

Travel vaccines: information for health care workers

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Abstract

Travel and volume of passengers and goods carried continue to expand in reach as more sophisticated air, sea and land transport networks develop. People are travelling for business and leisure, taking with them pathogens and their vectors bringing about diseases such as the global influenza pandemics. This review briefly examines some of the important vaccine preventable diseases related to travel. We then outline diseases known to Africa and other similar parts of the world, and potential approaches for preventing these conditions. The paper provides practical advice for health care workers when consulting with the international traveler and hence may strengthen the battle against vaccine preventable diseases.

Keywords: travel vaccines, yellow fever, dengue, polio, meningococcal meningitis

Introduction and Background

A vaccine is most commonly defined as a suspension of attenuated or killed microorganisms (viruses, bacteria, or Rickettsiae), administered for the prevention, amelioration, or treatment of infectious diseases.¹ Vaccine science encompasses the disciplines of microbiology, infectious diseases and immunopharmacology, and vaccines generally confer either active immunization (i.e. the administration of an antigen to the host to stimulate or induce the formation of antibodies and cell-mediated immunity) or passive immunization (where immunity is transferred to the host using preformed immunological products - in practice, this generally translates into immunoglobulins).²

Other important points to remember:

- After administration, organisms in live-attenuated vaccines undergo minimal replication as they may confer life-long immunity with a single dose
- To induce lifelong immunity multiple doses of “killed vaccines” are needed for effective immunity – for this reason booster vaccines are often required for maintaining immunity. These booster vaccines elicit memory responses from the B cells via the production of immunoglobulin G (IgG) – resulting in a rapid

intense response that is lifelong.

- Polysaccharide antigens stimulate B cells directly and elicit a T-cell-independent immune response that cannot be produced in children younger than two years of age.

When travelling for either business or pleasure, a part of the package should include knowledge about the local diseases, including preparatory vaccines. Epidemiologically, travellers represent an important population with the potential for exposure to diseases for both themselves and the country they are visiting, which is just a plane ride (or other vehicle of transport) away. This brings about adverse health outcomes outside their home country, but also the likelihood that they may import conditions that are non-endemic to their country of origin. By 2012 international tourist arrivals exceeded 1 billion and are projected to double to almost 2 billion by 2030, so the public health impact of travel will only increase. A large proportion of these diseases may be preventable through adequate vaccination, highlighting the importance of the knowledge that the health care practitioner should have on travel vaccination.^{3,4}

When planning a trip, health evaluation including getting vaccines should be done 4-6 weeks in advance.^{5,6} As part of the routine

Table 1: Vaccination terminology

Routine vaccinations	Recommended vaccinations	Required vaccinations
Part of the normal immunization schedule to maintain health (e.g. Tetanus) and it includes diseases that are considered prevalent in many parts of the world	Vaccinations considered necessary based on the travel destination, planned activities, season, previous immunizations, urban/rural location, age and current health status. e.g. when travelling to cholera-affected countries, a cholera vaccine is required	These are mandatory vaccines, as stipulated by International Health Regulations. Yellow fever vaccination is a great example as it is required for all travellers entering sub-Saharan Africa, as well as tropical South America. Yellow fever is the only vaccine with an internationally recognised certificate

conversation that the health care practitioner (HCP) should have with the client, the terminology pertaining to vaccination which is listed in Table 1, is of importance.⁷

Information regarding the actual risk for travellers and deciding on appropriate vaccination require thorough examination and questioning, as well as counselling with the client. As part of this counselling session the following points should be included:

Questions for client	✓
Where are you travelling to?	
Are you pregnant or breastfeeding?	
Have you seen a HCP within the last 4-6 weeks?	
Do you have any conditions that may affect your immune status (immunocompromised), e.g. cancer/HIV?	
Are you up-to-date with your routine immunization, e.g. MMR?	
What activities will you be participating in?	
Does the country you are travelling to require documentation of your vaccination status?	

Infectious diseases related to travelling (disease maps)

Approximately 10% of travellers in developing countries will acquire an infection during or shortly after their trip. Most of these diseases will probably be well-controlled within the traveller's home country. However, research shows that there is lack of knowledge of these vaccine-preventable diseases.⁸

With the ever-increasing numbers of travellers throughout each continent, the risk for acquiring vaccine preventable diseases is high.⁹ When travelling to certain parts of the world, e.g. Europe, Australia or North America, it is unlikely that vaccination other than those routinely given according to the South African Expanded Programme on Immunization will be needed, provided they are all up to date.⁹ For more tropical areas such as sub-Saharan Africa, Southern Asia, Central and South America, one would need protection against specific infectious diseases.⁹ The list of vaccine-preventable travel-related diseases is extensive, hence only the most common ones are covered in this section.

Hepatitis A is a viral disease that is transmitted through ingestion of contaminated food and water or through direct contact with infected people (faecal-oral transmission). Hepatitis A can be found throughout the world but its risk is associated with areas that lack clean water and proper sanitation, with men who have sex with men and with intravenous drug users.^{1,2} Hepatitis A usually presents

with jaundice, malaise, fever, loss of appetite, diarrhoea and nausea. Not all who are infected will experience symptoms and children are most prone to asymptomatic manifestations of the disease.^{1,10} There is no specific treatment for acute Hepatitis A and the symptoms of most people slowly subside following infection.^{1,11} It is paramount to note that paracetamol and anti-emetics should be avoided due to risk of liver damage as these are metabolized hepatically.¹ Non-pharmacological treatment is recommended to keep the patient relatively comfortable, including fluid replacement due to vomiting and diarrhoea.^{1,2,12} Hepatitis A is very common in countries like South Africa and usually occurs in young children between the ages of one and four years. The hepatitis A vaccine is administered as a two-series vaccine injection given 6 months apart and is known to provide long term protection of up to 8 years.^{1,2,10,11,12}

Hepatitis B is a viral infection that causes chronic liver diseases such as liver cirrhosis and hepatocellular carcinoma.¹³ It is transmitted via contaminated blood products and body fluids such as semen. According to the WHO, sub-Saharan Africa, East Asia and Amazonian South America have the highest hepatitis prevalence of chronically infected people. People who are originally from high risk regions, injectable drug users and people with multiple sexual partners are at increased risk.^{1,2,10} Travellers visiting countries with moderate-high risk of this infection are advised to get vaccinated against hepatitis B, especially those who participate in activities which increase their risk, such as work which may result in injury, contact sport, unprotected sex, dental care, acupuncture, and cosmetic procedures including tattooing or piercings.^{13,14}

Most infectious people do not experience any symptoms and many fight off the condition without realizing they are infected. However, some people experience symptoms that may last several weeks, namely jaundice, dark urine, extreme fatigue and abdominal pain.^{1,2,15} There is no specific treatment for acute hepatitis B, therefore care is usually aimed at comfort and adequate fluid replacement therapy.¹⁵ On the other hand, chronic hepatitis B is treated with medicines such as antivirals to slow cirrhosis progression and improve prognosis.¹³

Immunization is the backbone of hepatitis B prevention whereby a 3-dose schedule is given shortly after birth at 6 weeks and the 2nd and 3rd doses administered at the same time as the diphtheria pertussis and tetanus (DTP) vaccine; this is part of the routinely given EPI schedule since 1995.¹⁶

Influenza is a respiratory tract infection caused by influenza viruses which are classified either as A, B or C. Type A and B cause disease in humans. Influenza, commonly known as "the flu" is a seasonal viral infection. The flu viruses are present in all parts of the world with most people being infected.^{1,2} Influenza causes annual epidemics that peak during the winter in temperate regions such as South Africa, Mozambique and the United States.^{1,2,10} Infections are usually transmitted through airborne droplets coughed up by an infectious person, which in turn can be inhaled by another person, and through contaminated hands.^{2,10}

Antiviral agents such as adamantanes (e.g. amantadine) and influenza neuraminidase inhibitors (e.g. oseltamivir) can be given in confirmed cases as per registered indication to reduce the severity of the infection. Ideally, they need to be administered within 48 hours of onset of symptoms to be effective.¹ However, the most



effective way to prevent acquiring the disease or lessen how severe it may become is through vaccination.

Influenza vaccine is usually a combination of three types of the flu in current circulation – two subtypes of Influenza type A and one B virus. The vaccine is recommended for individuals with special conditions e.g. cardiovascular, pulmonary, gastrointestinal or renal impairment. In temperate climates, seasonal epidemics occur mainly during winter while in tropical regions, influenza may occur throughout the year, causing outbreaks more irregularly, therefore it is important to get vaccinated annually.^{1,15}

Japanese Encephalitis (JE) is caused by *Flavivirus*, a single-stranded RNA virus which is spread by an infected mosquito through bites. Japanese encephalitis is the most common vaccine-preventable encephalitis in Asia and occurs in annual epidemics or endemically in many Asian countries.^{17,18}

It affects the central nervous system including the cerebrum, the cerebellum, and the spinal cord. Japanese encephalitis is an asymptomatic infection affecting children, with a 20–30% mortality.^{17,19} Illness usually begins with sudden onset of fever, headache, and vomiting. Mental status changes, focal neurologic deficits, generalized weakness, and movement disorders may develop over the next few days.^{17,19}

Regardless of vaccination status, avoiding mosquito bites and employing other preventative measures such as avoiding outdoor activities, using insect repellent during peak biting hours, wearing appropriate clothing, and sleeping under mosquito nets help reduce disease incidence.^{17,20} Inactivated Vero cell culture-derived Japanese encephalitis vaccine IXIARO® is given as a two-dose series, with the doses spaced 28 days apart. The vaccine is suitable from the age of two months.²



Measles is caused by the measles virus which is spread mainly from person-to-person by large respiratory droplets as well as via the airborne route as aerosolized droplet nuclei. Measles has been eradicated in most countries but those travelling particularly outside the western hemisphere might be at risk. Worldwide, there are approximately 20 million new measles infections annually. Symptoms include fever, coryza, cough, koplik spots, maculopapular rash and complications may include diarrhoea, otitis media, pneumonia and encephalitis which may lead to permanent brain damage.¹⁴

Meningococcal disease is caused by *Neisseria meningitidis* which has six major serogroups (A, B, C, W, X and Y) that can lead to epidemics. It is transferred from person-to-person via close contact with respiratory droplets and outbreaks may occur anywhere globally, usually in crowded areas. The highest incidences are found in sub-Saharan Africa.^{1,2} Large-scale epidemics mostly of type A occur in the so-called "meningitis belt" of Africa.² Epidemics of meningococcal disease are frequent in the area of sub-Saharan Africa, extending from Senegal in the west to Ethiopia in the east.²

Meningococcal disease is characterised by sudden onset with fever, intense headache, nausea and vomiting, stiff neck and frequently a rash. Hospitalization and treatment with parenteral antibiotics is recommended and close contacts of the person diagnosed with the infection should receive one dose of ciprofloxacin.²¹ In South Africa, there are three types of vaccines available. Menomune® and Mencevax® are polysaccharide vaccines and are protective against the serogroups A, C, W-135 and Y and are recommended for ages ≥ 2 years, and Menactra® is a quadrivalent conjugate vaccine suitable for administration from 9 months to adults not older than 55 years.¹²

Meningococcal meningitis vaccine is a visa requirement for individuals that travel to countries such as Saudi Arabia.^{13,14}



Pneumococcal disease is an infection caused by the *Streptococcus pneumoniae* bacterium, also known as pneumococcus. Infection can result in pneumonia, sepsis, middle-ear infection (otitis media), or bacterial meningitis. Pneumococci are transmitted by direct contact with respiratory droplets from patients and healthy carriers.^{1,2}

Symptoms range from fever and chills, cough, rapid breathing or difficulty in breathing, chest pain for pneumonia to ear pain, headache, confusion and swollen ear drum for sinusitis. Depending on the diagnosis, treatment may include antibiotics such as amoxicillin, paracetamol for fever and salbutamol for wheezing and difficulty breathing.²³

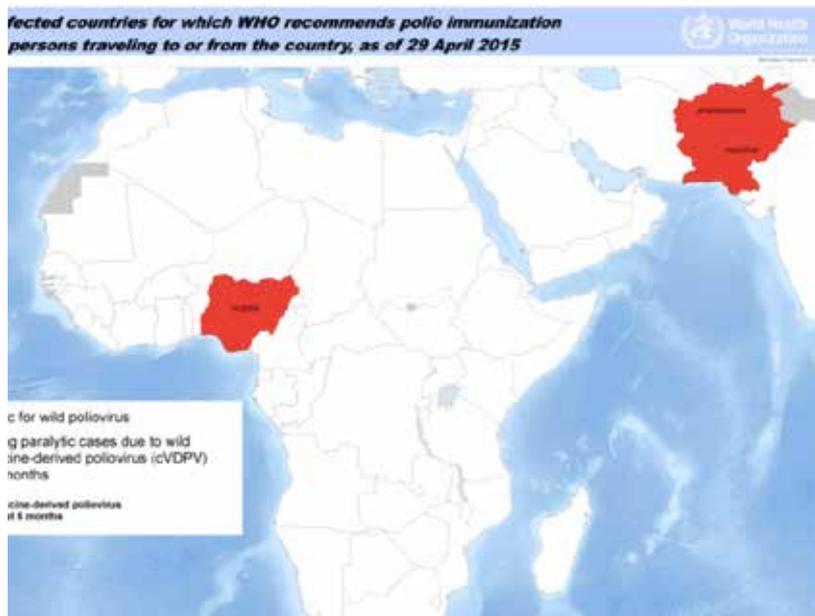
Prevention is through the administration of pneumococcal conjugated vaccine. The EPI-SA schedule has three doses that are given at the ages of 6 weeks, 14 weeks and 9 months. It is currently being recommended for use in individuals with special medical conditions.²⁴

Mumps is caused by a paramyxovirus, which is spread via respiratory droplets, saliva or contaminated fomites. It is endemic in many countries globally and risk of contraction is high. It may

present with swollen salivary glands, fever, headache, anorexia, malaise and myalgia. Complications include orchitis, meningitis, encephalitis and pancreatitis.¹⁴

Pertussis is a bacterial infection caused by *Bordetella pertussis*. It is spread from person-to-person via aerosolized respiratory droplets or by direct contact with respiratory secretions. Pertussis is endemic worldwide. It is characterized by paroxysmal cough (whoop) or post-tussive vomiting.¹⁴

Poliomyelitis is caused by a virus called *poliovirus* which is transmitted via the faecal-oral and oral route. The majority of infections are asymptomatic and those which become symptomatic present with flaccid muscles, single limb to tetraplegia, respiratory failure and death which is uncommon. Travellers who visit polio-infected areas are at risk of contracting the virus and those who visit a polio-free country can spread the virus. For this reason, residents or long term-travellers (staying longer than 4 weeks) from countries such as Cameroon, Pakistan and Syria should receive a documented vaccine booster dose 4 weeks to 12 months before departure. The same principle applies to countries such as Ethiopia, Nigeria, Somalia, Afghanistan, Equatorial Guinea, Iraq, and Israel which are known to be non-polio exporting but infected with wild type poliovirus. In situations where last minute travel is imminent, a documented dose of the vaccine should be given before departure if no dose was given within 12 months. Residents and long term-travellers from polio-infected countries are required to have a documented polio vaccine prior to obtaining a visa in polio-free countries.^{13,14}



Yellow fever is a viral vector-borne disease which is transmitted through a bite of an infected mosquito that usually bites during the day. Yellow fever can be found in sub-Saharan/tropical Africa and tropical South America. Individuals who are at risk should be vaccinated to protect vulnerable countries, which are countries where the disease is not prevalent but arthropod (mosquito) and non-human primate hosts are present.¹³ Yellow fever is the only vaccine with an internationally recognised certificate and it is valid ten days after receiving the vaccine.¹³

Tetanus is an infection caused by a toxin released *Clostridium tetani*. This bacterium is not communicable and it is usually contracted through contact of broken skin or injury with spore contaminated objects. The neurotoxins produced by the bacteria may cause local muscular spasms or generalized tetanus (locked-jaw) which may be deadly. It is prevalent worldwide.¹⁴

The tetanus bacteria are found in soil and manure and may be introduced through open wounds, e.g. as a puncture wound, burn or scratch.^{12,25} Tetanus has an incubation period ranging from 3–21 days and is characterised by muscle spasms, initially in the jaw muscles (lockjaw), stiffness of the neck, difficulty in swallowing, and rigidity of abdominal muscles.¹² If left untreated, the disease progresses and eventually may result in death.¹

Travellers should have up-to-date vaccination according to the EPI-SA schedule. A booster dose tetanus vaccine is recommended when travelling to countries with limited medical facilities if the last dose was more than ten years ago. Tetanus vaccine is often combined with polio, pertussis (whooping cough) and diphtheria vaccines as a single injection. Tetanus prevention further includes

thorough cleaning of all wounds, followed by appropriate medical attention.^{12,25}

Tuberculosis (TB) is a bacterial infection of the lungs caused by *Mycobacterium tuberculosis*. It is spread through air when an infected patient coughs or sneezes. It is prevalent worldwide with varying incidences and there are approximately 1.3 million deaths annually related to TB. Common characteristics of TB include fever, persistent cough, loss of appetite and weight, night sweats and hemoptysis.¹⁴

Typhoid fever is caused by a bacterial infection; *Salmonella typhi* which is usually transmitted via contaminated water or food or direct faecal-oral transmission. Typhoid fever is still common in the developing world, where it affects about 21.5 million people each year.²⁶ Ingestion of contaminated food or drink that has been handled by a person shedding *Salmonella typhi* can cause infection; infection may also occur if sewage contaminated with the bacteria gets into the water used for drinking or washing food. Therefore, typhoid fever is more common in areas of the world where hand-washing is less frequent and water is likely to be contaminated with sewage.²⁶ Symptoms may be febrile with increasing fatigue, headache, malaise, anorexia, abdominal pain, diarrhoea or constipation. Complications include life threatening intestinal haemorrhage or perforation. Travellers who have had prior infections are still advised to get vaccination as previous infection does not guarantee immunity.¹⁴

Vaccination is recommended for travellers who visit areas where there is insufficient sanitation and food hygiene. There are two vaccines currently available to prevent typhoid; one is an inactivated single dose vaccine administered as an injection and the other is a live, attenuated vaccine taken orally as four doses: one capsule every other day for a week (day 1, day 3, day 5 and day 7). The capsules should not be chewed, but swallowed with water an hour before meals.^{2,26} Besides vaccination, practice of hand hygiene and avoidance of risky food and drinks go a long way as prevention measures.^{2,26}

Rabies is an acute, progressive, nearly always fatal infection caused by a neurotropic virus, causing progressive encephalomyelitis. It is widely distributed across the globe, South Africa being no exception, and more than 95% of human deaths occur in Asia and Africa.^{27,28} Transmission usually occurs through the bite from a rabid mammal, usually dogs, and once symptoms develop, prognosis is poor.^{27,28} The early symptoms of rabies in people are similar to that of many other illnesses, including fever, headache, and general weakness or discomfort. As the disease progresses, more specific symptoms appear and may include insomnia, anxiety, confusion, slight or partial paralysis, excitation, hallucinations, agitation, hypersalivation, difficulty swallowing, and hydrophobia.¹

The infection may be spread via saliva of an infected mammal into broken skin or mucous membranes through a lick, scratch or bite. The mammalian hosts may be dogs and wildlife mammals including bats, foxes, jackals, skunks, raccoons and mongooses. It is prevalent in all continents except Antarctica. There are only a few countries that have been declared rabies-free.¹⁴

While this illness has one of the highest case-fatality ratios of any infectious disease, it is highly preventable with appropriate pre-exposure prophylaxis. Vaccination usually requires a course of three doses for protection. The first dose is given as appropriate, the second dose seven days after the first and the third dose is given 21 or 28 days after the first, depending on which vaccine is used.² It should be offered to at-risk people such as all travellers who will be living or travelling in endemic areas and who may be exposed to rabies because of their travel activities.^{1,2} Post-exposure treatment, which includes thorough wound washing, leaving the wound open and immediately seeking medical treatment after a bite, contribute to reducing deaths attributed to rabies.² Lastly, vaccination of domestic dogs helps immensely in driving down the need for prophylaxis and rabies fatalities.^{27,29,30}

Dengue, a flavivirus is transmitted to humans through the bite of an *Aedes aegypti* mosquito, the same species responsible for yellow fever and zika virus transmission. Dengue is widespread throughout the tropics, with risk in each area being influenced by rainfall, temperature and unplanned rapid urbanization. Africa, the Americas, Southeast Asia and Western Pacific regions are the most seriously affected.²⁵

Dengue is usually a self-limiting disease with only a number of people developing symptoms with an incubation period of 4–10 days. The virus should be suspected if a patient presents with high fever (40°C) accompanied by two of the following symptoms: severe headache, pain behind the eyes, muscle and joint pains, nausea, vomiting, swollen glands or rash.^{1,10}

There is no vaccine to prevent dengue in South Africa. Prevention is by minimizing mosquito bites, use of insect repellent, sleeping under a mosquito bed net and other measures used for mosquito bite prevention. If available, use of air-conditioning is recommended.^{1,2,10}

The severe form of this infection is known as dengue haemorrhagic fever, characterised by high fever, abdominal pains, prolonged vomiting and bleeding. Its prevalence is similar to that of malaria, though it is more prevalent in areas of residence than malaria. Dengue disease map is available at¹⁴: www.healthmap.org/dengue/index.php.

Treatment for symptomatic relief is use of paracetamol for fever, plenty of fluids and bed rest.^{10,24}

Cholera is an acute secretory diarrhoeal infection caused by the bacterium *Vibrio cholera*. This infection is rare in industrialised countries and mostly prevalent in regions of the world with poor sanitation, such as parts of sub-Saharan Africa, South and Southeast Asia, the Middle East, Central America and the Caribbean.^{1,2,10} With its prevalence in over 50 countries, vaccination is encouraged for individuals at high risk, such as those in refugee camps and humanitarian relief workers in disaster areas.^{13,14}

Cholera affects both children and adults and can kill within hours if untreated. However, the majority of people can be treated successfully through prompt administration of oral rehydration solution.³¹ In severe cases, intravenous fluids and antibiotics are given to lessen the duration of diarrhea.^{1,2} When travelling to endemic areas, prophylaxis in the form of the cholera vaccine is

Table 2: General advice to be provided to the client**Counselling Tips****Check the water safety of the destination. Can you drink from the tap? Consider the following:****Consider drinking:**

Water, sodas, or sports drinks that are bottled and sealed (carbonated is safer)
 Water that has been disinfected (boiled, filtered, treated)
 Ice made with bottled or disinfected water
 Hot coffee or tea
 Pasteurized milk

Don't drink:

Tap or well water
 Fountain drinks
 Ice made with tap or well water
 Drinks made with tap or well water, such as reconstituted juice
 Unpasteurized milk

Remember when eating local food:**Consider eating:**

Food that is cooked and served hot
 Food from sealed packages
 Hard-boiled eggs
 Fruits and vegetables you have washed in safe water or peeled yourself
 Pasteurized dairy products

Don't eat:

Food served at room temperature
 Food from street vendors
 Raw or soft-cooked (runny) eggs
 Raw or undercooked (rare) meat or fish
 Unwashed or unpeeled raw fruits and vegetables
 Condiments (such as salsa) made with fresh ingredients
 Salads
 Flavored ice or popsicles
 Unpasteurized dairy products
 Bush meat (monkeys, bats, or other wild game)

Check the status of "bugs" for the area – and use physical measures where possible**Prevent Bug Bites**

Bugs (including mosquitoes, ticks, and some flies) spread diseases (including Zika, dengue, and Lyme disease), many of which cannot be prevented or treated with a vaccine or medicine. The following are important and practical measures to use:

Use Insect Repellent

Use EPA-registered insect repellents that contain at least 20% DEET for protection against mosquitoes, ticks and other bugs. Other repellents protect against mosquitoes but may not be effective against ticks or other bugs, examples include picaridin (also known as KBR 3023, Bayrepel, and icaridin), oil of lemon eucalyptus (OLE) or para-menthane-diol (PMD), IR3535, 2-undecanone (methyl nonyl ketone)

Clothing and gear (such as boots, pants, socks and tents) that are treated with permethrin (an insecticide). Pre-treat clothes and never use permethrin directly on the skin.

Exposed skin should be covered by wearing long-sleeved shirts, long pants, socks and a hat. All shirts should be tucked into pants, and should be tucked into your socks for maximum protection.

Avoid bugs where you are staying

Advice should be given that as far as possible they should choose hotel rooms or other accommodations that are air-conditioned or have good window and door screens so bugs can't get inside. Preferably, they should sleep under a permethrin-treated bed net that can be tucked under the mattress. When outdoors, use area repellents (such as mosquito coils) containing metofluthrin or allethrin.

Personal hygiene - Wash your hands often with soap and water or use alcohol-based hand sanitizer.

Don't touch animals, especially monkeys, dogs and birds. – Remind your clients that rabies is spread in the saliva of an infected animal. Prevention outside of vaccination is to avoid being bitten, scratched or licked by any animal. Although any mammal can get rabies, dogs are responsible for most rabies deaths.

recommended. Currently, two oral cholera vaccines, given in two doses two weeks apart: Dukoral® and ShanChol® with the former dissolved in 150 ml of safe water. Both vaccines are suitable for children from two months.^{1,24}

Clinical presentation is usually described as rice-watery stools diarrhoea which can lead to severe dehydration and death within hours.¹⁴ Provided that the necessary precautions are adhered to, risk of contraction is relatively low even in cholera epidemic countries.¹³

Diphtheria is a bacterial infection caused by toxigenic strains of *Corynebacterium diphtheriae*. It is spread from person-to-person mainly through oral or respiratory droplets. There have been recent outbreaks in Indonesia, Thailand and Laos. Diphtheria is endemic in Asia, the Middle East, South Pacific, Eastern Europe, Haiti and the Dominican Republic.¹⁴

Information from the health care worker (HCW) to the traveller

Although vaccination can cover a large number of diseases, encourage the client to seek advice from a health professional six to eight weeks prior to departure to an international destination, and remind them upon the initial visit that two or more appointments may be required.

General advice may be based on the travel medicine assessment, and may typically include advice about the avoidance of risks, prescription of prophylactic medicines, such as antimalarial agents and general hygiene measures. The following Table 2 and 3 provide some general advice to give to the patient.³²

A summary of considerations for travellers with special medical conditions are shown in Table 3.³³

Travelling to Africa

Africa has 53 countries as recognized by the WHO and each country has its own specific recommendations when it comes to vaccines. When considering vaccination, it is the traveller's responsibility to take into account the risk of being infected with yellow fever virus, the specific country entry requirements, as well as their individual risk factors (e.g. age, immune status, etc.) for serious vaccine-associated adverse events. The majority of the recommendations are based on the yellow fever vaccine. There is, however, a small number of countries in Africa for which a polio vaccine and/or a meningococcal vaccine is recommended.³⁴

Table 3: Considerations for travellers with special medical conditions³³

Condition	Immunization	General considerations
Cancer	<ul style="list-style-type: none"> Immunosuppressive medication may alter response to immunization Live attenuated vaccines may be contraindicated Revaccination may be necessary following cancer treatment 	<ul style="list-style-type: none"> Emphasize food and water precautions Plan for self-management of dehydration Take precaution for DVTs* Supplemental oxygen Wear loose-fitting clothing to prevent worsening of lymphedema Check for medication restrictions in the destination country, especially in the case of scheduled medicines for pain control
Cardiovascular diseases	<ul style="list-style-type: none"> Influenza Pneumococcal Hepatitis B 	<ul style="list-style-type: none"> Plan for self-management of dehydration and volume overload; may include adjusting medication Supplemental oxygen Take a copy of recent EKG with Take an information card for your pacemaker or other implanted devices Take precautions for DVT* Have sublingual nitroglycerine available in carry-on bag Mefloquine is not recommended in cardiac conduction abnormalities, particularly ventricular arrhythmias Self-monitoring and management of INR* should be tailored to the individual patient needs by the medical practitioner
Pulmonary diseases	<ul style="list-style-type: none"> Influenza Pneumococcal Hepatitis B 	<ul style="list-style-type: none"> Supplemental oxygen Arrange with airline to have other equipment on plane (e.g. nebulizer) Plan for self-management of exacerbations (including COPD*, asthma) Take precautions for DVT* Consider carrying a short course of antibiotics and corticosteroids for exacerbations, as appropriate and prescribed by medical practitioner Consider advising an inhaler available in carry-on luggage, even if not routinely used
Gastrointestinal diseases	<ul style="list-style-type: none"> Influenza Pneumococcal Hepatitis A Hepatitis B 	<ul style="list-style-type: none"> Emphasize food and water precautions Consider prophylactic antibiotic for travellers' diarrhoea, as prescribed by medical practitioner Avoiding undercooked seafood, if diagnosed with cirrhosis, or heavy alcohol use May experience increased colostomy output during air travel Proton-pump inhibitors and H₂ blockers may increase susceptibility to travellers' diarrhoea Use mefloquine with caution in any chronic liver disease
Renal failure and chronic renal insufficiency	<ul style="list-style-type: none"> Influenza Pneumococcal Hepatitis B 	<ul style="list-style-type: none"> Emphasize food and water precautions Dehydration can worsen renal function; plan for self-management Arrange dialysis abroad, if needed Adjust medication for CrCl* Know HIV, hepatitis C, and hepatitis B status Atovaquone-proguanil contraindicated when CrCl < 30 ml/min
Diabetes mellitus	<ul style="list-style-type: none"> Influenza Pneumococcal Hepatitis B 	<ul style="list-style-type: none"> Plan for self-management of dehydration, diabetic foot, pressure sores Insulin adjustments Check blood glucose during air travel at intervals of 4-6 hours Discuss changes in insulin regimen or oral agent with diabetes specialist Provide medical practitioners letter certifying the need for all equipment, including syringes, glucose meter and supplies Keep insulin and all glucose meter supplies in carry-on luggage Bring food and supplies needed to manage hypoglycaemia during travel Check feet daily for pressure sores
Severe allergic reactions		<ul style="list-style-type: none"> Plan for managing allergic reactions while travelling and consider bringing a short course of corticosteroids for possible allergic reactions Should always carry injectable adrenaline and antihistamines on person Observe peanut allergies – policies in place by many airlines

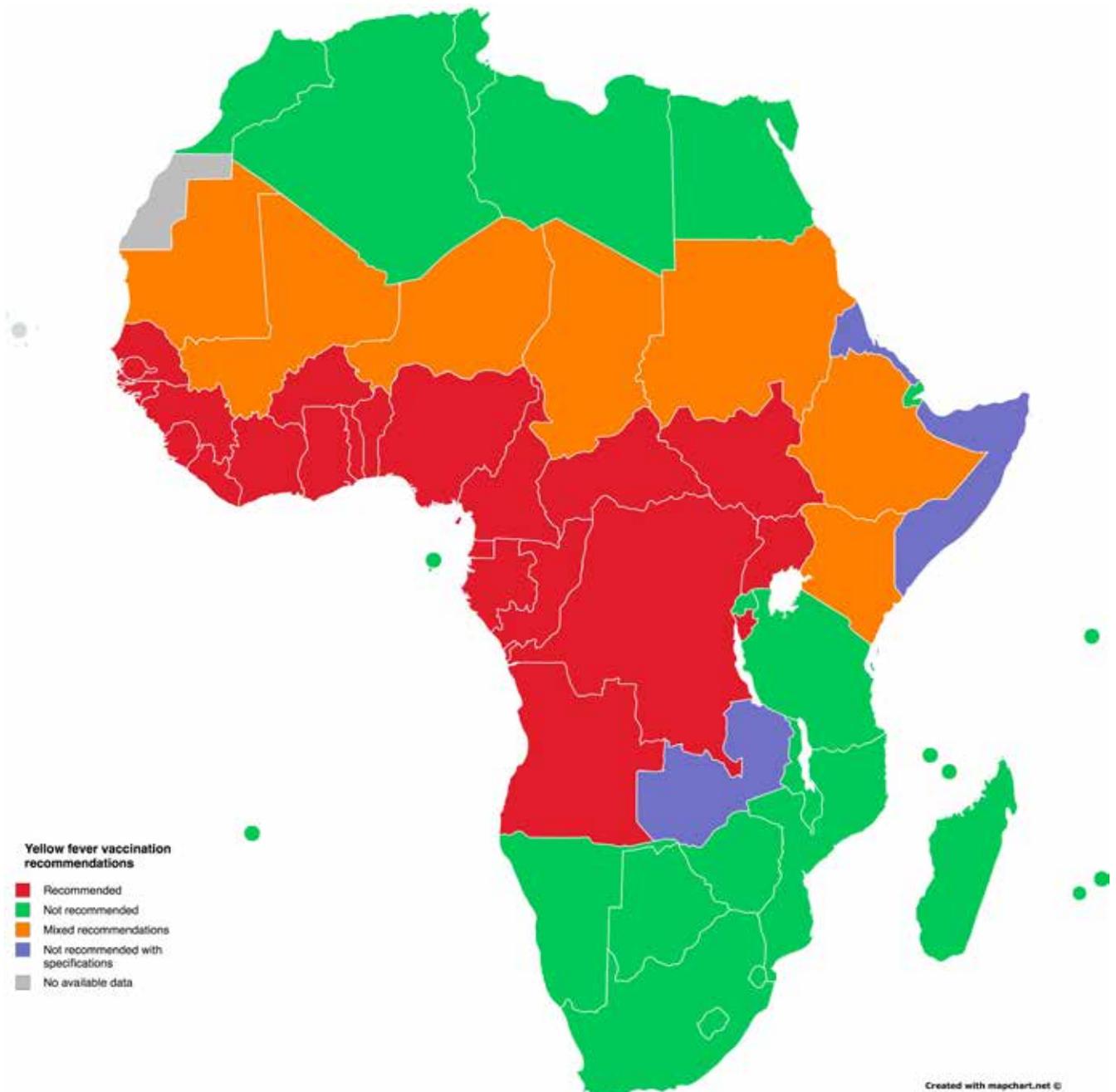
*DVT: deep vein thrombosis; INR: international normalized ratio; COPD: chronic obstructive pulmonary disease; CrCl: creatinine clearance

Yellow fever in Africa

There are two main purposes for carrying out yellow fever vaccination. Firstly to prevent the international spread of a specific disease and secondly to protect the travellers that may be exposed to yellow fever infection.³⁴

According to the WHO, yellow fever vaccination is recommended for all travellers from the age of 9 months old, in locations where persistent or periodic yellow fever virus transmission occurs. It is, however, generally not recommended when the potential for yellow fever exposure is low.³⁴

The map below summarizes the WHO's revised recommendations for yellow fever vaccination for travellers in Africa.



Vaccination recommended

Yellow fever vaccination is **recommended** by the WHO for the following countries (red on map): Angola, Benin, Burkina Faso, Burundi, Cameroon, Central African Republic, Congo, Cote D'Ivoire, DRC (for all travellers aged 9 months or over), Equatorial Guinea, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Nigeria, Senegal, Sierra Leone, South Sudan, Togo and Uganda.³⁴

Vaccination not recommended

Yellow fever vaccination is **not recommended** by the WHO for the following countries (green on map): Algeria, Botswana, Comoros, Djibouti, Egypt, Lesotho, Libya, Madagascar, Malawi, Mauritius,

Mayotte, Morocco, Mozambique, Namibia, Rwanda, Saint Helena, Sao Tome and Principe, Seychelles, South Africa, Swaziland, Tanzania, Tunisia and Zimbabwe.³⁴

Mixed recommendations

Mixed recommendations³⁴ exist for the following countries (orange on map):

- For Chad, Mali, Mauritania and Niger, yellow fever vaccination is **recommended** for all travellers aged 9 months or over going to areas south of the Sahara desert. However, it is **not recommended** for travellers whose itineraries are limited to areas within the Sahara Desert.

Table 4: Additional vaccine requirements as per country*

Travelling to	Vaccine	Requirements
Egypt	Polio	Proof of receipt of a OPV or IPV, within the last 12 months and at least 4 weeks before departure, is required if arriving from polio-endemic countries to apply for an entry visa
Gambia	Meningococcal meningitis	Required
Libya	Meningococcal meningitis	Required
	Polio	Required within last 12 months and at least 4 weeks before departure for residents arriving from Afghanistan and Pakistan
Madagascar	Polio	Proof of polio vaccination for travellers spending more than 28 days in the country
Seychelles	Polio	Required for travellers arriving from countries with polio outbreaks

*As adapted from.³⁴

- For Ethiopia, yellow fever vaccination is **recommended** for all travellers aged 9 months or over, except as mentioned below. It is however, generally **not recommended** for travellers whose **itineraries** are limited to the Afar and Somali provinces.
- For Kenya, it is **recommended** that all travellers aged 9 months or over, except as mentioned below, get vaccinated against yellow fever. However, it is generally **not recommended** for travellers whose itineraries are limited to the entire North Eastern Province; the states of Kilifi, Kwale, Lamu, Malindi and Tana River in Coastal Province; and the cities of Nairobi and Mombasa.
- In Sudan, yellow fever vaccination is **recommended** for all travellers aged 9 months or over travelling to areas south of the Sahara desert. However, **not recommended** for travellers whose itineraries are limited to areas in the Sahara desert and the city of Khartoum.

Not recommended with specifications

In Eritrea, yellow fever vaccination is generally not recommended for travellers going to Anseba, Debub, Gash Barka, Mae Kel and Semenawi Keih Bahri (purple on map). It is further not recommended for all other areas not listed above, including the islands of the Dahlak Archipelagos (purple on map). In Somalia it is not recommended for travellers going to the following regions: Bakool, Banaadir, Bay, Gado, Galgadud, Hiran, Lower Juba, Middle Juba, Lower Shabelle and Middle Shabelle, and all other areas not listed (purple on map).³⁴

Country requirements

Despite the recommendations by the WHO, certain countries have their own stated requirements and recommendations entailing yellow fever vaccination. It is important to note that country requirements are subject to change at any time, and therefore it is vital that travellers know the requirements of the country to which they are travelling. The latest global vaccination updates received by the WHO from countries can be found at: <http://www.who.int/ith>.

Additional vaccines required as per country

Recommendations for additional vaccines required by specific countries are included in Table 4. Updates on currently endemic and affected states can be found at: <http://www.polioeradication.org>.

Factors influencing the uptake and use of travel vaccines

The lists below illustrate the factors that generally support the use of vaccines by travellers, or dissuade them from doing so.

Factors supporting the use of vaccines by travellers:

Availability of vaccinations which involve fewer doses and those with a fast onset of action for those who decide to travel "at the last minute".³⁵

- Travellers' knowledge regarding vaccine preventable diseases at their destination, especially when they think they are at risk.³⁵
- Those who travel for work may receive a vaccine as part of the company's health program.³⁵
- A given vaccine may be an entry requirement for a specific transit of final destination.

Factors dissuading the use of vaccines by travellers:

- Availability of products in different countries.³⁶
- Different cultures and perceptions about the risks.³⁶
- Lack of evidence.³⁶
- Differences in public opinion.³⁶
- Travelling agencies which assist the traveller with the arrangements of the trip do not show concern for vaccination need.³⁶
- Travel vaccines are not affordable to everyone, and some medical aids do not cover the vaccines.^{35,36}
- Individuals who travel on short notice.³⁶
- People who extend their visits as vaccination protection declines over time and those who are unaware of their vaccination status and perceive themselves as immune.^{35,36}
- Frequent travellers neglect taking precautions, since they have travelled several times without any significant health complaints.³⁴
- Some travellers are concerned about the side effects, most common complaint being pain with injections.³⁵

Conclusion

With the ease of modern travel, geographical boundaries have become irrelevant and the natural quarantine of diseases has diminished. The result of the ease of movement between countries and geographical areas is that we could expect a continued appearance of communicable disease pandemics. Health care practitioners should be skilled in providing prospective travellers with professional advice concerning appropriate vaccines. They should have a good working knowledge of vaccines available and of the schedules that should be followed to ensure efficacy. Vaccines are a potent but often overlooked medicinal entity in countering the spread of preventable diseases and thus in the prevention of disease pandemics.

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