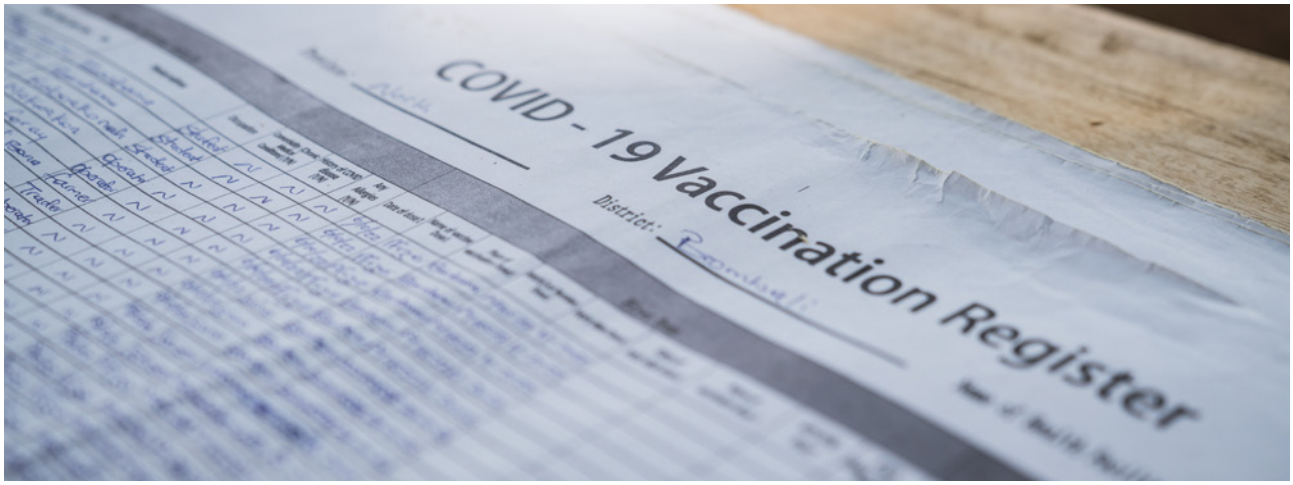


Credit: WHO / Michael Duff
Mobile health teams bring COVID-19 vaccination to hard-to-reach communities in Makontakay, Sierra Leone, 2022.

# Dengue

| Summary of vaccine data | | |
|---|---|---|
| | Type of vaccine | Two dengue vaccines have been licensed: CYD-TDV (Dengvaxia®, Sanofi) and TAK-003 (Qdenga®, Takeda). Both are tetravalent live attenuated vaccines but differ in the extent of chimerization and the genome backbone, as well as in their efficacy and safety.<br>Although licensed in about 20 dengue-endemic countries, with an age indication ranging from 9 to 45 years in most countries, the CYD-TDV (Dengvaxia®) is being withdrawn from the market. Only those who test positive (dengue immunoglobulin G (IgG)) should receive this vaccine. Because of the requirement for pre-vaccination screening, this vaccine is currently not being widely used.<br>The TAK-003, a live attenuated vaccine, contains weakened versions of dengue virus serotypes 1, 2, 3 and 4. It is licensed for use in individuals aged ≥ 4 years by the European Medicines Agency, the United Kingdom's Medicines and Healthcare products Regulatory Agency and many endemic countries. The age indication for use varies between countries. |
| | Number of doses | The vaccination schedule for the primary series of TAK-003 is two doses administered subcutaneously with an interval of 3 months between doses. It is not advised to reduce this interval. If the second dose is delayed for any reason, it is not necessary to restart the series, and the second dose should be administered at the earliest opportunity *(1)*. |
| | Contraindications | Dengue vaccine is not recommended for pregnant or lactating women.<br>A history of anaphylaxis to any component of the dengue vaccine is a contraindication. If anaphylaxis occurs after any dose, no subsequent dose of the vaccine should be administered. |
| | Before departure | Travellers who have already had documented dengue or are seropositive could consider vaccination before travel to settings with high dengue transmission.<br>Frequent travellers, long-term travellers, migrants, and long-term expatriates have a higher likelihood of previous dengue infection (and are therefore more likely to be seropositive) compared to first-time or short-term travellers.<br>Persons living in non-endemic countries who have previously been infected with any of the four dengue virus serotypes following travel to dengue-endemic countries may benefit from TAK-003 vaccination to prevent a second (and hence potentially more severe) dengue infection when travelling again to an endemic country. |
| | Consider for | Prevention of dengue fever in children aged ≥ 9 years living in areas highly endemic for this infection<br>WHO recommends the use of TAK-003 in children aged 6–16 years in settings with high dengue transmission intensity. |
| | Special precautions | A small number of anaphylactic reactions have been reported in vaccinees without a history of anaphylaxis. Therefore, TAK-003 vaccine should be administered only in settings where anaphylaxis can be treated. Until more data are available, all vaccinees should be observed for at least 15 minutes following vaccination.<br>Dengue vaccine should be avoided in pregnant and lactating women and immunocompromised individuals. This includes those with symptomatic HIV infection or asymptomatic infection associated with evidence of impaired immune function, due to the paucity of safety data in these populations. |
| Cause | | Dengue virus (genus: *Flavivirus*) serotypes 1–4 |
| Transmission | | Dengue virus is maintained primarily in a human-to-mosquito-to-human cycle. Primary vectors are virus-infected *Aedes aegypti* and *Ae. albopictus*. |
| Nature of the disease | | About 75% of all dengue virus infections are asymptomatic. Symptomatic dengue most commonly presents as a mild-to-moderate, acute febrile illness with headache, retro-orbital pain, generalized myalgia and arthralgia, anorexia, abdominal pain, nausea and a rash. However, some dengue patients develop severe, life-threatening disease characterized by hypovolaemic shock, respiratory distress, severe bleeding or severe organ impairment. |

## **Dengue** Contd.

| | |
|---|---|
| Geographical distribution | Dengue is endemic throughout the tropics and subtropics, predominantly in Asia but also in Africa and Latin America. |
| Risk for travellers | Dengue is a leading cause of febrile illness among travellers returning from the Caribbean, Latin America and South-East Asia. Sporadic outbreaks with local transmission have also occurred in the United States of America (in Florida, Hawaii and along the Texas–Mexico border). The risk of infection increases with longer duration of travel and with higher disease incidence in the travel destination (such as during the rainy season and during epidemics). |
| General precautions | Protection against mosquito bites (appropriate clothing, indoor insecticides, repellents, destruction of mosquito breeding sites)<br>The benefits of vaccination with TAK-003 are lower for travellers who have never experienced dengue infection (and are therefore seronegative) than for travellers who are seropositive. Data on the effectiveness of the vaccine against DENV3 and DENV4 in seronegative persons are scarce although studies are currently being conducted. Travellers need to be informed that the vaccine may not confer protection against DENV3 and DENV4 if they are seronegative, and that if seronegative individuals are exposed to DENV3 and DENV4 there is a potential risk of severe dengue. Travellers also need to be informed that transmission of dengue is heterogeneous within countries and the circulating serotypes may vary. The highest benefit with the lowest risk is during an ongoing epidemic due to DENV2 or DENV1 at the destination. |
| Vaccine | TAK-003 does not prevent all cases of dengue. |

### References

1. WHO position paper on dengue vaccines – May 2024. Wkly Epid Rec. 2024;99:203–24 (https://www.who.int/publications/i/item/who-wer-9918-203-224).

### Further information

- Dengue and severe dengue: Key facts [webpage]. Geneva: World Health Organization; 2024 (https://www.who.int/news-room/fact-sheets/detail/dengue-and-severe-dengue).

## Diphtheria, tetanus and pertussis- (DTP-)containing vaccine

| Summary of vaccine data | | |
|---|---|---|
| | Type of vaccine | Many different DTP-containing (combination) vaccines are licensed worldwide. |
| | Number of doses | Licensed for use from 6 weeks of age. Three doses for the primary series and an interval of at least 4 weeks between the doses are recommended. Three booster doses are recommended in childhood/adolescence *(1–3)*. |
| | Contraindications | Severe allergic reaction to a vaccine component or a prior dose |
| | Consider for | All travellers should ensure they are up to date with their (DTP-)containing (combination) vaccines before travelling. |
| | Special precautions | None |

| | |
|---|---|
| **Diphtheria** | In most countries, diphtheria vaccine is routinely administered in childhood. Travellers who missed it should be offered the vaccine according to national recommendations. |
| Cause | Toxigenic *Corynebacterium diphtheriae* and, in tropical climates, occasionally toxigenic *C. ulcerans* |
| Transmission | *C. diphtheriae* residing in the respiratory tract is transmitted from person to person through droplets and close physical contact; *C. ulcerans* and *C. pseudotuberculosis* can also be transmitted by zoonotic spread. |

## Diphtheria, tetanus and pertussis- (DTP-)containing vaccine Contd.

| | |
|---|---|
| Nature of the disease | Clinical manifestations are usually mild, but, occasionally, potent bacterial toxins cause obstructive membranes in the upper respiratory tract or damage to the myocardium and other tissues. Systemic manifestations are less likely to be caused by *C. ulcerans* or *C. tuberculosis*. |
| Geographical distribution | Very rare in countries with high coverage with diphtheria-containing vaccines. Incidence increases in crowded regions where vaccination programmes are insufficient, and standards of hygiene are poor. |
| Risk for travellers | Risk of exposure increases in populations with low coverage of vaccination against diphtheria, tetanus and pertussis (DTP). |
| Vaccine | For primary or booster vaccination, appropriately formulated combined DTP vaccines or booster tetanus and diphtheria (Td) vaccines should be used according to national recommendations. Individuals ≥ 7 years of age should receive combinations with reduced diphtheria toxoid content. |
| | |
| **Tetanus** | In most countries, tetanus vaccine is routinely administered in childhood. Unvaccinated travellers should be offered the vaccine according to national recommendations. |
| Cause | The bacterium *Clostridium tetani* |
| Transmission | Spores of *C. tetani* may contaminate necrotic, anaerobic tissue and transform into vegetative, toxin-producing bacteria. Tetanus is not communicable. |
| Nature of the disease | Potent bacterial neurotoxins originating from vegetative *C. tetani* may cause local muscular spasms or generalized muscle spasms and rigidity. Untreated generalized tetanus is often fatal. |
| Geographical distribution | Spores of *C. tetani* are widespread globally, particularly in the soil. |
| Risk for travellers | The risk is linked to activities that increase the likelihood of dirty or contaminated injuries. This risk is not necessarily increased during travel. |
| Vaccine | Travellers should be vaccinated with combined diphtheria–tetanus or DTP vaccines according to national recommendations. Individuals ≥ 7 years of age should receive tetanus-containing combinations with a reduced content of diphtheria toxoid. |
| | |
| **Pertussis** | In most countries, pertussis vaccine is routinely administered in childhood. Unvaccinated travellers should be offered the vaccine according to national recommendations. |
| Cause | The bacterium *Bordetella pertussis* |
| Transmission | *B. pertussis* is transmitted from person to person through droplets. |
| Nature of the disease | The *Bordetella* bacteria colonize only ciliated cells of the respiratory mucosa, causing an acute respiratory infection (also known as whooping cough), marked by severe, spasmodic coughing episodes. In early infancy, pertussis may be atypical and sometimes life-threatening. Disease manifestations are less dramatic with increasing age, including in adults. |
| Geographical distribution | Pertussis incidence depends on DTP vaccination coverage; the disease is common, and outbreaks are reported even in high coverage areas. |
| Risk for travellers | The highest risk is for unvaccinated infants visiting countries with low coverage of DTP vaccination. |
| Vaccine | For primary as well as booster vaccination, acellular or whole-cell pertussis vaccines should be used in fixed combination with vaccines against diphtheria and tetanus. The schedule should follow national recommendations. Children ≥ 7 years of age should receive combinations with reduced diphtheria toxoid content. |

## References

1. Diphtheria vaccines: WHO position paper – August 2017. Wkly Epidemiol Rec. 2017;92(31):417–35 (https://www.who.int/publications/i/item/who-wer9231).

2. Tetanus vaccines: WHO position paper – February 2017. Wkly Epidemiol Rec. 2017;;92(6):53–76 (https://www.who.int/publications/i/item/WHO-WER9206).

3. Pertussis vaccines: WHO position paper – August 2015. Wkly Epidemiol Rec. 2015;90(35):433–58 (https://www.who.int/publications/i/item/WHO-WER9035).

## Further information

- For the observed rate of reactions to DTP vaccines, see Information sheet. Observed rate of vaccine reactions: diphtheria, pertussis, tetanus vaccines. Geneva: World Health Organization; 2014 (https://cdn.who.int/media/docs/default-source/pvg/global-vaccine-safety/dtp-vaccine-rates-information-sheet.pdf).
- For vaccine information, see Immunization, Vaccines and Biologicals: Vaccine-preventable diseases [webpage]. Geneva: World Health Organization (https://www.who.int/teams/immunization-vaccines-and-biologicals/diseases).

# 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.<br>The live attenuated vaccine can be administered as a single subcutaneous dose. |
| | Number of doses | Inactivated vaccine: one- or two-dose schedules of inactivated hepatitis A vaccine can be used *(1)*.<br>Live vaccine: one dose |
| | Contraindications | Severe allergic reaction to previous dose |
| | Before departure | Inactivated and live vaccines: protection is achieved within 2–4 weeks after the first dose. Because of the long incubation period of hepatitis A (average 2–4 weeks), the vaccine can be administered up to the day of departure and still protect travellers. |
| | Consider for | Hepatitis A vaccination should be considered for people aged ≥ 1 year who are travelling to countries or areas of intermediate or high endemicity. Those at high risk of acquiring severe disease, such as immunosuppressed individuals and those with chronic liver disease, should be strongly encouraged to be vaccinated regardless of where they travel. In addition, people at increased risk of hepatitis A, including men who have sex with men, people who require lifelong treatment with blood products and people who inject drugs should be vaccinated.<br>Inactivated hepatitis A vaccines should also be considered for use in pregnant women at risk of hepatitis A virus infection. |
| | Special precautions | None |
| Cause | | Hepatitis A virus |
| Transmission | | The virus is acquired through close contact with infected individuals or by consumption of faecally contaminated food or drinking-water. There is no insect vector or animal reservoir. |
| Nature of the disease | | Acute viral hepatitis is characterized by abrupt onset of fever, malaise, nausea and abdominal discomfort, followed by jaundice a few days later. In very young children, infection is usually mild or asymptomatic, whereas in older children symptomatic disease is common. The disease is often more severe in adults, and full recovery may take several months. The case-fatality rate is > 2% for people > 40 years of age and about 4% for those aged ≥ 60 years. |

## **Hepatitis A** Contd.

| | |
|---|---|
| Geographical distribution | Worldwide, but most common in areas where sanitary conditions are poor. |
| Risk for travellers | Non-immune travellers to developing countries are at significant risk of infection, particularly in settings with poor food and drinking-water safety control and poor sanitation. |
| General precautions | Avoid or boil potentially contaminated food and water. Short-term protection through injection of human immunoglobulin is gradually being replaced by hepatitis A vaccination. |
| Vaccines | Two types of hepatitis A vaccine are currently used worldwide, namely inactivated and live attenuated vaccines. Both types are safe and highly immunogenic and provide long-lasting, possibly lifelong, protection against hepatitis A in both children and adults. The minimum age to receive the vaccine is 1 year.<br>**1) Inactivated vaccines**<br>Inactivated hepatitis A virus vaccines are used in most countries. Monovalent inactivated vaccines are available in both a paediatric dose (0.5 mL) for children aged 1–15 years and an adult dose (1 mL). A two-dose schedule is usually recommended, particularly for immunocompromised individuals. However, in healthy individuals, comparable effectiveness has been achieved with a single dose. Combined hepatitis A/typhoid vaccines are available, conferring protection against both of these waterborne diseases. A combination vaccine that provides protection against both hepatitis A and hepatitis B should be considered for travellers who may be exposed to both organisms (see hepatitis B vaccines). The inactivated hepatitis A vaccines produced are interchangeable, as are the combinations that contain inactivated hepatitis A vaccine.<br>**2) Live attenuated vaccines (based on the H2 or LA-1 strain of hepatitis A virus)**<br>These vaccines are manufactured in China and are available in several other countries. The presence of anti-hepatitis A virus IgG antibodies was documented after 15 years in 72–88% of vaccinees and was associated with a 32-fold reduction in reported hepatitis A virus incidence, implying that, in most cases, long-term protection against hepatitis A is achieved following a single dose of these live attenuated vaccines. |

## References

1. Hepatitis A vaccines: WHO position paper, October 2022. Wkly Epid Rev. 2022;97:493–512 (https://www.who.int/publications/i/item/who-wer9740-493-512).

## Further information

- For the observed rate of reactions to hepatitis A vaccines, see Information sheet. Observed rate of vaccine reactions: Hepatitis a vaccine. Geneva: World Health Organization. Geneva: World Health Organization; 2024 (https://cdn.who.int/media/docs/default-source/pvg/global-vaccine-safety/hep-a-vaccine-rates-information-sheet.pdf?sfvrsn=184724d1_4).
- For vaccine information, see Immunization, Vaccines and Biologicals: Vaccine-preventable diseases [webpage]. Geneva: World Health Organization (https://www.who.int/teams/immunization-vaccines-and-biologicals/diseases).
- International travel and health Module 2: Environmental health risks. Geneva: World Health Organization; 2024 (https://iris.who.int/bitstream/handle/10665/378100/9789240093607-eng.pdf?sequence=1).
- Five keys to safer food [poster]. Geneva: World Health Organization (https://cdn.who.int/media/docs/default-source/infographics-pdf/food-safety/five-keys-to-safer-food.pdf?sfvrsn=1cf1f432_2).

# Hepatitis B (HepB)

| Summary of vaccine data | | |
|---|---|---|
| | Type of vaccine: | Hepatitis B vaccines are available as monovalent formulations for birth doses or for vaccination of adults at risk, and in combination with other vaccines for infant vaccination, including diphtheria–tetanus–pertussis (DTP), *Haemophilus influenzae* type b (Hib) and inactivated polio vaccine (IPV). A combined hepatitis B and hepatitis A vaccine is also available. |
| | Number of doses | Hepatitis B vaccine is administered by intramuscular injection.<br>A three-dose schedule of hepatitis B vaccine is recommended *(1)*. |
| | Contraindications | Allergy to yeast is considered a contraindication to immunization with yeast-produced hepatitis B vaccine. |
| | Before departure | Hepatitis B vaccine is safe and effective. For non-immune travellers, hepatitis B vaccine should be administered according to the national schedule. |
| | Consider for | Prevention of hepatitis B, a liver infection caused by the hepatitis B virus (HBV). Hepatitis B vaccination is universally recommended. Unvaccinated travellers should be offered the vaccine according to national recommendations. |
| | Special precautions | None |
| Cause | | HBV genotypes A–G |
| Transmission | | HBV is transmitted by exposure of mucosal membranes or non-intact skin to infected blood or other body fluids (saliva, semen and vaginal fluid). It may be transmitted perinatally from infected mothers to infants, through injection or transfusion of contaminated blood products, or through penetration of the skin with contaminated needles. Hepatitis B is frequently transmitted by sexual intercourse. |
| Nature of the disease | | When contracted perinatally or in early childhood, the infection is rarely symptomatic but is likely to develop into chronic liver disease that may develop into cirrhosis and/or cancer over decades. Infection of older children and adults more often causes acute hepatitis and rarely chronic liver disease. The course of disease might depend on other factors, such as viral genotype. |
| Geographical distribution | | Prevalence assessments are based on the presence of HBV surface antigen (HBsAg) in serum. The highest prevalence is found in some African and eastern Asian countries with low coverage of hepatitis B vaccination. In well-vaccinated populations, the prevalence of hepatitis B is usually low. Globally, very high prevalence rates may be found among certain risk groups such as sex workers and injecting drug users. |
| Risk for travellers | | The risk of acquiring HBV infection for non-immune travellers depends mainly on personal risk-taking behaviour and the prevalence of HBsAg in the population visited. Except for the risk of nosocomial infection in poorly equipped health care facilities, the risk of contracting hepatitis B is unlikely to be increased for most travellers.<br>If there is insufficient time to allow completion of the standard vaccination schedule, a three-dose schedule, at 0, 7 and 21 days, may be used; in this case, a fourth dose is recommended 12 months after the first dose. |
| General precautions | | Travellers should follow the general recommendations for avoiding potentially contaminated food and drinking-water. |
| Vaccine | | The active ingredient of hepatitis B vaccine is HBsAg. The primary series of vaccinations usually consists of one dose of monovalent vaccine at birth followed by two or three doses of monovalent or combined hepatitis B vaccine at intervals of one to several months. For older children and adults, three doses at appropriate intervals are recommended, with a monovalent or a combined hepatitis A and B vaccine. For travellers, if there is insufficient time to complete the standard vaccination schedule, a three-dose schedule given at 0, 7 and 21 days may be used; in this case, a fourth dose is recommended 12 months after the first dose. |

## References

1. Hepatitis B vaccines: WHO position paper – July 2017. Wkly Epidemiol Rec. 2017;92(27):369–92 (https://www.who.int/publications/i/item/WER9227).

### Further information

- For the observed rate of reactions to hepatitis B vaccines, see Information sheet. Observed rate of vaccine reactions: Hepatitis B vaccine. Geneva: World Health Organization; 2012 (https://cdn.who.int/media/docs/default-source/pvg/global-vaccine-safety/hep-b-vaccine-rates-information-sheet.pdf).
- For hepatitis B information, see Hepatitis [overview]. Geneva: World Health Organization (https://www.who.int/health-topics/hepatitis/viral-hepatitis-in-the-world-map#tab=tab_1).
- For vaccine information, see Immunization, Vaccines and Biologicals: Vaccine-preventable diseases [webpage]. Geneva: World Health Organization (https://www.who.int/teams/immunization-vaccines-and-biologicals/diseases).

## Hepatitis E

| Summary of vaccine data | | |
|---|---|---|
| | Type of vaccine | Recombinant vaccine based on genotype 1 capsid protein which cross-protects against all four genotypes of hepatitis E virus (HEV) of human relevance. This vaccine was developed and first licensed in China (HEV 239, Hecolin®). |
| | Number of doses | Three (administered intramuscularly at 0, 1 and 6 months) or<br>two doses in humanitarian contexts and fragile settings *(1)* |
| | Contraindications | Not described, except for serious allergy to vaccine components |
| | Consider for | Travellers and health care and humanitarian relief workers travelling to areas experiencing outbreaks of hepatitis E, after individual evaluation and weighing of risks and benefits |
| | Special precautions | So far, limited data are available on the safety of its use in children, pregnant women or immunodeficient patients.<br>The Global Advisory Committee on Vaccine Safety Hepatitis E Working Group concluded that data on the safety of HEV 239 use during pregnancy are limited. This is despite a reported safety signal of spontaneous abortion associated with exposure to the Hecolin® vaccine in the 90-day period prior to pregnancy and during pregnancy. This information was derived from the large prospective cluster randomized trial in Bangladesh *(2)*. WHO concluded that in fragile and conflict-affected settings with documented HEV circulation, the benefits of vaccinating women of childbearing age (i.e. ≥ 16 years) outweigh the potential harms *(3)*. This includes vaccination during pregnancy, especially during the second and third trimesters, when the risk of severe disease is particularly high. |
| Cause | | HEV has four known genotypes (1–4) that infect mammalian hosts. |
| Transmission | | The virus is usually acquired from contaminated drinking-water. Direct faecal–oral transmission from person to person is also possible. There is no insect vector. Various domestic animals, including pigs, may be reservoirs of HEV. |
| Nature of the disease | | Acute infection is characterized by malaise, anorexia, abdominal pain and tenderness, nausea, vomiting, fever and jaundice. The clinical features and course of the disease are generally similar to those of hepatitis A (see hepatitis A section above). However, during the third trimester of pregnancy, HEV infection is more serious and is associated with case-fatality rates ≥ 20%. In addition to pregnant women, people with pre-existing liver disease and immunosuppression are at greater risk for severe disease after HEV infection. |
| Geographical distribution | | HEV is a leading cause of acute viral hepatitis in low-income countries. Each year, HEV genotypes 1 and 2 may account for about 20.1 million HEV infections, 3.4 million symptomatic cases, 70 000 deaths and 3000 stillbirths. |
| Risk for travellers | | The risk for most travellers is very low, even in countries where hepatitis E epidemics occur, provided that simple precautions such as practising good hygiene[a] are taken. However, humanitarian relief workers in disaster areas and refugee camps may be at risk. |

## **Hepatitis E** Contd.

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|---|---|
| General precautions | Travellers should follow the general recommendations for avoiding potentially contaminated food and drinking-water. |
| Vaccine | A vaccine against HEV has been developed and licensed in China. The vaccine contains a recombinant viral capsid protein corresponding to genotype 1 of HEV, which is nevertheless likely to protect against all four genotypes. Three doses of the vaccine are given intramuscularly at 0, 1 and 6 months. So far, this vaccine has shown a favourable safety profile as well as excellent immunogenicity and clinical efficacy when used in healthy individuals aged 16–65 years. The duration of protection is at least 2 years.<br><br>WHO does not make a recommendation on the introduction of the vaccine against HEV for routine use in national programmes in populations where epidemic and sporadic hepatitis E disease is common. However, national authorities may decide to use the vaccine based on the local epidemiology.<br><br>The current WHO position concerning routine programmes should not preclude the use of the vaccine when the risk of contracting HEV is particularly high, such as during outbreaks and for special risk groups such as pregnant women where the incidence is high. WHO recognizes the high risk of HEV infection for travellers, health care and humanitarian relief workers deployed or travelling to areas where there are ongoing outbreaks of hepatitis E. In such circumstances, each person should be evaluated individually to determine the risks and benefits of vaccination against HEV. |

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

## References

1. WHO position paper on hepatitis E vaccines – May 2015. Wkly Epidemiol Rec. 2015;90(18):185–200 (https://www.who.int/publications/i/item/WER9018-185-200).

2. Zaman K, Julin CH, Aziz AB, Stene-Johansen K, Yunus M, Qadri F et al. Safety and effectiveness of a recombinant hepatitis E vaccine in women of childbearing age in rural Bangladesh: a phase 4, double-blind, cluster-randomised, controlled trial. Lancet Glob Health. 2024;12(8):e1288–e1299 (https://www.thelancet.com/journals/langlo/article/PIIS2214-109X(24)00192-X/fulltext).

3. Meeting of the Strategic Advisory Group of Experts on Immunization, March 2024: conclusions and recommendations. Wkly Epidemiol Rec. 2024;99(22):285–306 (https://www.who.int/publications/i/item/WER-9922-285-306).

## Further information

- Hepatitis E fact sheet. Geneva: World Health Organization; 2025 (https://www.who.int/news-room/fact-sheets/detail/hepatitis-e).
- For hepatitis E information, see Hepatitis [overview]. Geneva: World Health Organization (https://www.who.int/health-topics/hepatitis/viral-hepatitis-in-the-world-map#tab=tab_1).
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- Five keys to safer food [poster]. Geneva: World Health Organization (https://cdn.who.int/media/docs/default-source/infographics-pdf/food-safety/five-keys-to-safer-food.pdf?sfvrsn=1cf1f432_2).

# *Haemophilus influenzae* type b (Hib)

| Summary of vaccine data | | |
|---|---|---|
| | Type of vaccine | *Haemophilus influenzae* type b (Hib) conjugate vaccines *(1)* |
| | Number of doses | One dose administered intramuscularly |
| | Contraindications | Severe allergic reaction to a vaccine component or a prior dose |
| | Consider for | In many countries, (Hib) vaccine is routinely administered in childhood. Unvaccinated travellers < 5 years of age should be offered the vaccine according to national recommendations. |
| | Special precautions | None |
| Cause | | The bacterium *H. influenzae* type b (Hib) |
| Transmission | | Respiratory droplets |
| Nature of the disease | | Hib is an important cause of pneumonia, meningitis, septicaemia, epiglottitis infection and other potentially life-threatening infections, primarily in children aged 3 months to 5 years. |
| Geographical distribution | | Prevalent in countries with low Hib-vaccination coverage |
| Risk for travellers | | The risk is likely to be increased in an environment of low Hib-vaccination coverage. |
| Vaccine | | All licensed Hib vaccines are conjugated. They differ in their carrier protein, method of chemical conjugation, polysaccharide size and adjuvant.<br>Hib vaccine is available in a variety of formulations: liquid Hib conjugate vaccine (monovalent), liquid Hib conjugate combined with DTP and/or hepatitis B vaccine; Hib conjugate in combination with meningococcal antigens; lyophilized Hib conjugate with saline diluent (monovalent) and lyophilized Hib conjugate for use with liquid DTP, or DTP in combination with other antigens, such as inactivated polio vaccine or hepatitis B vaccine.<br>In infants, one of three schedules can be followed: three primary doses without a booster, two primary doses plus a booster, or three primary doses with a booster, with the first dose as early as possible after 6 weeks of age. Hib vaccine is not required for healthy children > 5 years. |

## Reference

1. Haemophilus influenzae type b (Hib) Vaccination Position Paper – July 2013
2. Wkly Epidemiol Rec. 2013;88(39):413–26 (https://www.who.int/publications/i/item/who-wer8839-413-426).

## Further information

- For the observed rate of reactions to Hib vaccines, see Information sheet. Observed rate of vaccine reactions: haemophilus influenzae type B (HIB) vaccine. Geneva: World Health Organization; 2012 (https://cdn.who.int/media/docs/default-source/pvg/global-vaccine-safety/hib-vaccine-rates-information-sheet.pdf?sfvrsn=3f3c280e_4&download=true).
- For vaccine information, see Immunization, Vaccines and Biologicals: Vaccine-preventable diseases [webpage]. Geneva: World Health Organization (https://www.who.int/teams/immunization-vaccines-and-biologicals/diseases).

# Human papillomavirus (HPV)

| Summary of vaccine data | | |
|---|---|---|
| | Type of vaccine | Currently six prophylactic recombinant human papillomavirus (HPV) vaccines are licensed (bivalent, quadrivalent and nonavalent vaccines using virus-like particles: VLPs). Five vaccines have been prequalified by WHO and one vaccine is licensed in India (Cervavac®, Serum Institute of India). |
| | Number of doses | The schedule of HPV vaccine depends on the age at administration *(1)*.<br>• One or two-dose schedule for the primary target population of 9–14-year-olds<br>• One- or two-dose schedule for young people aged 15–20 years<br>• Two doses with a 6-month interval for those aged 21 years and older<br>HPV vaccines should be administered intramuscularly. Only vaccine products for which one-dose efficacy (or immunobridging) data are available can be used in a single-dose regimen. |
| | Contraindications | HPV vaccines are not recommended for use in pregnant women. |
| | Consider for | In most countries, the vaccine against HPV is routinely administered in early adolescence. When vaccinations are checked before travelling, individuals who have missed their HPV doses should be offered the vaccination according to national recommendations. |
| | Special precautions | None |
| Cause | | HPV |
| Transmission | | Skin-to-skin contact, in particular though sexual contacts. Most people are infected with HPV shortly after onset of sexual activity and the highest incidence rates in women are in those aged 20–30 years. |
| Nature of the disease | | Although HPV usually causes a transient, benign mucosal infection, persistent infection with certain oncogenic types of HPV (in particular 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 the Caribbean, Latin America, Melanesia, south-eastern Asia and sub-Saharan Africa. |
| Risk for travellers | | HPV is most commonly transmitted through sexual activity. Given the high incidence of HPV-related cancers in immunocompromised people, those living with HIV, and children or adolescents who face sexual abuse, WHO recommends that these groups be considered for vaccination even if they are outside the standard eligible age range. |
| General precautions | | Abstaining from sexual activity is the most reliable method for preventing HPV infection. Condoms used consistently and correctly can reduce the chances of acquiring and transmitting HPV and developing HPV-related diseases (e.g. genital warts and cervical cancer). However, because HPV can infect areas not covered by a condom, condoms might not fully protect against the virus. |
| Vaccines | | Three types of vaccines against HPV infection are available: bivalent (types 16 and 18), quadrivalent (types 6, 11, 16 and 18) and nonavalent (all the above plus five additional types: 31, 33, 45, 52 and 58).<br>A single-dose HPV vaccine delivers robust protection against HPV, which is comparable to two-dose schedules.<br>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.<br>Immunocompromised individuals, including those with HIV, should receive at least two and ideally three doses.<br>WHO considers girls aged 9–14 years the primary target for HPV vaccination. High vaccination coverage in girls also results in herd protection of boys. If resources allow, countries may also vaccinate boys and other secondary targets such as older adolescents and adults. |

## Reference

1. Human papillomavirus vaccines: WHO position paper, December 2022. Wkly Epidemiol Rec. 2022;97: 645–72 (https://www.who.int/publications/i/item/who-wer9750-645-672).

## Further information

- For vaccine information, see Immunization, Vaccines and Biologicals: Vaccine-preventable diseases [webpage]. Geneva: World Health Organization (https://www.who.int/teams/immunization-vaccines-and-biologicals/diseases).

# Influenza (seasonal)

| Summary of vaccine data *(1)* | | |
|---|---|---|
| | Type of vaccine | Inactivated and live attenuated seasonal influenza vaccines are available as either trivalent or quadrivalent formulations.<br>Recombinant vaccines are available as a (trivalent) recombinant haemagglutinin (rHA) vaccine. |
| | Number of doses | Children aged 6 months to 8 years who have never been vaccinated previously should receive two doses at least 4 weeks apart.<br>Those who have previously been vaccinated at least once should subsequently receive one annual dose, as should children and adolescents aged 9 years or over and healthy adults. |
| | Contraindications | People who have had a severe allergic reaction (e.g. anaphylaxis) after a previous dose or to a vaccine component |
| | Consider for | Prevention of seasonal influenza to protect high-risk groups against severe influenza-associated disease and death |
| | Special precautions | Multiple vaccine products and formulations are effective and safe and are approved for use in specific populations. Efficacy and effectiveness vary by type of vaccine and the antigenic similarity of the vaccine to the circulating strains. |
| Cause | | Influenza viruses of types A and B |
| Transmission | | Infectious droplets dispersed into the air, and by direct contact, in particular from hands contaminated with influenza viruses. During the influenza season, the annual global attack rate is estimated to be 5–10% in adults and 20–30% in children. |
| Nature of the disease | | Acute respiratory infection, usually mild but occasionally severe, with high fever, sore throat, cough and aches. Complications include viral pneumonitis and secondary bacterial infections. Older adults, 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 and subtropical areas, seasonality may differ by locality. |
| Risk for travellers | | Travellers are not a particular risk group for influenza. However, as for other diseases, in some countries appropriate health care may be unavailable or hard to access for non-residents in the event of severe disease. The Ministry of Health in Saudi Arabia requires all domestic pilgrims and health workers in the *Hajj* and *Umrah* areas to have the most recently available seasonal influenza vaccine 10 days before their arrival. It also recommends that all visitors arriving for *Umrah* or *Hajj* or for seasonal work in *Hajj* zones be vaccinated against seasonal influenza *(2)*. |
| General precautions | | Frequent hand-washing, face coverings (masks) and avoiding crowds may lower the risk of transmission. |

# **Influenza (seasonal)** Contd.

| | |
|---|---|
| Vaccine | Seasonal influenza vaccines include the prevailing strains of influenza A and B, which are either inactivated or live attenuated. Inactivated influenza vaccines are injected, while live attenuated influenza vaccines are delivered via nasal spray. Inactivated vaccines are used for children aged > 6 months, pregnant women, people with high-risk medical conditions and older people. Healthy non-pregnant individuals aged 2–49 years may receive live attenuated influenza vaccines.<br><br>Current vaccine formulations contain one (trivalent formulations) or both (quadrivalent formulations) of the influenza B lineages.<br><br>Travellers should be vaccinated according to the recommendations of the respective national health authorities in the country of origin and the destination country 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 their influenza vaccines may be different. |

## References

1. Vaccines against influenza: WHO position paper – May 2022. Wkly Epidemiol. Rec. 2022;97: 185–208 (https://www.who.int/publications/i/item/who-wer9719).

2. Pilgrim's Health [webpage]. Ministry of Health of Saudi Arabia (https://www.moh.gov.sa/en/HealthAwareness/Pilgrims-Health/Pages/default.aspx).

## Further information

- For the observed rate of reactions to influenza vaccines, see Influenza vaccine information sheet. Geneva: World Health Organization; 2012 (https://www.who.int/publications/m/item/influenza-vaccine-information-sheet).
- For vaccine information, see Immunization, Vaccines and Biologicals: Vaccine-preventable diseases [webpage]. Geneva: World Health Organization (https://www.who.int/teams/immunization-vaccines-and-biologicals/diseases).

Credit: WHO / Felix Marquez
Julia Paredes Lopez, a nurse with the Chihuahua Health Secretariat, explains the importance of vaccinations to indigenous Raramuri girls at a camp in the city of Chihuahua, Mexico, on 24 June 2024.

# Japanese encephalitis (JE)

| Summary of vaccine data *(1)* | | |
|---|---|---|
| | 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 have been replaced by cell culture-based vaccines, which have a better safety profile.<br>*Inactivated Vero cell-derived vaccines*: The primary series requires two intramuscular doses at 4-week intervals for individuals ≥ 6 months of age. A booster dose is recommended 1–2 years after primary immunization.<br>*Live attenuated vaccine*: A single dose is administered to individuals ≥ 8 months of age. The need for a booster dose has not been established.<br>*Live recombinant (chimeric) vaccine*: A single dose is administered to individuals ≥ 9 months 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 individuals. |
| Cause | | Japanese encephalitis virus (JEV) is antigenically related to West Nile, Murray Valley and St. Louis encephalitis viruses. JEV is categorized into five genotypes. |
| Transmission | | Pigs and various wild birds are the natural reservoirs of this virus, which is transmitted to new animal hosts and occasionally humans by mosquitoes of the genus *Culex*. *Culex* mosquitoes are primarily night-biting. There is no human-to-human transmission. |
| Nature of the disease | | Most human infections are asymptomatic. Severe disease is estimated to occur in about one case per 250 infections; severe cases have a rapid onset and progression, with headache, high fever and meningeal signs. Permanent neurological sequelae are common among survivors. About 20% of severe clinical cases have a fatal outcome. No specific treatment is available. |
| Geographical distribution | | Japanese encephalitis virus is the leading cause of viral encephalitis in Asia and occurs in almost all Asian countries and some part of Australia. Transmission occurs principally in rural agricultural locations where flooding irrigation is practised, although cases may also occur near or within urban centres. Transmission occurs mainly during the rainy season in South-East Asia but may occur all year round, particularly in tropical climate zones. In the temperate regions of China, Japan, the Korean peninsula and eastern parts of the Russian Federation, transmission occurs mainly during the summer and autumn. The disease is also reported from northern parts of Australia, Bangladesh, parts of India and Pakistan, and from Cambodia, the Lao People's Democratic Republic, the Philippines, and other countries in the region. However, the incidence of Japanese encephalitis has been decreasing in China, Japan, the Republic of Korea and more recently in Nepal, Sri Lanka, Thailand, Viet Nam and other countries, largely as a result of high vaccination coverage. |
| Risk for travellers | | The risk of Japanese encephalitis is very low for most travellers to Asia, particularly for short-term visitors to urban areas. However, the risk varies according to season, destination, duration of travel and activities. Vaccination is recommended for travellers with extensive outdoor exposure (such as those camping and hiking) during the transmission season, particularly in endemic countries or areas where farming involves irrigation by flooding. In areas of risk, Japanese encephalitis is primarily a disease of children, but it can occur in travellers of any age. Prevention consists of avoiding mosquito bites and vaccination. |
| Vaccines | | Vaccination against Japanese encephalitis is recommended for travellers to endemic areas who will have extensive outdoor exposure during the transmission season.<br>Inactivated Vero cell-derived, live attenuated and live recombinant vaccines are available, but are not licensed in all countries. These vaccines have excellent safety profiles and can be used to protect travellers from non-endemic countries. |

# Japanese encephalitis (JE) Contd.

| | |
|---|---|
| | Vaccination schedules:<br>*Inactivated Vero cell-derived vaccines*: The primary series is generally given as two intramuscular doses at 4-week intervals for individuals ≥ 6 months of age. Travellers aged ≥ 17 years who have received primary immunization > 1 year previously may be given a booster dose if exposure is ongoing or re-exposure to JEV is expected. Currently there is no paediatric booster dose recommendation.<br>*Live attenuated vaccine*: A single dose is administered to travellers ≥ 8 months of age. The need for travellers to receive a booster dose has not been established. In some endemic countries, two doses are routinely given to ensure long-term protection.<br>*Live recombinant vaccine*: A single dose is administered subcutaneously to individuals ≥ 9 months of age. Currently, there is no booster recommendation for adults. |
| Contraindications and precautions | A hypersensitivity reaction to a previous dose is a contraindication. As occasional allergic reactions to components of the vaccine may occur up to 2 weeks after administration, it is advisable to ensure that the complete course of vaccination is administered well in advance of departure. In principle, the live attenuated and live recombinant vaccines should be avoided in pregnancy, and inactivated vaccine should be used instead. Rare, but serious, neurological adverse events attributed to inactivated mouse brain-derived vaccine have been reported, but no causal relationship has been confirmed. |

## Reference

1. Japanese Encephalitis Vaccines: WHO position paper. Wkly Epidemiol Rec. 2015;90:69–88 (https://www.who.int/publications/i/item/japanese-encephalitis-vaccines-who-position-paper).

## Further information

- For the observed rate of reactions to Japanese encephalitis vaccines, see Information sheet. Observed rate of vaccine reactions: Japanese encephalitis vaccine. Geneva: World Health Organization; 2016 (https://cdn.who.int/media/docs/default-source/pvg/global-vaccine-safety/je-vaccine-rates-information-sheet-jan-2016.pdf?sfvrsn=279e1105_4&download=true).
- For global disease distribution, see Japanese encephalitis [key facts]. Geneva: World Health Organization; 2024 (https://www.who.int/news-room/fact-sheets/detail/japanese-encephalitis).
- For vaccine information, see Immunization, Vaccines and Biologicals: Vaccine-preventable diseases [webpage]. Geneva: World Health Organization (https://www.who.int/teams/immunization-vaccines-and-biologicals/diseases).

# Malaria

| Summary of vaccine data *(1)* | | |
|---|---|---|
| | Type of vaccine | Two malaria vaccines, RTS,S/AS01 and R21/Matrix-M against *Plasmodium falciparum*, are WHO-prequalified and recommended for use in young children living in malaria-endemic areas.<br>These vaccines are not recommended for use in adults (including health workers and pregnant women).<br>The vaccine is not indicated for travellers, who should use chemoprophylaxis and vector control methods to prevent malaria when travelling to endemic settings. |
| | Number of doses: | The malaria vaccine should be provided in a schedule of four doses for children from around 5 months of age.<br>A fifth dose, given 1 year after dose 4, may be considered in areas where the malaria risk remains high in children a year after receiving dose 4. |
| | Contraindications | A hypersensitivity response to a previous dose of malaria vaccine or hepatitis B vaccines or to any of the vaccine components is a contraindication to vaccination with RTS,S/AS01 or R21/Matrix-M. |
| | Adverse reactions | Febrile seizures within 7 days (but mainly within 2–3 days) post-vaccination. In the clinical trials, these seizures resolved without long-term sequelae. |
| | Consider for | WHO recommends the use of malaria vaccines for the prevention of *P. falciparum* malaria in children living in malaria-endemic areas, prioritizing areas of moderate and high transmission.<br>It is not recommended for travellers. |
| | Special precautions | Travellers should note the five principles – the ABCDE – of malaria protection *(2)*:<br>Be **A**ware of the risk, the incubation period, the possibility of delayed onset, and the main symptoms.<br>Avoid being **B**itten by mosquitoes, especially between dusk and dawn.<br>Take antimalarial drugs (**C**hemoprophylaxis) when appropriate, at regular intervals to prevent acute malaria attacks.<br>Immediately seek **D**iagnosis and treatment if a fever develops 1 week or more after entering an area where there is a malaria risk and up to 3 months (or, rarely, later) after departure from a risk area.<br>Avoid outdoor activities during the evening or at night in **E**nvironments where malaria is endemic. |
| Cause | | *Plasmodium (P)* species such as *P. falciparum* and *P. vivax*. |
| Transmission | | *Plasmodium* species are transmitted by the bite of an infective female *Anopheles* mosquito. Occasionally, transmission occurs through blood transfusion, needle sharing, organ transplantation or from mother to fetus. |
| Nature of the disease | | Fever, headache and chills are the most common early symptoms of malaria. Symptoms usually start within 10–15 days of being bitten by an infective mosquito. Symptoms may be mild for some people, especially those who have had a malaria infection before. Because some malaria symptoms are not specific, early testing is important.<br>Malaria can progress rapidly from fever to severe illness and death, often within 24 hours of fever onset.<br>Some types of malaria can cause severe illness and death. Infants, children under 5 years, pregnant women, travellers, travellers visiting friends and relatives (VFR) and people with HIV or AIDS are at higher risk. |
| Geographical distribution | | Approximately 95% of malaria cases and deaths occur in sub-Saharan Africa, with the remainder occurring mainly in South-East Asia and South America. |

## **Malaria** Contd.

| | |
|---|---|
| Risk for travellers | Travellers going to malaria-endemic countries are at risk of contracting the disease, with the risk varying considerably from traveller to traveller and from region to region. Factors affecting the risk include intensity of transmission, duration, season, type of travel, use of prophylaxis and mosquito bite prevention.<br><br>The vaccine is not indicated for travellers, including travelling children, who should use chemoprophylaxis and vector control methods to prevent malaria when travelling to endemic settings. Chemoprophylaxis is the most reliable means to prevent malaria illness and death.<br><br>VFR, defined here as persons who currently reside in an area without malaria transmission but who return to their former home in an area with malaria transmission, should be counselled on the importance of taking malaria chemoprevention due to loss of acquired immunity when living outside a malaria-endemic area.<br><br>Travellers are advised to seek immediate care for fever that occurs from 10 days after arriving in a malarious area or during the first 3 months after leaving the malarious area. The traveller should immediately inform their medical provider that they have travelled to an area where malaria is endemic. |
| Vaccine | WHO recommends the use of malaria vaccine for the prevention of *P. falciparum* malaria in children living in malaria-endemic areas, prioritizing areas of moderate and high transmission. Two vaccines, RTS,S/AS01 and R21/Matrix-M, are recommended. Malaria vaccines have been shown to significantly reduce malaria, severe malaria and all-cause mortality among young children. |

### References

1. Malaria vaccine: WHO position paper – May 2024. Wkly Epidemiol Rec. 2024; 99:225–48 (https://www.who.int/publications/i/item/who-wer-9919-225-248).

2. International travel and health module 3 malaria. Geneva: World Health Organization; 2024 (https://iris.who.int/bitstream/handle/10665/379612/9789240102286-eng.pdf).

### Further reading

- Malaria: key facts [webpage]. Geneva: World Health Organization; 2024 (https://www.who.int/news-room/fact-sheets/detail/malaria).
- For vaccine information, see Immunization, Vaccines and Biologicals: Vaccine-preventable diseases [webpage]. Geneva: World Health Organization (https://www.who.int/teams/immunization-vaccines-and-biologicals/diseases).

## Measles

Summary of vaccine data *(1)*

| | |
|---|---|
| Type of vaccine | Several live attenuated measles vaccines are available, either as monovalent vaccine or in combination with rubella, mumps or varicella vaccines, or some combination of these. |
| Number of doses | Two doses usually injected subcutaneously, but are also effective when injected intramuscularly |
| Contraindications | Vaccination with a measles-containing vaccine (MCV) should be avoided if a person has a high fever or other signs of serious acute illness. Contraindications for MCVs include a history of anaphylactic reactions or severe allergic reactions to any component of the vaccine, pregnancy and immunosuppression (severe immunodeficiency; advanced HIV disease; advanced leukaemia or lymphoma; other serious malignant disease; treatment with high-dose steroids, alkylating agents or antimetabolites; treatment with immunosuppressive therapeutic radiation). |

## **Measles** Contd.

| | | |
|---|---|---|
| | Consider for | Prevention of measles for all susceptible children and adults, i.e. those who have not received two lifetime doses. Measles vaccine is routinely administered in childhood. Unvaccinated travellers should be given the vaccine according to national recommendations. |
| | Special precautions | MCVs should be avoided during pregnancy. No significant adverse outcomes for fetus or mother following vaccination of pregnant women have been reported. Inadvertent administration of measles vaccine during pregnancy is not a reason for terminating the pregnancy. |
| Cause | | Measles virus |
| Transmission | | Primarily by airborne respiratory droplets. The virus is highly contagious. |
| Nature of the disease | | Measles is characterized by fevers, cough, nasal congestion and a typical maculopapular rash. The disease tends to be more serious in older children and adults. In infants and in individuals with chronic diseases, impaired immunity or severe malnutrition, measles may be serious or even fatal. |
| Geographical distribution | | In the pre-vaccination era, measles epidemics occurred worldwide. Although measles is targeted for elimination in all regions, outbreaks continue to occur in countries or segments of populations with insufficient vaccination coverage (< 95%). In 2023, a total of 669 083 cases of measles were reported to WHO from all regions *(2)*. Even in high-income countries, complications result in hospitalization in up to 25% of cases and can lead to lifelong disability, ranging from brain damage and blindness to hearing loss. Recently, case numbers have spiked, including in countries with high overall vaccination coverage, as the disease has spread among clusters of unvaccinated people. |
| Risk for travellers | | Any non-immune traveller (i.e. anyone who has not been vaccinated with two doses of measles-containing vaccine) can become infected. Infected travellers may spread the disease to non-immune individuals.<br>Susceptible individuals travelling to measles-endemic areas are considered at risk of contracting measles. Vaccine should be offered to children from 6 months of age, as well as to adolescents and adults likely or known to be susceptible to measles. |
| Vaccine | | Live attenuated vaccine: available either in monovalent form (measles component only) or in fixed combinations with one or more of the vaccines against mumps, rubella and varicella. Two subcutaneous doses are administered at an interval of at least 4 weeks. Travellers who are uncertain of their measles vaccination status should receive at least one dose of measles vaccine. WHO recommends that travellers be vaccinated against measles at least 15 days before travel. It also recommends that infants from 6 months of age receive a supplementary dose of measles vaccine if they are travelling to countries experiencing measles outbreaks. Children aged 6–9 months of age who receive a supplementary dose of measles vaccine should also receive two doses of measles vaccine at the recommended ages according to the national immunization schedule. Measles vaccine can be administered at the same time as other vaccines recommended for travellers, such as yellow fever vaccine. |

### References

1. Measles vaccines: WHO position paper – April 2017. Wkly Epidemiol Rec. 2017;92(17):205–27 (https://www.who.int/publications/i/item/who-wer9217-205-227).

2. Measles reported cases and incidence [webpage]. Geneva: World Health Organization (https://immunizationdata.who.int/global/wiise-detail-page/measles-reported-cases-and-incidence?CODE=Global&YEAR=).

### Further information

- For vaccine information, see Immunization, Vaccines and Biologicals: Vaccine-preventable diseases [webpage]. Geneva: World Health Organization (https://www.who.int/teams/immunization-vaccines-and-biologicals/diseases).

# Meningococcal

| Summary of vaccine data *(1–3)* | | |
|---|---|---|
| | Type of vaccine | Polysaccharide vaccines that include four meningococcal serogroups (A, C, W and Y) are about to be supplanted by:<br>• Conjugate vaccines, available as monovalent (A or C/*Haemophilus influenzae* type B (Hib) combination) and multivalent (quadrivalent ACWY and pentavalent ACWYX vaccines).<br>• Recombinant protein-based vaccines against serogroup B infections are now available internationally and gradually being recommended for use either in routine infant vaccination or for age-based risk groups in several countries.<br>• Combination vaccines 5-in-1 (ABCWY), combining quadrivalent conjugate (ACWY) and protein-based (B) vaccines have now been licensed and are about to be recommended in specific countries. |
| | Number of doses | *For polysaccharide vaccines*: a single (usually subcutaneous) dose to individuals aged ≥ 2 years. A booster may be required after 3–5 years.<br>*For conjugate vaccines*: primary series of one to three intramuscular doses with subsequent boosters. The schedule depends on the vaccine as well as the age and immunological status of the vaccinee.<br>*For recombinant protein-based vaccines*: Although primary series of two to three intramuscular doses are now recommended in some countries, WHO has not yet formulated recommendations for national programmes. |
| | Contraindications | Severe allergic reaction to vaccine components |
| | Adverse reactions | Apart from transient local reactions, all meningococcal vaccines have an excellent safety record. However, a significant increase in fever and pain at the injection site has been noted for recombinant protein-based vaccines against serogroup B when compared with other vaccines. |
| | Before departure | Preferably given 10–14 days before travel to ensure protection at departure |
| | Consider for | Travellers from low-endemic regions visiting countries that are highly endemic for meningococcal disease. In Africa's meningitis belt, the risk of acquiring infection is greatest in the dry season. Travellers to *Hajj* and *Umrah*. |
| | Special precautions | None |
| Cause | | *Neisseria meningitidis* bacteria; in most cases serogroups A, B, C, W, X and Y |
| Transmission | | By direct person-to-person contact and through respiratory droplets from patients or asymptomatic meningococcal carriers. Human beings are the only reservoir. |
| Nature of the disease | | Endemic disease occurs primarily in children and adolescents, with the highest attack rates in children younger than 5 years of age.<br>Meningococcal meningitis is characterized by a sudden onset of fever, nausea, vomiting, photophobia, neck stiffness, intense headache and/or various neurological signs. Permanent neurological sequelae are common. The disease is fatal in 5–10% of cases and approximately one in five individuals who survive lives with a long-lasting disability. Meningococcal septicaemia is characterized by hypovolaemic shock, multi-organ failure and/or disseminated intravascular coagulation, haemorrhagic skin rash and a high fatality rate. |
| Geographical distribution | | Sporadic cases are found worldwide. In temperate zones, most cases occur in the winter months. Localized outbreaks occur under particular risk conditions, such as crowded areas, mining areas, mass gatherings such as religious or sport events, settings with refugees or displaced persons, closed institutions (e.g. dormitories and military barracks), and areas with high migration, such as high-traffic markets and border areas. 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 disappeared in all countries in which mass vaccination campaigns followed by routine vaccination with group A conjugate vaccine were implemented. Cases and outbreaks due to serogroups C, W and Y remain variable in their distribution over time and by country whereas serogroup X has further expanded in the African meningitis belt. Serogroup B is still predominant in the Americas, Australia and Europe. |

## **Meningococcal** Contd.

| | |
|---|---|
| Risk for travellers | The risk of meningococcal disease in travellers is generally low. Those travelling to high-income countries may be exposed to sporadic cases, mostly of B, C or W. Travellers to the sub-Saharan meningitis belt may be exposed to outbreaks, most commonly of serogroups C, W and X, with much higher incidence rates during the dry season. Long-term travellers living in close contact with the indigenous population and individuals joining mass gatherings, such as sports, youth (e.g. scout jamborees) or religious (e.g. pilgrims visiting Mecca for the *Hajj* or *Umrah*) events are at particular risk. |
| General precautions | Avoid overcrowded, confined spaces. After close contact with an individual with meningococcal disease, medical advice should be sought as soon as possible about possible chemoprophylaxis and vaccination. |
| Vaccines | *1) Polysaccharide vaccines*<br><br>Internationally marketed quadrivalent meningococcal polysaccharide vaccines provide serogroup-specific protection for 2–4 years in adults and children ≥ 2 years of age, after a single dose, usually subcutaneous. These vaccines have important limitations: no or poor and short-lived immunogenicity in infants and young children, due to poor antibody avidity and bactericidal activity; no induction of immune memory and poor response to booster; no effect on nasopharyngeal carriage of the bacteria and no induction of herd protection; and they can induce immunological hyporesponsiveness upon repeated vaccination. Therefore, they are now often replaced by conjugate meningococcal vaccines, which correct these shortcomings.<br><br>*2) Conjugate meningococcal vaccines*<br><br>Conjugate meningococcal vaccines, available as monovalent serogroup A or C/Hib combination, and multivalent (quadrivalent ACWY and pentavalent ACWYX) are serogroup-specific and highly immunogenic, eliciting adequate antibody responses and immunological memory even in infants.<br><br>A monovalent conjugated serogroup A meningococcal vaccine designed particularly for use in the African meningitis belt is licensed for single-dose vaccination of people aged 1–29 years.<br><br>Four quadrivalent conjugate vaccines against serogroups A, C, W and Y meningococci are now licensed internationally. They differ in the conjugate carrier protein, but all are administered intramuscularly and show similar immunogenicity. These vaccines are licensed for single-dose vaccination of people aged 2–55 years. In addition, these vaccines are given according to a one- or two-dose schedule for children aged 9–23 months and a three-dose schedule for infants.<br><br>Although quadrivalent 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.<br><br>A pentavalent meningococcal ACWYX conjugate vaccine, the first to include NmX, has been prequalified by WHO, with an indication for use in individuals aged ≥ 9 months and a WHO recommendation for routine use in national programmes of all countries in the sub-Saharan African meningitis belt.<br><br>*3) Recombinant protein-based vaccines*<br><br>Recombinant protein-based vaccines against serogroup B infections have been licensed internationally for use in infants and for adolescents and young adults, and primary series of two to three intramuscular doses are now recommended in some countries. However, their use is still mostly limited to certain high-risk individuals and particular outbreak situations and is not recommended for ordinary travellers. A combination vaccine 5-in-1 (ABCWY), combining quadrivalent conjugate (ACWY) and protein-based (B) vaccines has been licensed for use in adolescents 10–25 years of age and is about to be recommended in specific countries (a second such product is in the registration phase). There is no general recommendation to vaccinate travellers with these 5-in-1 combination vaccines. |
| Required vaccinations | Saudi Arabia requires proof of recent meningococcal vaccination (with a polysaccharide or conjugate quadrivalent vaccine) as a visa requirement for *Hajj* and *Umrah* pilgrims and people in close contact with the local population. See section 3 on Required vaccinations. |

## References

1. Meningococcal vaccines: WHO position paper – November 2011. Wkly Epidemiol Rec. 2011;86:521–540 (https://www.who.int/publications/i/item/WER8647).

2. Meningococcal A conjugate vaccine: updated guidance, February 2015. Wkly Epidemiol Rec. 2015;90:57–68 (https://www.who.int/publications/i/item/WHO-WER9008-57-62).

3. Meningococcal Vaccines: WHO Position paper on the use of multivalent meningococcal conjugate vaccines in countries of the African meningitis belt. Wkly Epidemiol Rec. 2024;99:1–10 (https://iris.who.int/bitstream/handle/10665/375623/WER9901_02-eng-fre.pdf?sequence=1).

## Further information

- Meningitis [key facts]. Geneva: World Health Organization; 2025 (https://www.who.int/news-room/fact-sheets/detail/meningitis).
- For vaccine information, see Immunization, Vaccines and Biologicals: Vaccine-preventable diseases [webpage]. Geneva: World Health Organization (https://www.who.int/teams/immunization-vaccines-and-biologicals/diseases).

# Mpox

| Summary of vaccine data *(1)* | | |
|---|---|---|
| | Type of vaccine | Live vaccinia virus-containing vaccines: ACAM2000 (second-generation smallpox vaccine), MVA-BN (non-replicating) and minimally replicating LC16m8 vaccine |
| | Number of doses | *ACAM2000* should be administered as a single dose using the scarification method with a bifurcated needle.<br>*MVA-BN* should be administered as a two-dose subcutaneous injection given 4 weeks apart.<br>*LC16m8* should be administered as a single dose using the scarification method with a bifurcated needle. |
| | Contraindications | ACAM2000 is contraindicated for use in infants, pregnant women and immunocompromised individuals.<br>MVA-BN is not licensed for use in children under the age of 12 years *(2)*. However, this vaccine may be used off-label in infants, children and adolescents when the benefits of vaccination outweigh the potential risks in the context of an outbreak. Available human data on MVA-BN administered to pregnant women are insufficient to determine vaccine-associated risks in pregnancy.<br>The effectiveness of LC16m8 vaccine has not been studied in children. No data are available for assessing the risk of its use during pregnancy.<br>For immunocompromised individuals, minimally replicating (LC16m8) vaccine is contraindicated. Instead, non-replicating vaccine (MVA-BN) should be used. |
| | Adverse reactions | ACAM2000 and MVA-BN: local and systemic adverse events and some rare cases of myocarditis<br>LC16m8: erythema, induration and lymphadenopathy are frequently reported. |
| | Consider for | Vaccination is recommended for people, including travellers, at high risk of exposure to mpox in an outbreak. |
| | Special precautions | Replicating and minimally replicating smallpox and mpox vaccines should not be administered during pregnancy, to individuals with advanced immunodeficiency or severe immunosuppression or to individuals with skin conditions such as atopic dermatitis. Replicating vaccine such as ACAM2000 should not be used in infants. Allergy to vaccine components is a contraindication to administration of the vaccine. |
| | | Mpox is a viral illness caused by the monkeypox virus, a species of the genus *Orthopoxvirus*. Two different clades exist: clade I and clade II, both of which have further evolved into subclades. |
| Cause | | Mpox virus (MPXV) of the *Orthopoxvirus* genus |

## **Mpox** Contd.

| | |
|---|---|
| Transmission | MPXV can be transmitted through contact with infected animals (bites, scratches, animal body fluids or consumption of insufficiently processed animal meat) or through close human-to-human contact. Human-to-human transmission generally requires direct skin-to-skin contact or prolonged close contact, such as being face-to-face in close proximity, or indirect contact with materials (fomites) such as contaminated sharps or bed linen. |
| Nature of the disease | The initial phase of clinical illness typically lasts 1–5 days and is marked by symptoms such as fever, headache, back pain, muscle aches, lack of energy and lymphadenopathy, which is a characteristic sign of the disease. Subsequently, a second phase ensues, typically within 1–3 days after the fever subsides, characterized by the onset of a rash. Typically, the rash presents in sequential stages: macules, papules, vesicles and pustules followed by umbilication before eventually forming crusts and desquamating over a period of 2–3 weeks. However, mpox can also present as a less severe illness, with fewer or less widely disseminated lesions, the appearance of lesions before symptoms, or appearance of lesions in different stages of development.<br><br>People with mpox may be infectious from the onset of any symptom until all scabs have fallen off. |
| Geographical distribution | Globally, with zoonotic transmission confined to Africa. |
| Risk for travellers | Mpox can be prevented by avoiding physical contact with someone who has mpox. Vaccination can help prevent infection for people at risk. |
| Vaccine | MVA-BN was approved in 2013 for the prevention of smallpox in Canada and the European Union (EU) in people ≥ 18 years of age.<br><br>In 2019, MVA-BN was approved for the prevention of smallpox and mpox in adults in the United States. In the same year, Canada extended the indication for MVA-BN to mpox. In 2022, the United States granted emergency use authorization for the use of MVA-BN in persons under 18 years of age.<br><br>On 22 July 2022, the EU approved the indication of MVA-BN for the prevention of mpox in adults. In September 2024, the EU approved the use of MVA-BN for the prevention of mpox for individuals aged ≥ 12 years.<br><br>MVA-BN is the first vaccine against mpox to be WHO-prequalified for adults and adolescents aged 12 years and older.<br><br>In Japan, LC16m8 was licensed in 1975 for smallpox, without age restriction, and the indication was extended for the prevention of mpox in August 2022. As of 19 November 2024, LC16m8 received WHO Emergency Use Listing for individuals aged ≥ 1 year.<br><br>ACAM2000 is approved by the United States Food and Drug Administration for immunization against smallpox and is made available for use against mpox under an Expanded Access Investigational New Drug protocol.<br><br>Non-replicating vaccines (e.g. MVA-BN), minimally replicating vaccines (e.g. LC16m8), replicating cell-culture derived vaccinia-based vaccines (e.g. ACAM2000), or equivalent vaccines that meet WHO standards for quality, may be used in immunocompetent non-pregnant adults. |

## References

1. Smallpox and mpox (orthopoxviruses): WHO position paper, August 2024. Wkly Epidemiol Rec. 2024; 99: 429–56 (https://www.who.int/publications/i/item/who-wer-9934-429-456).

2. EMA recommends extending indication of mpox vaccine to adolescents. Amsterdam: European Medicines Agency (EMA); 2024 (https://www.ema.europa.eu/en/news/ema-recommends-extending-indication-mpox-vaccine-adolescents).

## Further information

- For vaccine information, see Immunization, Vaccines and Biologicals: Vaccine-preventable diseases [webpage]. Geneva: World Health Organization (https://www.who.int/teams/immunization-vaccines-and-biologicals/diseases).

# Mumps

| Summary of vaccine data *(1)* | | |
|---|---|---|
| | Type of vaccine | Live attenuated vaccines available as monovalent vaccines, bivalent measles–mumps (MM) vaccines, trivalent measles–mumps–rubella (MMR) vaccines and quadrivalent measles–mumps–rubella–varicella (MMRV) vaccines<br>MMR and MMRV vaccines are those most widely used. |
| | Number of doses | Two doses either intramuscularly or subcutaneously |
| | Contraindications | Severe allergic reaction to vaccine components. Live attenuated vaccines such as mumps-containing vaccines should be avoided during pregnancy as a precautionary measure; however, the administration of MMR is not an indication for terminating a pregnancy as there is no evidence of harm to the fetus. |
| | Adverse reactions | Adverse reactions to mumps-containing vaccines are rare and mild. |
| | Consider for | Travellers are generally not at special risk of mumps unless they travel to an endemic country or outbreak setting. They should follow the vaccine recommendations for the general population and ensure that they are up to date with their vaccinations before travelling. Since vaccination against mumps is usually provided as MMR or MMRV vaccines, travellers should follow the WHO recommendations for measles. |
| | Special precautions: | MMR and yellow fever vaccine should be given 30 days apart, if not given on the same day, to prevent mutual interference with the immune response to each vaccine. |
| Cause | | Mumps virus |
| Transmission | | Droplets from the upper respiratory tract of infected individuals. |
| Nature of the disease | | Mostly a mild disease of children, characterized by transient swelling of the salivary glands. The mumps virus can also infect adolescents and adults, and, when it does, complications are more likely to be serious. Complications of mumps can include meningitis (in ≤ 15% of cases), orchitis and deafness. |
| Geographical distribution | | After the introduction of wide-scale vaccination, endemic transmission of mumps stopped in many industrialized countries. Outbreaks still occur in countries or segments of populations, in particular in close-contact settings and in settings with insufficient vaccination coverage. Outbreaks have also been reported in fully or partially vaccinated populations. |
| Risk for travellers | | For non-immune travellers from areas with limited transmission, the risk of exposure to mumps virus is increased in an environment of insufficient vaccination coverage. |
| Vaccine | | Live attenuated vaccine, normally in fixed combination with vaccines against rubella and measles, or rubella, measles and varicella. The vaccine is efficacious and safe. After primary immunization (two doses in children aged 1–2 years), protection against mumps is likely to extend into adulthood. |

## Reference

1. Mumps virus vaccines: WHO Position Paper, March 2024. Wkly Epidemiol Rec. 2024;99:115–33 (https://www.who.int/publications/i/item/who-wer-9911-115-133).

## Further information

- For vaccine information, see Immunization, Vaccines and Biologicals: Vaccine-preventable diseases [webpage]. Geneva: World Health Organization (https://www.who.int/teams/immunization-vaccines-and-biologicals/diseases).

# Pneumococcal vaccines

| Summary of vaccine data *(1)* | | |
|---|---|---|
| | Type of vaccine | Pneumococcal polysaccharide vaccine (PPV23) and pneumococcal conjugate vaccines (PCV) of different valencies are available. |
| | Number of doses | Possible options for PCVs during infancy:<br>Three primary doses at an interval of at least 4 weeks (3p+0 schedule)<br>Two primary doses at an interval of at least 8 weeks, plus a booster dose at 9–18 months of age (2p+1 schedule)<br>For older adults:<br>Countries may consider using one dose of PPV23 or PCV *(2)*. |
| | Contraindications | PCVs should not be given to individuals with a history of anaphylactic reactions or severe allergic reactions to any component of the vaccine. |
| | Adverse reactions | Adverse reactions include redness at the injection site and irritability in infants. |
| | Consider for | Infants as part of the routine immunization schedule and older adults and travellers with chronic illnesses or immunosuppression |
| | Special precautions | Intervals between administering PCVs and PPSV23 differ by age and risk group. |
| Cause | | Many serotypes of the bacterium *Streptococcus pneumoniae* (pneumococcus). |
| Transmission | | Respiratory droplets containing *S. pneumoniae*. |
| Nature of the disease | | Pneumococcus can cause invasive and non-invasive disease. The most common non-invasive pneumococcal infections include diseases of the upper respiratory tract and non-bacteraemic pneumonia. Pneumonia with empyema and/or bacteraemia, febrile bacteraemia and meningitis are the commonest manifestations of invasive pneumococcal infection. Resistance of these bacteria to commonly used antibiotics is of increasing concern. Both non-bacteraemic pneumonia and invasive pneumococcal infections are associated with considerable mortality, particularly in young children and older and immunodeficient individuals. |
| Geographical distribution | | Worldwide |
| Risk for travellers | | Paediatric vaccination with PCV is universally recommended. Before children < 2 years of age and children and adults considered to be at particular risk of serious disease travel to countries with limited access to modern health care facilities, they should be advised to be vaccinated against invasive pneumococcal disease. |
| Vaccines | | • Conjugate vaccines that include 10 (PCV10) or 13 (PCV13) pneumococcal serotypes. These PCVs are safe and effective and may be given either as two doses plus a booster, or as three doses without a booster from the age of 6 weeks. PCV10 and PCV13 are licensed for vaccination against invasive disease, pneumonia and acute otitis media caused by the respective vaccine serotypes of *S. pneumoniae*. PCV13 is also licensed for adults.<br>• A pneumococcal polysaccharide vaccine that contains 23 serotypes (PPV23). This vaccine is licensed for individuals aged ≥ 2 years. It is safe, although its efficacy and effectiveness in children and adults remain poorly defined. |

## References

1. WHO position papers on Pneumococcus [webpage]. Geneva: World Health Organization (https://www.who.int/teams/immunization-vaccines-and-biologicals/policies/position-papers/pneumococcus).

2. Considerations for pneumococcal vaccination in older adults. Wkly Epid Rec. 2021;23:217–28 (https://iris.who.int/bitstream/handle/10665/341722/WER9623-217-228-eng-fre.pdf?sequence=1).

## Further information

- For the observed rate of reactions to pneumococcal vaccines, see Information sheet. Observed rate of vaccine reactions: pneumococcal vaccine (https://cdn.who.int/media/docs/default-source/pvg/global-vaccine-safety/pneumococcal-vaccine-rates-information-sheet.pdf).
- For vaccine information, see Immunization, Vaccines and Biologicals: Vaccine-preventable diseases [webpage]. Geneva: World Health Organization (https://www.who.int/teams/immunization-vaccines-and-biologicals/diseases).

# Polio

| Summary of vaccine data *(1)* | | |
|---|---|---|
| | Type of vaccine | Orally administered, live attenuated polio vaccine (OPV) and inactivated poliovirus vaccine (IPV) for intramuscular (or subcutaneous) injection |
| | Number of doses | The primary series consists of three doses of OPV plus one of IPV. In countries at high risk of importation and subsequent spread of poliovirus, WHO also recommends an OPV dose at birth ("zero dose"). Provided that there is a low risk of importation and a high rate of vaccination coverage, routine vaccination with IPV followed by OPV can be used. Routine vaccination with IPV alone is recommended only in countries with immunization coverage > 90% and a low risk of wild poliovirus importation. WHO no longer recommends an OPV-only vaccination schedule. |
| | Contraindications | Severe allergy to vaccine components |
| | Adverse reactions | The only serious adverse events associated with OPV are the rare occurrence of vaccine-associated paralytic poliomyelitis and the emergence of vaccine-derived polioviruses. OPV may safely be administered to pregnant women and HIV-infected people. |
| | Before departure | Travellers from polio-free to polio-endemic countries should have completed the full series of polio vaccinations according to their national immunization schedule. Missed polio vaccinations should be administered to ensure that travellers are fully vaccinated. It is particularly important that people living in countries with active transmission of poliovirus (including vaccine-derived virus) be fully vaccinated. In addition, travellers from such countries should receive a dose of OPV or IPV at least 4 weeks before (and within 12 months of) departure. |
| | Special precautions | All travellers are advised to carry their written vaccination record (patient-retained record) in case evidence of polio vaccination is requested for entry into countries. Travellers should preferably use the International Certificate of Vaccination or Prophylaxis, which is available from the WHO website *(2)*.<br>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. |
| Cause | | Polioviruses |
| Transmission | | Polioviruses are spread predominantly by the faecal–oral route, although transmission by the oral–oral route may also occur. |
| Nature of the disease | | Poliomyelitis, also known as polio or infantile paralysis, is a disease of the central nervous system. After primary asymptomatic infection of the alimentary tract by poliovirus, paralytic disease develops in < 1% of cases. In low-income countries, 65–75% of cases occur in children < 3 years of age and 95% in children < 5 years. The resulting paralysis is permanent, although some recovery of function is possible. There is no cure. |
| Geographical distribution | | Worldwide, sustained use of polio vaccines since 1988 has led to a > 99% drop in the global incidence of poliomyelitis, and the number of countries with endemic polio has fallen from 125 to 2 (Afghanistan and Pakistan). 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. |

## **Polio** Contd.

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|---|---|
| Risk for travellers | Until the disease has been certified as eradicated globally, the risks of acquiring polio (for unvaccinated travellers to infected areas) and of reinfection of polio-free areas (by unvaccinated travellers from infected areas) remain. All travellers to and from countries and areas infected by wild poliovirus or vaccine-derived polioviruses should be adequately vaccinated. Updates on currently or recently infected countries can be found on the website of the Global Polio Eradication Initiative *(3)*. |
| Vaccines | Both OPV and IPV for intramuscular (or subcutaneous) injection are widely used internationally. IPV is considered very safe, and, although OPV is a live attenuated vaccine, it may safely be administered to pregnant women and HIV-infected people. A rare adverse event associated with OPV is vaccine-associated paralytic poliomyelitis, which occurs once in about 2.4 million doses.<br><br>Before travelling to areas with active poliovirus transmission, people from polio-free countries should ensure that they have completed the age-appropriate polio vaccination series, according to their respective national immunization schedules. Travellers to polio-infected areas who completed an OPV or IPV vaccine series > 12 months previously should be given another booster dose of polio vaccine. Travellers to polio-infected areas who have not received any polio vaccine previously should complete a primary schedule of polio vaccination before departure.<br><br>Before travelling abroad, people of all ages who reside in polio-infected countries (i.e. those with active transmission of a wild or vaccine-derived poliovirus) and long-term visitors to such countries (i.e. people who spend more than 4 weeks in the country) should have completed a full course of vaccination against polio in compliance with the national schedule. Travellers from infected areas should receive an additional dose of OPV or IPV within 4 weeks to 12 months of travel in order to boost intestinal mucosal immunity and reduce the risk of poliovirus shedding, which could lead to reintroduction of poliovirus into a polio-free area. For people who previously received only IPV, OPV should be preferentially given as the booster dose, if available and feasible. In case of unavoidable last-minute travel, travellers who have not received a documented dose of polio vaccine within the previous 12 months should still receive one dose of OPV or IPV before departure.<br><br>Some polio-free countries require long-term visitors (longer than 4 weeks) 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. |

## References

1. Polio vaccines: WHO position paper – June 2022 Weekly Epidemiological Record, 2022, vol. 97

2. WHO. International Health Regulations (2005), third edition. Geneva: World Health Organization, 2016 (https://apps.who.int/iris/handle/10665/246107 (Annex 6)

3. Updates on currently or recently infected countries can be found on the website of the Global Polio Eradication Initiative

## Further information

- For the observed rate of reactions to polio vaccines, see Information sheet. Observed rate of vaccine reactions: Polio vaccines (https://cdn.who.int/media/docs/default-source/pvg/global-vaccine-safety/polio-vaccine-rates-information-sheet.pdf?sfvrsn=79c1135a_4&download=true).
- For vaccine information, see Immunization, Vaccines and Biologicals: Vaccine-preventable diseases [webpage]. Geneva: World Health Organization (https://www.who.int/teams/immunization-vaccines-and-biologicals/diseases).

# Rabies

**Pre-exposure vaccination**

(For information on post-exposure vaccination, see below.)

| | |
|---|---|
| Type of vaccine | Inactivated cell-culture or embryonated-egg vaccine |
| Number of doses | Pre-exposure vaccination: Two doses, one each on days 0 and 7, given intramuscularly (1.0 or 0.5 mL/dose depending on the vaccine brand) or intradermally (0.1 mL/injection site) |
| Boosters | Not routinely required for general travellers |
| Contraindications | Severe allergy to components of the vaccine |
| Adverse events | Minor local or systemic reactions |
| Before departure | Start pre-exposure prophylaxis (PrEP) at least 1 week before departure to an area of high risk, especially if the destination is far from centres that can provide appropriate care. |
| Consider for | People planning to visit high-risk areas |
| Special precautions | Travellers should avoid contact with free-roaming animals, especially dogs and cats and with free-ranging or captive wild animals. They should not handle bats. Wild animals, particularly monkeys, will bite when people feed them or handle their food and when threatened, cornered or trapped. |

| | |
|---|---|
| Cause | Lyssaviruses |
| Transmission | Rabies is a zoonotic disease that affects domestic and wild mammals. Human infection occurs from bites of infected animals (usually dogs) and occasionally via penetrating scratches or licking of broken skin and mucosa. Domestic dogs, wild carnivore species and bats (*Carnivora* and *Chiroptera*) present a higher risk for rabies transmission than other mammals, as they are the reservoirs of the virus. The transmission risk should be evaluated in the context of the local epidemiology. Infected animals may not appear rabid. Laboratory-confirmed person-to-person transmission has not been reported other than through organ transplant. |
| Nature of the disease | Rabies is an acute, invariably fatal viral encephalitis. Initial signs include apprehension, headache, fever, malaise and sensory changes around the bite area. Excitability, hallucinations and abnormal fear of draughts 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. The majority of the estimated 59 000 deaths from rabies per year occur in Africa and Asia and 80% of these deaths occur in rural areas. |
| Risk for travellers | Assessment of individual risk of exposure to rabies virus is recommended for travellers. It should take into consideration: the remoteness of the destination, the prevailing rabies epidemiology and the cumulative duration of the stay(s) in endemic setting(s).<br><br>In both no- and low-risk areas, proper medical care, rabies vaccine and immunoglobulins should be accessible in a timely manner. Reliable, laboratory-based surveillance of domestic, reservoir and wild species should also be available.<br><br>The risk to humans should be assessed according to which countries they plan to visit *(1)*. The level of risk is based on: the presence of animal species in which lyssaviruses are maintained (e.g. dogs, bats or other wildlife), the availability of reliable laboratory-based surveillance data on these species, access to proper medical care and the availability of modern rabies vaccines. In countries or areas belonging to risk levels 2–4 (see below), PrEP against rabies is recommended for travellers with certain characteristics. The country risk levels are:<br><br>*Level 1*: no risk. No PrEP |

# **Rabies** Contd.

*Level 2*: low risk

In both, no- and low-risk areas, proper medical care, rabies vaccine and immunoglobulins should be accessible in a timely manner. Data from reliable, laboratory-based surveillance of domestic, reservoir and wild species should also be available. In countries in category 2 (low risk), PrEP should be offered to travellers involved in activities that are likely to bring them into direct contact with bats and wild carnivores. Such travellers include wildlife professionals, cavers, spelunkers, researchers, veterinarians and those visiting areas where bats and wild carnivores are commonly found. For people who regularly visit caves inhabited by bats, casual exposure to cave air is not a concern, but cavers should be warned not to handle bats.

*Levels 3 and 4*: medium and high risk

In medium- and high-risk areas, access to proper medical care, rabies vaccines and immunoglobulins depends on the local setting. Timely access is not guaranteed everywhere because of a short supply of recent rabies vaccines or the local availability of older-generation rabies vaccines, which are no longer recommended by WHO. Partial laboratory-based surveillance data may be available but may not cover all reservoir species or geographical settings in the country. PrEP should therefore be considered for travellers who will undertake considerable outdoor activities in remote rural areas or activities that lead to probable contact with bats. PrEP is also recommended for people with occupational risks, such as veterinarians, dog vaccinators and laboratory staff, and for expatriates living in remote areas with a significant risk of exposure to rabid domestic animals, particularly dogs, bats and wild carnivores.

Vaccine

Vaccination against rabies is used to:

- protect those at high risk of rabies exposure (PrEP); or
- prevent development of clinical rabies after suspected exposure (post-exposure prophylaxis (PEP)).

The vaccination schedules for the two uses differ, with the addition of rabies immunoglobulins for PEP. Recent inactivated vaccines are considered safe and effective and are available in major urban centres in most low-income countries. Rabies immunoglobulin may be unavailable, even in major urban centres, where canine rabies is prevalent.

***Pre-exposure vaccination***

Pre-exposure vaccination is recommended for people living in or travelling to countries classified by WHO as risk levels 2–4, as specified above. Children in regions of low-income countries enzootic for rabies have a higher risk of contracting rabies because of their size and behaviour (e.g. playing with animals, not reporting exposure).

In 2018, WHO updated its position on rabies vaccination to recommend regimens that are more cost-, dose- and time-sparing *(1)*. However, previous regimens are still valid. Pre-exposure rabies vaccination consists of two full intramuscular doses of inactivated vaccine, the first given on day 0 and the second dose at the earliest on day 7 (a delay in administration of the second dose for up to 28 days is acceptable). For adults and children aged ≥ 2 years, the vaccine should always be administered in the deltoid area of the arm; for children aged < 2 years, the anterolateral area of the thigh is recommended. Rabies vaccine should never be administered in the gluteal area as this results in lower neutralizing antibody titres.

Intradermal vaccination at doses of 0.1 mL on days 0 and 7 is less costly but requires appropriately trained staff and qualified medical supervision. Both the intradermal and the intramuscular route of vaccine administration can be used, but, as with other co-administered drugs, pre-exposure vaccination should be completed before chloroquine or hydroxychloroquine treatment is initiated. Receiving treatment with chloroquine or hydroxychloroquine is not a contraindication for rabies vaccination.

In case of a time constraint, a single pre-exposure rabies vaccination of one intramuscular dose or two intradermal doses will probably confer some protection for up to 1 year. Those who have received a pre-exposure rabies vaccination only on day 0 should receive a second dose as soon as possible and within 1 year.

# **Rabies** Contd.

| | |
|---|---|
| | Periodic booster injections are not recommended for general travellers. In the event of exposure through a bite or scratch by an animal known or suspected of being rabid, individuals who have previously received a complete series of pre- or at least two sessions of post-exposure rabies vaccine (with cell-culture or embryonated-egg-derived vaccine) are considered immunized and should receive two booster doses of vaccine either intramuscularly or intradermally. The first dose should ideally be administered on the day of exposure or as soon as possible afterwards and the second 3 days later. Alternatively, four intradermal doses should be given on the day of exposure or the first visit. This should be combined with thorough wound treatment (see PEP, below). Rabies immunoglobulin is not required for patients who have previously attended at least two vaccination sessions.<br>***Post-exposure vaccination***<br>A traveller suspected of being in contact with rabies in areas at risk of rabies may require PEP. In this situation, immediate medical advice should be obtained.<br>The category of exposure determines the PEP procedure indicated:<br>Category I: touching or feeding animals, animal licks intact skin (no exposure);<br>Category II: nibbling of uncovered skin, minor scratches or abrasions without bleeding (exposure);<br>Category III: single or multiple transdermal bites or scratches, contamination of mucous membrane or broken skin with saliva from animal licks, exposures due to direct contact with bats (severe exposure).<br>Indications for PEP depend on the type of contact with the confirmed or suspected rabid animal (see Table 2).<br>Strict adherence to the WHO-recommended guidelines for optimal PEP virtually guarantees protection from the disease. Administration of vaccine, and immunoglobulin if required, must be conducted by, or under the direct supervision of, a physician. |
| Precautions and contraindications | Modern rabies vaccines are highly purified and well tolerated. Mild systemic adverse events following vaccination, such as transient fever, headache, dizziness and gastrointestinal symptoms, have been observed in 5–15% of vaccinees. Serious adverse events after vaccination occur seldom, and no causality has been established in cases of neurological symptoms. |

Credit: WHO / Harrison Thane
Children at State Elementary School 24 on Pala Island, South Sulawesi, Indonesia, raise their hands to answer a question during a health and immunization outreach session. 27 September 2024.

## Table 2. Type of contact, exposure and recommended post-exposure prophylaxis (PEP)[a]

| | Category I exposure<br>touching or feeding animals, animal licks intact skin (no exposure) | Category II exposure<br>nibbling of uncovered skin, minor scratches or abrasions without bleeding (exposure) | Category III exposure<br>single or multiple transdermal bites or scratches, contamination of mucous membrane or broken skin with saliva from animal licks, exposures due to direct contact with bats (severe exposure) |
|---|---|---|---|
| Immunologically naive individuals of all age groups | Washing of exposed skin surfaces.<br>No PEP required | Wound washing and immediate vaccination:<br>• Two sites ID on days 0, 3 and 7[b]<br>**or**<br>• One site IM on days 0, 3, 7 and between days 14 and 28[c]<br>**or**<br>• Two sites IM on days 0 and one site IM on days 7 and 21[d]<br>RIG is not indicated. | Wound washing and immediate vaccination<br>• Two sites ID on days 0, 3 and 7[b]<br>**or**<br>• One site IM on days 0, 3, 7 and between days 14 and 28[c]<br>**or**<br>• Two sites IM on days 0 and one site IM on days 7 and 21[d]<br>RIG administration is recommended. |
| Previously vaccinated individuals of all age groups | Washing of exposed skin surfaces<br>No PEP required | Wound washing and immediate vaccination:[e]<br>• One site ID on days 0 and 3<br>**or**<br>• At four sites ID on day 0<br>**or**<br>At one site IM on days 0 and 3<br>RIG is not indicated. | Wound washing and immediate vaccination:[e]<br>• One site ID on days 0 and 3<br>**or**<br>• At four sites ID on day 0<br>**or**<br>At one site IM on days 0 and 3<br>RIG is not indicated. |

Category II and III exposures require human rabies vaccination.

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

[a] Wound treatment: The wound should be thoroughly washed for 15 minutes with soap or detergent and water, followed by application of ethanol or an aqueous solution of iodine or povidone. Depending on the characteristics of the wound, antibiotics, analgesics and a tetanus vaccination may be indicated.
[b] One-week, two-site ID regimen (Institut Pasteur of Cambodia regimen; 2-2-2-0-0); duration of entire PEP course: 7 days.
[c] Two-week IM PEP regimen (four-dose Essen regimen; 1-1-1-1-0); duration of entire PEP course: 14–28 days.
[d] Three-week IM PEP regimen (Zagreb regimen; 2-0-1-0-1); duration of entire PEP course: 21 days.
[e] Immediate vaccination is not recommended if complete PEP was received within < 3 months.

## Passive immunization

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

*Dosage and administration:* The dose of equine rabies immunoglobulin and F(ab')2 products is 40 IU/kg body weight, and that of human rabies immunoglobulin is 20 IU/kg body weight. The full dose of rabies immunoglobulin, or as much as is anatomically feasible, should be administered into and around the wound site(s). The remaining immunoglobulin dose may be given to other patients, after aseptic retention. This practice is particularly useful if immunoglobulin is in short supply. Skin testing before administration of equine immunoglobulin product has been abandoned as it does not reliably predict adverse effects. Multiple needle injections into the wound should be avoided. If the correct dose of rabies immunoglobulin is too small to infiltrate all wounds, as might occur in a severely bitten individual, it can be diluted in physiological saline to ensure greater wound coverage. Suturing of wounds should be delayed after immunoglobulin infiltration, or, if unavoidable, sutures should be loose to allow optimal immunoglobulin diffusion.

## Active immunization

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

## Recommended intramuscular regimens

### Immunologically naive individuals

Four-dose regimen administered on days 0, 3 and 7 and the last dose between days 14 and 28 into the deltoid muscle.

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

### Previously vaccinated individuals

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

## Recommended intradermal regimens

### Immunologically naive individuals

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

### Previously vaccinated individuals

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

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

## References

1. Rabies vaccines: WHO position paper – April 2018. Wkly Epidemiol Rec. 2018;93:201–20 (https://www.who.int/publications/i/item/who-wer9316).

2. The Global Health Observatory. Rabies [webpage]. Geneva: World Health Organization (https://www.who.int/data/gho/data/themes/topics/rabies).

## Further information

- For the observed rate of reactions to rabies vaccines, see Information sheet. Observed rate of vaccine reactions: Rabies vaccine. Geneva: World Health Organization; 2012 (https://cdn.who.int/media/docs/default-source/pvg/global-vaccine-safety/rabies-vaccine-rates-information-sheet.pdf?sfvrsn=444396ae_4&download=true).
- For global disease distribution, please see The Global Health Observatory: Rabies [webpage]. Geneva: World Health Organization (https://www.who.int/data/gho/data/themes/topics/rabies
- For vaccine information, see Immunization, Vaccines and Biologicals: Vaccine-preventable diseases [webpage]. Geneva: World Health Organization (https://www.who.int/teams/immunization-vaccines-and-biologicals/diseases).

# Rotavirus

| Summary of vaccine data | | |
|---|---|---|
| | Type of vaccine | Live, oral, attenuated rotavirus strains of human and/or animal origin that replicate in the human intestine to elicit an immune response.<br>RotaTeq® is a pentavalent vaccine that contains five reassortant rotaviruses.<br>ROTARIX is a monovalent vaccine originating from a G1P[8] strain.<br>ROTAVAC® is a monovalent vaccine containing rotavirus strain 116E grown in Vero cells.<br>ROTASIIL is a pentavalent vaccine containing five single gene (VP7) substitution reassortants between human strains G1, G2, G3, G4, G9 and the bovine United Kingdom strain (a G6P[5] strain). |
| | Number of doses | RotaTeq®, ROTAVAC® and ROTASIIL should be administered in a three-dose schedule, while a two-dose schedule should be used for ROTARIX *(1)*. |
| | Contraindications | Contraindications for using rotavirus vaccines are severe hypersensitivity to any of their components and severe immunodeficiency including severe combined immunodeficiency. Vaccination may be postponed in the case of ongoing acute gastroenteritis or fever with moderate to severe illness. For all four rotavirus vaccines, a prior history of intussusception is a contraindication for vaccination. |
| | Consider for | Infants should receive rotavirus vaccine according to their national schedule. In countries where infants are routinely vaccinated against rotavirus infections and in cases of incomplete or missed vaccination, vaccination should be offered according to the age of the child and national recommendations. |
| | Special precautions | Post-licensure evaluations of rotavirus vaccines have found intussusception risk to vary by vaccine and study location. |
| Cause | | Strains of highly contagious rotaviruses |
| Transmission | | Mainly by the faecal–oral route and by direct or indirect contact |
| Nature of the disease | | Rotavirus infection is characterized by watery diarrhoea, vomiting and fever, mainly in children aged < 2 years. Severe cases may require rapid rehydration therapy, especially in young infants. |
| Geographical distribution | | Worldwide: rotavirus infection is a leading cause of dehydrating diarrhoea, but fatal outcomes occur predominantly in low-income countries. |
| Risk for travellers | | Unvaccinated children < 2 years of age are likely to be at increased risk of rotavirus infection. Because of the typical age distribution of rotavirus gastroenteritis, rotavirus vaccination of individuals > 24 months of age is not recommended. |
| Vaccines | | When administered according to the respective national recommendations (or the schedule of routine vaccination against diphtheria, tetanus and pertussis), these vaccines are effective and safe. |

## Reference

1. Rotavirus vaccines: WHO position paper – July 2021. Wkly Epidemiol Rec. 96(28):301–19 (https://www.who.int/publications/i/item/WHO-WER9628).

## Further information

- For the observed rate of reactions to rotavirus vaccines, see Observed rate of vaccine reactions: Rotavirus vaccine. Geneva: World Health Organization; 2018 (https://cdn.who.int/media/docs/default-source/pvg/global-vaccine-safety/rotavirus-vaccine-rates-information-sheet-0618.pdf?sfvrsn=fdd3cc44_4).
- For vaccine information, see Immunization, Vaccines and Biologicals: Vaccine-preventable diseases [webpage]. Geneva: World Health Organization (https://www.who.int/teams/immunization-vaccines-and-biologicals/diseases).

# Rubella

| Summary of vaccine data | | |
|---|---|---|
| | Type of vaccine | Live attenuated rubella vaccines are available in combination with measles, mumps and varicella (measles and rubella (MR), measles, mumps and rubella (MMR), and measles, mumps, rubella and varicella (MMRV)) and also in a monovalent formulation. |
| | Number of doses | Two doses *(1)* |
| | Contraindications | In principle, because of a theoretical (but never demonstrated) risk of teratogenic outcomes, pregnancy is a contraindication to vaccination.<br>Severe allergic reactions to a previous dose or to a component of the vaccine are other contraindications to rubella-containing vaccines. |
| | Consider for | In most countries, rubella vaccine is routinely administered in childhood. Travellers going to areas with rubella who have not been vaccinated can be infected. |
| | Special precautions | It is recommended not to provide the vaccine to people with active tuberculosis or severe immunodeficiency (including individuals with symptomatic HIV infection, AIDS, congenital immune disorders, malignancies or who are undergoing aggressive immunosuppressive therapy). Rubella vaccination should be avoided in pregnancy because of a theoretical (but never demonstrated) risk of teratogenic outcomes. |
| Cause | | Rubella virus |
| Transmission | | Primarily by respiratory droplets |
| Nature of the disease | | Rubella is usually a mild childhood disease characterized by moderate fever, lymphadenopathy and a rash. In adults, transient arthralgia and arthritis may occur. Rubella infection in early pregnancy often results in miscarriage, stillbirth or multiple fetal defects (congenital rubella syndrome). |
| Geographical distribution | | Worldwide, except in the Region of the Americas, where endemic rubella transmission has been eliminated. Incidence depends on coverage of rubella vaccination. |
| Risk for travellers | | Non-immune travellers may be at risk when visiting countries with insufficient vaccination coverage. Particular attention should be paid to ensuring the protection of women in early pregnancy or who may become pregnant during the period of travel. |
| Vaccine | | Live attenuated vaccine, available in fixed combinations with one or more of the vaccines against mumps, measles and varicella. For protection against rubella, one dose of rubella-containing vaccine is sufficient. |

## Reference

1. Rubella vaccines: WHO position paper – July 2020. Wkly Epidemiol Rec. 2020;95 :306–24 (https://www.who.int/publications/i/item/WHO-WER9527).

## Further information

- For vaccine information, see Immunization, Vaccines and Biologicals: Vaccine-preventable diseases [webpage]. Geneva: World Health Organization (https://www.who.int/teams/immunization-vaccines-and-biologicals/diseases).

# Tick-borne encephalitis (TBE)

| Summary of vaccine data | | |
|---|---|---|
| | Type of vaccine | Inactivated vaccine |
| | Number of doses | *Western European vaccines*: Three doses with 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 *(1)*.<br>When needed, booster doses are offered at intervals of 3–5 years (in some endemic areas at intervals of up to 10 years).<br>*Russian vaccines*: The recommended intervals are 1–7 months between the first two doses and 12 months between the second and third doses. When needed, booster doses are recommended every 3 years.<br>*Chinese vaccines*: Not available internationally |
| | Contraindications | Hypersensitivity to any vaccine component; adverse reaction to previous dose |
| | Before departure | Second dose 2 weeks before departure |
| | Recommended for | High-risk destinations only |
| | Special precautions | Prevent blood-feeding ticks from becoming attached to the skin by use of appropriate clothing and repellents; remove ticks as soon as possible. |
| Cause | | Tick-borne encephalitis virus<br>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 system involvement. Encephalitis that develops during the second phase may result in paralysis, permanent sequelae or death. The severity of illness increases with the age of the patient. |
| Geographical distribution | | Tick-borne encephalitis tends to occur focally even within endemic areas. Currently, the highest incidences of clinical cases are reported from foci in the Baltic States, the Russian Federation and Slovenia. High incidences are also reported from foci in the North-Western Federal Area of the Russian Federation. Other countries that have reported cases within their territories, or that are considered to be at risk because of focally high prevalence of the virus in ticks, include Albania, Austria, Belarus, Bosnia, Bulgaria, China, Croatia, Denmark, Finland, Germany, Greece, Hungary, Italy, Mongolia, Norway, Poland, Republic of Korea, Romania, Serbia, Slovakia, Slovenia, Sweden, Switzerland, Turkey and Ukraine. |
| Risk for travellers | | Travellers to endemic areas may be at risk, mainly during April to November. The risk is highest for people who hike or camp in forested areas up to an altitude of about 1500 metres. |
| 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.<br>Repellents containing diethyltoluamide provide relative protection for several hours. The whole body should be inspected daily, and attached ticks should be removed as soon as possible. Vaccination should be offered to people travelling from non-endemic areas to endemic areas if their visits will include extensive outdoor activities. |

# Tick-borne encephalitis (TBE) Contd.

| | |
|---|---|
| Vaccine | Currently, there are four widely used vaccines of assured quality, all based on cell-cultured, formaldehyde-inactivated strains of the tick-borne encephalitis virus. FSME-Immun and Encepur (including FSME-Immun Junior and Encepur-Children) are based on the Western subtype of the virus and manufactured in Austria and Germany, respectively. TBE-Moscow and EnceVir, based on the Far Eastern subtype, are manufactured in the Russian Federation.<br><br>The two vaccines manufactured in western Europe are considered to be safe and efficacious for individuals aged ≥ 1 year. Both vaccines are available in adult and paediatric formulations. The two vaccines manufactured in the Russian Federation are considered safe and efficacious for individuals aged ≥ 3 years, although supporting data are more limited for the Russian products. In addition, one vaccine is manufactured and commercialized in China. The current vaccines appear to protect against all tick-borne encephalitis virus subtypes circulating in endemic areas of Asia and Europe. Vaccination against the disease requires a primary series of three doses; people who will continue to be at risk should probably have one or more booster doses.<br><br>In healthy individuals aged < 50 years, booster doses are conventionally offered at intervals of 3–5 years, although, in some endemic areas, intervals ≤ 10 years are now used.<br><br>Outside countries or areas at risk, tick-borne encephalitis vaccines may not be licensed and will have to be obtained by special request.<br><br>As the incidence of tick-borne encephalitis may vary considerably between and even within geographical regions, public vaccination strategies should be based on risk assessments conducted at country, regional or district level and should be appropriate to the local endemic situation. |
| Adverse reactions | Adverse events are commonly reported with the western European vaccines, including transient redness and pain at the site of injection in ≤ 45% of cases and fever ≥ 38 °C in ≤ 5–6% of cases. However, none of these events is life-threatening or serious.<br><br>Both the Russian vaccines have been reported to be moderately reactogenic. No information is available on the Chinese product. |

## Reference

1. Vaccines against tick-borne encephalitis: WHO position paper – 2011. Wly Epidemiol Rec. 2011;86:241–56 (https://iris.who.int/bitstream/handle/10665/241769/WER8624_241-256.PDF?sequence=1).

## Further information

- For vaccine information, see Immunization, Vaccines and Biologicals: Vaccine-preventable diseases [webpage]. Geneva: World Health Organization (https://www.who.int/teams/immunization-vaccines-and-biologicals/diseases).

# Typhoid

| Summary of vaccine data | | |
|---|---|---|
| | Type of vaccine | Currently, three types of typhoid vaccine are licensed for use *(1)*:<br>• The newer-generation typhoid conjugate vaccine (TCV), consists of Vi polysaccharide antigen linked to a carrier protein. TCV is currently recommended as a single intramuscular dose for infants and children from 6 months of age and in adults ≤ 45 years.<br>• The oral Ty21a vaccine is based on a live attenuated strain of *Salmonella* Typhi. It is supplied in enteric-coated capsules for use in people aged ≥ 6 years. Depending on national recommendations, primary vaccination consists of three or four capsules (one capsule every other day). Revaccination is recommended after 1–7 years. Ty21a has been used primarily to protect travellers.<br>• The injectable unconjugated Vi capsular polysaccharide (ViPS) vaccine is given intramuscularly or subcutaneously in a single dose to people aged ≥ 2 years. To maintain protection, revaccination is recommended every 3 years. A combined typhoid–hepatitis A vaccine is also available in some countries. |
| | Contraindications | Serious allergy to any of the vaccine components |
| | Adverse reactions | To date, the newer-generation TCV has a good safety profile (similar to that of ViPS), and no serious adverse events have been reported. Both the Ty21a and unconjugated ViPS vaccines have been found to be safe and well tolerated over three decades of use. |
| | Before departure | Immunity develops 7–10 days after primary vaccination with ViPS and Ty21a. Ideally, therefore, primary vaccination should be completed at least 1 week before departure. Immunity is restored within a few days of a booster dose of ViPS and Ty21a. Currently, there is no evidence for use of booster vaccination with TCV. |
| | Consider for | Long-term (> 1 month) visitors from non-endemic to endemic areas, particularly where antibiotic-resistant strains of *S.* Typhi are prevalent. |
| | Special precautions | Ty21a should not be administered to people who are taking antibiotics. Ty21a may be taken with chloroquine but should not be taken until 8–24 hours after administration of mefloquine. There is inconclusive evidence regarding co-administration of proguanil and Ty21a. |
| Cause | | Typhoid fever is a severe, potentially life-threatening, acute, generalized infection caused by *Salmonella* Typhi. *S.* Paratyphi A and *S.* Paratyphi B (and uncommonly *S.* Paratyphi C) cause paratyphoid fever, particularly in parts of Asia, which is clinically indistinguishable from typhoid fever. Both *S.* Typhi and *S.* Paratyphi infect humans only. Typhoid fever and paratyphoid fever are collectively referred to as "enteric fever". |
| Transmission | | The typhoid bacillus is transmitted through contaminated food or water. Occasionally, direct faecal–oral transmission may occur. Shellfish taken from sewage-polluted areas are an important source of infection; transmission also occurs from eating raw fruit and vegetables fertilized with human excreta, and ingestion of contaminated milk and milk products. Flies may cause human infection by transferring the infectious agents to foods. Pollution of water sources may result in epidemics of typhoid fever when large numbers of people use the same source of drinking-water. |
| Nature of the disease | | Typhoid fever is a systemic disease of varying severity. Severe cases are characterized by gradual onset of fever, headache, malaise, anorexia and insomnia. Constipation is more common than diarrhoea in adults and older children. Without treatment, some patients develop sustained fever, bradycardia, hepatosplenomegaly, abdominal symptoms and, occasionally, pneumonia. In light-skinned patients, pink spots, which fade on pressure, appear on the skin of the trunk in up to 20% of cases. In the third week, untreated patients may have gastrointestinal and cerebral complications, which may prove fatal in up to 10–20% of cases if untreated. The highest case-fatality rates are reported in children < 4 years of age. Around 2–5% of infected people become chronic carriers, as the bacteria persist in the biliary tract after symptoms have resolved. |
| Geographical distribution | | The risk of typhoid fever is higher in countries or areas with low standards of hygiene, sanitation and water supply. |

# **Typhoid** Contd.

| | |
|---|---|
| Risk for travellers | All travellers to endemic areas are at potential risk of typhoid fever, although the risk is generally low in tourist and business centres where standards of accommodation, sanitation and food hygiene are high. Areas of high endemicity include parts of sub-Saharan Africa and South and South-East Asia. Elsewhere, travellers are usually at risk only when exposed to low standards of hygiene. Even vaccinated travellers should take care to avoid consuming potentially contaminated food and water, as the vaccine does not confer 100% protection. There is a continuing increase in the emergence and spread of antibiotic resistance among S. Typhi isolates in typhoid-endemic countries. |
| General precautions | Information on general precautions against exposure to foodborne and waterborne infections can be found in International travel and health collection. Module 2. Environmental health risks. |
| Vaccine | Vaccination may be offered to travellers to destinations where the risk of typhoid fever is high, especially to those staying in endemic areas for > 1 month and/or in locations in which antibiotic-resistant strains of S. Typhi are prevalent. For previously vaccinated travellers from non-endemic to endemic areas, a booster dose of the Ty21a vaccine is recommended after 1–7 years, and after 3 years for the ViPS vaccine, depending on national recommendations. |
| Contraindications and precautions | All three typhoid vaccines are safe, and there are no contraindications to their use other than previous severe hypersensitivity reactions to any of the vaccine components.<br>Ty21a should not be administered to people who are taking antibiotics. Ty21a may be taken with chloroquine but should not be taken until 8–24 hours after administration of mefloquine. There is inconclusive evidence regarding co-administration of proguanil and Ty21a. |

## Reference

1. Typhoid vaccines: WHO position paper – March 2018. Wkly Epidemiol Rec. 2018;93 (https://www.who.int/publications/i/item/typhoid-vaccines-who-position-paper-march-2018).

## Further information

- For the observed rate of reactions to typhoid vaccine, see Information sheet. Observed rate of vaccine reactions: Typhoid vaccine. Geneva: World Health Organization; 2014 (https://cdn.who.int/media/docs/default-source/pvg/global-vaccine-safety/typhoid-vaccine-rates-information-sheet.pdf?sfvrsn=706de51b_4&download=true).
- For vaccine information, see Immunization, Vaccines and Biologicals: Vaccine-preventable diseases [webpage]. Geneva: World Health Organization (https://www.who.int/teams/immunization-vaccines-and-biologicals/diseases).
- International travel and health Module 2: Environmental health risks. Geneva: World Health Organization; 2024 (https://iris.who.int/bitstream/handle/10665/378100/9789240093607-eng.pdf?sequence=1).
- Five keys to safer food. [poster]. Geneva: World Health Organization (https://cdn.who.int/media/docs/default-source/infographics-pdf/food-safety/five-keys-to-safer-food.pdf?sfvrsn=1cf1f432_2).

# Varicella and herpes zoster

| Summary of vaccine data *(1)* | | |
|---|---|---|
| | Type of vaccine | *Varicella*: two doses of live attenuated vaccine, monovalent or in combination with measles, mumps and rubella<br>*Herpes zoster*: two doses of recombinant zoster vaccine to prevent shingles and related complications in adults 50 years and older |
| | Number of doses | Two doses |
| | Contraindications | Allergy to vaccine components, immunocompromising conditions or treatments, and pregnancy |
| | Recommended for | • Varicella<br>Travellers are not generally at increased risk of acquiring or transmitting varicella compared to the general population and should follow their national immunization programme's vaccine recommendations for the general population.<br>• Herpes zoster<br>Travellers are not at increased risk of herpes zoster compared to the general population and should follow their national immunization programme's vaccine recommendations for the general population. |
| | Special precautions | None |
| Cause | | Varicella zoster virus |
| Transmission | | *Varicella*: Primarily by airborne respiratory droplets and by direct and indirect contact with someone who has varicella or shingles<br>*Herpes zoster (shingles)*: Caused by reactivation of varicella zoster virus after primary varicella infection. Varicella zoster virus can be transmitted from a person who has shingles-related-rash. |
| Nature of the disease | | Varicella is usually a mild disease of childhood but may be more serious in adults. The disease is characterized by fever and malaise followed by an itchy, vesicular rash. Varicella may be severe or fatal in newborns and in immunocompromised people.<br>After infection, varicella zoster virus remains latent in neural ganglia and may cause zoster upon subsequent reactivation. Zoster, commonly known as "shingles", is a disease that affects mainly immunocompromised and elderly people. The usual clinical manifestation is a vesicular rash restricted to a single dermatome, accompanied by radicular pain. |
| Geographical distribution | | Worldwide |
| Risk for travellers | | As for the general population |
| Vaccine | | Live attenuated vaccines are available for the prevention of varicella and herpes zoster. The varicella vaccine is often available in fixed combination with vaccines against measles, mumps and rubella. |

## Reference

1. Varicella and herpes zoster vaccines: WHO position paper, June 2014. Wkly Epidemiol Rec. 2014;89: 265–288 (https://www.who.int/publications/i/item/who-wer-8925-265-288).

## Further information

- For the observed rate of reactions to varicella vaccine, see Information sheet. Observed rate of vaccine reactions: varicella zoster virus vaccine. Geneva: World Health Organization; June 2012 (https://cdn.who.int/media/docs/default-source/pvg/global-vaccine-safety/varicella-zoster-vaccine-rates-information-sheet.pdf?sfvrsn=14f90c6_4&download=true).
- For vaccine information, see Immunization, Vaccines and Biologicals: Vaccine-preventable diseases [webpage]. Geneva: World Health Organization (https://www.who.int/teams/immunization-vaccines-and-biologicals/diseases).

# Yellow fever

(For the International Certificate of Vaccination or Prophylaxis, see section 3.1 under Required vaccinations.)

| | | |
|---|---|---|
| Summary of vaccine data *(1)* | | |
| | Type of vaccine | Live attenuated |
| | Number of doses | One dose of 0.5 mL |
| | Boosters | A single dose of yellow fever vaccine provides lifelong immunity to the disease, making boosters unnecessary. Since July 2016, a certificate of vaccination against yellow fever is valid for the lifetime of the vaccinated person (traveller). |
| | Contraindications | Infants aged < 6 months; history of severe allergy to egg or to any of the vaccine components or hypersensitivity to a previous dose of the vaccine; thymoma or history of thymectomy; immunodeficiency due to medication, disease or symptomatic HIV infection including those with a CD4 count of less than 200. |
| | Adverse reactions | Mostly mild, nonspecific general signs such as low-grade fever or myalgia; very rarely, neurological (e.g. encephalitis, acute disseminated encephalomyelitis, Guillain–Barré syndrome) or multi-organ failure resembling wild-type yellow fever. |
| | Before departure | The International Certificate of Vaccination becomes valid 10 days after vaccination. |
| | Required and recommended for | Yellow fever vaccination is required for travellers to certain countries and is recommended for all travellers to areas with endemic and epidemic disease *(2)*. |
| | 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 caution 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.<br>A risk–benefit assessment for yellow fever vaccination should be performed for any person ≥ 60 years of age who has not been previously vaccinated and for whom the vaccine is recommended. |
| Cause | | Yellow fever virus |
| Transmission | | Yellow fever occurs in urban and rural areas of Africa and Central and South America. In jungle and forest areas, monkeys are the main reservoir of the infection, which is spread by mosquitoes from monkey to monkey and, occasionally, to human beings. In urban settings, mosquitoes transmit the virus from person to person, and introduction of infection into densely populated urban areas can lead to large epidemics of yellow fever. In Africa, an intermediate pattern of transmission is common in humid savannah regions, where mosquitoes infect both monkeys and human beings, causing localized outbreaks. |
| Nature of the disease | | Although most infections are asymptomatic, some lead to an acute illness characterized by two phases. Initially, there is fever, muscular pain, headache, chills, anorexia, nausea and/or vomiting, often with bradycardia. About 15% of infected people progress to a second phase after a few days, with resurgence of fever, development of jaundice, abdominal pain, vomiting and haemorrhagic manifestations; up to half of these patients die 10–14 days after the onset of illness. |
| Geographical distribution | | Tropical areas of Africa and Central and South America: yellow fever virus cannot be transmitted at altitudes > 2300 m. The number of countries or areas in which yellow fever virus is present far exceeds that officially reported. Some countries may have no reported cases simply because of high vaccine coverage or because of poor surveillance. |
| Risk for travellers | | Yellow fever virus may be transmitted not only in areas of high endemicity but also in areas of low endemicity if a traveller's itinerary results in heavy exposure to mosquitoes (e.g. during prolonged travel in rural areas). A valid certificate of vaccination against yellow fever may be required for visitors to and from areas at risk of transmission (see section **3.1**). |
| General precautions | | Avoid mosquito bites. Note that the highest risk for transmission of yellow fever virus is during the day and early evening. |

## **Yellow fever** Contd.

| | |
|---|---|
| Vaccine | Yellow fever vaccine is highly effective (approaching 100%). A single dose of vaccine is sufficient to confer sustained, lifelong protective immunity against the disease; a booster dose is not necessary. Yellow fever vaccine may be administered simultaneously with other vaccines, including measles and measles-containing vaccines. As a general rule, any live vaccine may be given either simultaneously or at an interval of 4 weeks. Oral polio vaccine may be given at any time in relation to yellow fever vaccination.<br><br>A fractional dose is not recommended for travellers and is not compliant with international travel regulations. Fractional-dose yellow fever vaccine can only be used during times of crisis, such as large epidemics or times of shortage.<br><br>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.<br><br>Yellow fever vaccine may be offered to asymptomatic HIV-infected people with a $CD4^+$ T-cell count ≥ 200 cells/$mm^3$. Although there are limited data on the safety and immunogenicity of yellow fever vaccine when used in HIV-infected children, it may be administered to all clinically healthy children. HIV testing is not a prerequisite for vaccination. |
| Non-serious adverse events | 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. |
| Adverse reactions | Very rare but serious adverse events after vaccination with yellow fever vaccine fall into three categories:<br><br>1) Immediate severe hypersensitivity or anaphylactic reactions<br><br>2) Yellow fever vaccine-associated neurological disease, a group of neurological conditions caused either:<br>• by direct viral invasion of the central nervous system by the vaccine virus, resulting in meningitis or encephalitis,<br>• or by an autoimmune reaction resulting in conditions such as Guillain–Barré syndrome or acute disseminated encephalomyelitis.<br><br>3) Yellow fever vaccine-associated viscerotropic disease, which is caused by replication and dissemination of the vaccine virus in a manner similar to the natural virus. People with this condition typically develop multi-organ system dysfunction or failure, and > 60% of cases have been fatal. The risk of adverse effects is higher in people aged ≥ 60 years, but the overall risk remains low.<br><br>The reported rate of yellow-fever-vaccine-related adverse events after vaccination in mass campaigns in endemic regions was 0.05 per 100 000 administered doses. |
| Contraindications and precautions | The vaccine is contraindicated in children aged < 6 months and is not recommended for those aged 6–8 months, except during epidemics when the risk of infection with yellow fever virus may be very high. Other contraindications for yellow fever vaccination are severe hypersensitivity to egg and severe immunodeficiency.<br><br>Caution is recommended before vaccinating people aged ≥ 60 years against yellow fever, and a risk–benefit assessment should be performed for any person ≥ 60 years of age who has not been vaccinated and for whom the vaccine would normally be recommended. |

## Reference

1. Vaccines and vaccination against yellow fever: WHO Position Paper – June 2013. Wkly Epidemiol Rec. 88(27):269–83 (https://www.who.int/teams/immunization-vaccines-and-biologicals/policies/position-papers/yellow-fever).

2. Travel advice [webpage]. Geneva: World Health Organization (https://www.who.int/travel-advice).

## Further information

- For vaccine information, see Immunization, Vaccines and Biologicals: Vaccine-preventable diseases [webpage]. Geneva: World Health Organization (https://www.who.int/teams/immunization-vaccines-and-biologicals/diseases).

Credit: WHO / Jason Chute
COVID-19 vaccination at Valelevu Health Centre. Volunteer Misale V stamps a replacement vaccination card. Suva, Fiji, 2022.

# 3 Required vaccinations

## 3.1. Yellow fever

Vaccination against yellow fever may be required to prevent importation of the virus into countries in which the disease does not occur, but the mosquito vector and non-human primate hosts are present. In these settings, vaccination may be an entry requirement for all travellers arriving (including airport transit) from countries in which there is a risk of yellow fever transmission. Note that a few hours' transit in an air-conditioned international airport in an endemic area should not be considered to present a realistic risk of contracting yellow fever and hence should not be seen as an indication for yellow fever vaccination or restriction of entry of non-vaccinated people into non-endemic countries.

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

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 lifetime of the vaccinated person. A single dose of yellow fever vaccine is sufficient for most travellers to confer sustained lifelong protective immunity against yellow fever disease; a booster dose is not necessary.

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 concerned.

## 3.2. Meningococcal disease

Vaccination against meningococcal disease is required by Saudi Arabia for pilgrims visiting Mecca for the *Hajj* or for *Umrah*. The same requirements apply to guest workers. Following the occurrence of cases of meningococcal disease associated with *Neisseria meningitidis* W-135 among pilgrims in 2000 and 2001, the current requirement is for vaccination with quadrivalent vaccine (A, C, Y and W-135). Vaccine requirements for *Hajj* pilgrims are issued each year and are published in the *Weekly Epidemiological Record (1)*.

## 3.3. Polio

Some polio-free countries may require proof of vaccination against polio from travellers from countries or areas in which the presence of polioviruses *(2)* has been reported in order for them to be granted an entry visa. Updates are published in the Weekly Epidemiological Record.

States endemic for WPV1, cVDPV1 or cVDPV3 with potential risk of international spread may require travellers to be vaccinated against polio before international travel *(3).*

## References

1. *Wly Epid Rec*. 2016;91(26/27):329-40.

2. GPEI – Global Polio Eradication Initiative (https://polioeradication.org/).

3. Statement of the fortieth meeting of the Polio IHR Emergency Committee [web page]. Geneva: World Health Organization; 2024 (https://www.who.int/news/item/03-12-2024-statement-of-the-fortieth-meeting-of-the-polio-ihr-emergency-committee).

Credit: WHO / Tom Vierus
Reaching the unreached in Yasawa Islands, A mother and her child after vaccination at Yalobi Nursing Station, Waya Island, Fiji, 2024.

# 4 Special groups

## 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 mosquito bites and foodborne illnesses (including use of contaminated water to make formula[1]) by means other than vaccination.

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

## 4.2. Adolescents and young adults

Adolescents and young adults make up the largest group of travellers as well as being the group most likely to acquire sexually transmitted and other travel-related infections. They are particularly at risk when travelling on a limited budget and staying in poor-standard accommodation (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.

## 4.3. Frequent travellers

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

## 4.4. Pregnant and lactating women

Pregnancy or lactation should not deter a woman from receiving vaccines that are safe and will protect both her health and that of her child. However, care must be taken to avoid inappropriate administration of certain vaccines that could harm the infant. Killed or inactivated vaccines, such as influenza vaccine, toxoids, polysaccharides and conjugated

[1] Breastfeeding infants and young children while travelling can protect them from potential exposure to contaminants.

vaccines, can generally be given during pregnancy and lactation. Except for OPV, live vaccines are generally contraindicated because of largely theoretical risks to the infant; measles, mumps, rubella, varicella and yellow fever vaccines should therefore be avoided in pregnancy, although the risks and benefits should be examined in each case. Vaccination against yellow fever may be considered in early pregnancy, depending on the risk (see Table 3). More detailed information can be found in WHO's specific vaccine position papers.

## Table 3. Vaccination in pregnancy

| Vaccine | Use in pregnancy | Use in lactating women | Comments |
|---|---|---|---|
| Bacillus Calmette–Guérin (BCG)[a] | No | No | |
| Cholera | Yes, administer oral inactivated vaccine if indicated. | Yes, administer oral inactivated vaccine if indicated. | Vaccination is not generally recommended for long-term or short-term travellers to cholera-affected countries but should be guided by specific travel risks. |
| COVID-19 | Yes | Yes | COVID-19 vaccination is recommended during pregnancy because COVID-19 infection puts pregnant women at higher risk of becoming severely ill and of giving birth to preterm babies. Increasing evidence on the safety and effectiveness of COVID-19 vaccination during pregnancy suggests that the benefits outweigh potential risks whenever there is ongoing or anticipated community transmission of the virus. |
| Dengue | No | No | |
| Hepatitis A (inactivated) | Yes, administer if indicated. | Yes, administer if indicated. | |
| Hepatitis A (live vaccine) | No | Safety not determined | |
| Hepatitis B | Yes, administer if indicated. | Yes, administer if indicated. | |
| Hepatitis E | Yes, administer if indicated. | Yes, administer if indicated. | |
| Influenza | Yes, administer if indicated. | Yes, administer if indicated. | Use inactivated vaccine. |
| Malaria | No | No | To prevent malaria in pregnancy, WHO recommends intermittent preventive treatment in pregnancy (IPTp) with sulfadoxine pyrimethamine given at monthly intervals, starting as early as possible in the second trimester, with the aim of ensuring that at least three doses are received. |
| Measles[a] | No | Safety not determined | |
| Meningococcal disease | Yes, administer if indicated. | Yes, administer if indicated. | Data are not available for lactating women; however, there is no evidence that bacterial vaccines or toxoids given to lactating women can harm a developing child, and lactation is not considered a contraindication for administration of MenA conjugate vaccine. |
| mpox | No | No | During pregnancy, should vaccination be indicated, non-replicating vaccine (MVA-BN) should be used. Minimally replicating vaccine (such as LC16m8) should not be used in pregnancy. Administration of MVA-BN in pregnancy constitutes "off-label" use. |

## Table 3 Contd.

| Vaccine | Use in pregnancy | Use in lactating women | Comments |
|---|---|---|---|
| Mumps[a] | No | No | |
| Pertussis (Tdap) | Yes, administer if indicated. | Yes, administer if indicated. | Only acellular pertussis-containing vaccine |
| Polio | | | |
| Oral poliovirus vaccine (OPV)[a] | Yes, administer if indicated. | Yes, administer if indicated. | |
| Inactivated poliovirus vaccine (IPV) | Yes, administer if indicated. | Yes, administer if indicated. | |
| Rabies | Yes, administer if indicated. | Yes, administer if indicated. | |
| Rubella[a] | No | Safety not determined | |
| Respiratory syncytial virus (RSV) | Yes, administer if indicated. | Yes, administer if indicated. | |
| Tetanus–diphtheria | Yes, administer if indicated. | Yes, administer if indicated. | |
| Tick-borne encephalitis | Yes, administer if indicated. | Yes, administer if indicated. | |
| Typhoid Ty21a[a] | No | Safety not determined | Use of live attenuated Ty21a vaccine during pregnancy should be avoided. |
| Typhoid (TCV/ViPS) | Safety not determined | Safety not determined | No theoretical concern about the safety of TCV and ViPS for pregnant and lactating women |
| Varicella[a] | No | Safety not determined | Contraindicated during pregnancy, and pregnancy should be delayed for 4 weeks after vaccination. The limited data available on infants born to women who were inadvertently vaccinated during pregnancy do not indicate any cases of congenital varicella syndrome. Termination of pregnancy is not indicated for women inadvertently vaccinated during pregnancy. |
| Yellow fever[a] | Yes, administer if indicated. | Yes, administer if indicated. | A risk–benefit assessment should be conducted before vaccinating pregnant and lactating women. Vaccination is recommended, if indicated, for pregnant or lactating women travelling to endemic areas when such travel cannot be avoided or postponed. Avoid, unless at high risk. |

[a] Live vaccine.

# 4.5. Older adult travellers

## Increasing numbers of poorly vaccinated elderly travellers

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

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

## The ageing immune system

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

## Vaccines designed for older adults

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

## Vaccines of particular relevance to older adults

Ageing of the immune system (immunosenescence) increases the risk and severity of infectious diseases in older individuals without (vaccine-)acquired immunity. Compared to younger individuals, older adults may also have a weaker immune response to certain standard vaccines. Specific vaccines (with a higher antigen dose, adjuvants and multivalent vaccines) and vaccination strategies (booster doses) have been developed to improve the efficiency of vaccines in older adults.

As for any individual, un- or partially vaccinated older adults should be offered missing vaccines (catch-up vaccination) as per their national schedule if the vaccine-preventable disease continues to pose a risk in that age-group. Of particular relevance to older adults are vaccines against diseases where the risk of severe disease is particularly high during immunosenescence. This includes seasonal influenza, pneumococcal disease, COVID-19, respiratory syncytial virus and herpes zoster.

As for any traveller, older adults should consult their health care provider before travelling.

For travellers to certain countries in Africa or Central or South America, yellow fever vaccination is recommended. Although, in general, this live attenuated vaccine is considered very safe, a few serious adverse events have been reported after primary yellow fever

vaccination, particularly in older individuals. Therefore, a risk–benefit assessment should precede possible yellow fever vaccination of people ≥ 60 years of age.

Special considerations arise in the case of older travellers with chronic health problems (see section 4.6).

## 4.6. Travellers with chronic medical problems

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

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

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

Credit: WHO / Danil Usmanov
Men read brochures about vaccines during Friday prayers in support of the supplementary immunization campaign in response to the measles outbreak at a mosque in Jalal-Abad city, Kyrgyzstan.

# 5 Adverse reactions and contraindications

## 5.1. Reactions to vaccines

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

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

## 5.2. Common mild vaccine reactions

Most vaccines cause some mild local and/or systemic reaction relatively frequently. These reactions generally occur within a day or two of vaccination. The systemic symptoms (mainly fever and/or rash) that are reported in 5–15% of recipients of measles or measles, mumps and rubella vaccine 5–12 days after vaccination are commonly attributable to normal background illnesses during childhood.

## 5.3. Uncommon, serious adverse reactions

Most of the rare vaccine reactions (Table 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 4. Uncommon severe adverse reactions

| Vaccine | Possible adverse reaction | Expected rate[a] per million doses |
|---|---|---|
| Bacille Calmette–Guérin (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 | |
| COVID-19 | Myocarditis and pericarditis | Varies according to the vaccine |
| | Thrombosis with thrombocytopenia syndrome | |
| Dengue | Anaphylaxis | ? |
| DTP | Persistent crying | DTaP: 0–2000<br>DTwP: 35000 |
| | Seizures | DTaP: 5<br>DTWP: 6 |
| | Hypotonic–hyporesponsive episode | DTaP: 140–620<br>DTwP: 570–2500 |
| | Anaphylaxis | DTaP: undocumented<br>DTwP: 1.3 |
| *Haemophilus influenzae* type b | None reported | |
| Hepatitis A | None reported | |
| Hepatitis B[b] | Anaphylaxis | 1–2 |
| Influenza | Guillain–Barré syndrome | < 1 |
| Japanese encephalitis | Neurological event (mouse-brain-derived vaccine only) | Rare |
| | Hypersensitivity (mouse-brain-derived vaccine only) | 1800–6400 |
| Malaria | Febrile seizures | 2.5 per 1000 doses of RTS,S/AS01 administered,<br>1 per 2800 doses of R21/Matrix-M administered |
| Measles | Febrile seizure | 333 |
| | Thrombocytopenic purpura | 33–45 |
| | Anaphylaxis | 1–50 |
| | Encephalitis | 1 (unproven) |
| Meningococcal disease | Anaphylaxis | 1 |
| Mpox | No serious adverse event reported | |
| Mumps | Depending on strain: aseptic meningitis | 0–500 |
| Pneumococcal disease | Anaphylaxis | Very rare |
| Polio (OPV) | Vaccine-associated paralytic poliomyelitis | 1.4–3.4 |
| Polio (IPV) | None reported | |

### Table 4 Contd.

| Vaccine | Possible adverse reaction | Expected rate[a] per million doses |
|---|---|---|
| Rabies | Animal brain tissue only: neuroparalysis | 17–44 |
| | Cell-derived: allergic reactions | Rare |
| Rubella | Transient arthralgia, arthritis or arthropathy | In non-immune women: arthralgia: 25%, arthritis: 12% |
| Tetanus | Brachial neuritis | 5–10 |
| | Anaphylaxis | 1–6 |
| Tick-borne encephalitis | None reported (data for western European vaccines only) | |
| Typhoid fever | Parenteral vaccine: various | Very rare |
| | Oral vaccine: none reported | |
| Yellow fever | Neurotropic disease | Very rare |
| | Allergy or anaphylaxis | 5–20 |
| | Viscerotropic disease | 0–24 |

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

## 5.4. Contraindications

Information on the main contraindications to administration of vaccines is available online: https://vaccine-safety-training.org/contraindications.html

### Further information

- Global Influenza Surveillance Network (FluNet) (https://www.who.int/tools/flunet).
- For information on safety of vaccines, see The Global Advisory Committee on Vaccine Safety [webpage]. Geneva: World Health Organization (http://www.who.int/vaccine_safety/committee/en/).
- For information on vaccines and diseases, see Immunization, Vaccines and Biologicals: Vaccine-preventable diseases [webpage]. Geneva: World Health Organization (http://www.who.int/immunization/diseases/en/).
- For WHO vaccine position papers, see Strategic Advisory Group of Experts on Immunization (SAGE). WHO Vaccine Position Papers [webpage]. Geneva: World Health Organization (http://www.who.int/immunization/documents/positionpapers/en/).
- WHO health emergency dashboard [webpage]. Geneva: World Health Organization (https://extranet.who.int/publicemergency/).

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