

ABSTRACT

Risk of contracting specific diseases for travelers, as well as the risk of international spread of diseases can be reduced by immunizations prior to travel. The important factors to be considered in such risk assessments are the destination countries, travel duration, and reasons for travel. Travel vaccines can be grouped in three: required vaccines, routine vaccines, and recommended vaccines. The main required vaccine is yellow fever vaccine. This requirement is based on the International Health Regulations (IHR). Routine vaccines include those in the national immunization programmes, comprising vaccines against diphtheria, tetanus, poliomyelitis, measles, mumps, rubella, and hepatitis B. For recommended vaccines, it is useful to consider the anticipated itinerary, accommodation and the likelihood of high-risk activities. The vaccines should be prioritised based on the severity of diseases, host-related considerations, and vaccine-related consideration.

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INTRODUCTION

Immunizations prior to travel contribute to the reduction of risk of specific diseases for the travelers as well as the risk of an international spread of diseases.

The important factors to be considered in risk assessment are the countries to be visited, duration of travel and reasons for travel.

TRAVEL VACCINES

Travel vaccines can be grouped as:

- κ required, e.g. yellow fever, meningococcal
- κ routine, e.g. diphtheria/tetanus, poliomyelitis, Measles/Mumps/Rubella
- κ recommended, e.g. hepatitis A, typhoid fever, cholera, influenza, Japanese B encephalitis and rabies

REQUIRED VACCINES

The main required vaccine is yellow fever vaccine. This requirement is based on the International Health Regulations (IHR)¹.

Yellow fever is an arthropod-borne disease that occurs in tropical Africa and northern South America. Although yellow fever was never reported in Asia, the mosquito vector, *Aedes* and *Haemogogus* mosquitoes are reported to be present in Asia. This explains the reason why the yellow fever vaccine is required when entering an endemic country and also when entering Asia after visiting any endemic area.

Meningococcal disease has frequently been observed during or after hajj and to a lesser extent during umrah by Muslims to Mecca (200 cases per 100,000). Immunization against meningococcal disease with quadrivalent vaccine is a requirement for pilgrims and workers in Saudi Arabia since 2000 although not specifically mentioned in the IHR. Meningococcal vaccination is also recommended for those visiting the sub-Saharan "meningitis belt" during months of high transmission with annual regional epidemics.

ROUTINE VACCINES

Routine vaccines include those in the national immunization programmes. These include vaccines against diphtheria, tetanus, poliomyelitis, measles, mumps, rubella and hepatitis B.

Recommended childhood vaccinations are not consistent across all countries and the number of immunizations required to complete each series may also differ.

Poliomyelitis has been eradicated from many parts of the world but wild poliovirus remains endemic in Nigeria, India, Pakistan and Indonesia.

Pertussis is more frequent in parts of the world where vaccination levels are low. A primary reason for the continued circulation of *Bordetella pertussis* is that immunity to pertussis wanes about 5-10 years after completion of childhood pertussis vaccination, leaving adolescents and adults susceptible to pertussis.

Hepatitis B is transmitted through contaminated blood or blood products and sexual activity with an infected partner. 6% of adults and 25% of children develop chronic infection with possible complications such as chronic liver disease, cirrhosis and hepatocellular carcinoma.

The vaccine is recommended for all children born in Singapore where seroprevalence of hepatitis B is about 30%. CDC recommends hepatitis B vaccination for all travelers going to destinations where greater than 2% of the population is seropositive for hepatitis B surface antigen and for travelers who anticipate "sexual contact with the local population or who are likely to seek medical or dental treatment in local facilities".

The 2 vaccines which should be regarded as routine for adults are namely the pneumococcal and influenza vaccines.

Pneumococcal (23-valent) polysaccharide vaccine is indicated presently for healthy adults³ 65 years of age, younger adults who have any chronic illness such as cardiovascular or pulmonary disease or individuals at risk of invasive pneumococcal disease such as those with sickle cell anaemia, functional or anatomic asplenia, nephrotic syndrome or chronic renal failure, immunosuppressive conditions and HIV infection. Pneumococcal (7-valent) conjugate vaccine is recommended for children < 2 years of age and children 2-9 years of age with the above-mentioned chronic disease or risk factors.

Influenza vaccine is recommended for groups of individuals such as healthcare workers or household members who might transmit disease to those at high risk. Individuals at greater risk include those³ 50 years of age, residents of long term care facility, those who have chronic pulmonary or cardiovascular disease or are on long term aspirin therapy. The risk of exposure to influenza during foreign travel is variable, depending on the season and destination. In the tropics, influenza occurs throughout the year, whereas transmission peaks from December to March in the Northern Hemisphere and April to September in the Southern Hemisphere.

RECOMMENDED VACCINES

For recommended vaccines, it is useful to consider the anticipated itinerary, accommodation and the likelihood of high-risk activities. Up-to-date reports of diseases in destination country should be checked at recognised sources such as Centers for Disease Control and Prevention (CDC) website: <http://www.cdc.gov> or the World Health Organization's International Travel and Health website: <http://www.who.int/ith>

Hepatitis A

Hepatitis A is one of the most common vaccine preventable infection acquired during travel. The average incidence rate has been 3 per 1000 travelers per month. It is transmitted by contaminated food and water.

Travelers who remain in an area of high endemicity for extended periods (>1 month) are likely to be at higher risk of exposure to hepatitis A. This is true for those who travel frequently to countries of endemicity. Backpackers have a higher probability of exposure to infection with hepatitis A.

Hepatitis A is common throughout the developing world, where infections most frequently are acquired during early childhood and are usually asymptomatic or mild. This population plays an important role in the transmission of hepatitis A in nursery settings.

Typhoid Fever

An estimated 33 million cases of typhoid fever occur each year in the endemic regions of Asia, Africa, Caribbean, Central and South America. A large proportion of typhoid fever is imported by individuals visiting friends and relatives in their country of origin.

Medical treatment of typhoid fever has become increasingly challenging due to the emergence of multi-drug resistant strains in the Indian sub continent, Southeast Asia and South Africa.

Typhoid vaccination and education about food and water hygiene are essential in preventing this infection. It should be noted that immunization provides only 50% to 80% protection lasting 2 to 5 years depending on the type of vaccine received.

Cholera

WHO estimates that more than 120,000 people die of cholera every year, with 3-5 million cases worldwide. Cholera occurs in approximately 0.2 per 100,000 travelers.

The majority of imported cases originate from the Indian subcontinent and Southeast Asia. The reasons for the increasing incidence of cholera are:

- κ crowded living conditions and poor sanitation
- κ climate change and natural disasters such as drought or floods
- κ war and civil unrest resulting in displaced populations

The risk of cholera increases for travelers who drink untreated water or consume poorly cooked or raw seafood in disease-endemic areas. Certain medical conditions such as immunocompromised state, inflammatory bowel disease, diabetes, reduced gastric acidity and persons with O-type blood are at risk of contracting cholera.

Japanese Encephalitis

Japanese encephalitis, a mosquito-borne flaviviral infection, is the leading cause of childhood encephalitis in Asia. Transmission is seasonal and occurs in the summer and autumn in temperate regions of China, Japan, Korea and eastern Russia. The annual rate of Japanese encephalitis is <1 per 1 million.

Most recently the incidence of Japanese encephalitis has decreased in most endemic countries as a result of intermittent irrigation of rice field and other plantations. In most Southeast Asian countries, pigs are usually contained in large farms which are rarely approached by travelers.

The risk to short-term travelers and those who confine their travel to urban centers is low. Travelers living for prolonged periods in rural areas where Japanese encephalitis is endemic or epidemic are at greater risk. Travelers with extensive unprotected outdoor, evening and night-time exposure in rural areas may be at high risk even if their trip is brief.

Rabies

The risk of acquiring rabies is particularly high in the rural parts of Asia, Africa and Latin America. There may be under-reporting in many parts of the world.

It is always transmitted by an animal bite that inoculates the virus into wounds. 90% of human rabies are transmitted by dog bites. Rabies is a particular risk for those who work with animals, explore caves or travel by bicycle. Rabies is also a particular concern in small children, who do not tell their parents or guardian that they have been bitten by an animal.

WHO advises travelers visiting rabies infected areas to avoid contact with wild animals and unknown domestic animals, and to immediately wash and flush the wound with soap or detergent if bitten by a susceptible animal. Post-exposure prophylaxis (PCP) entails rabies vaccine and rabies Ig to be used. Immunization status of the animal should not be taken into consideration to withhold PCP. Pre-exposure vaccination avoids the need to use rabies Ig in the event of an animal bite.

ADMINISTRATION OF TRAVELER'S VACCINES

Among vaccine-preventable diseases, immunization against hepatitis A and B saves the most lives. The greatest reduction in morbidity from travel vaccines can be expected with influenza, hepatitis A and to lesser extent hepatitis B.

Recommended vaccines should be prioritized based on:

- 1) the severity of diseases, their incidence among travelers to the specific countries and the estimated degree of exposure. The duration of travel and the reasons for travel also need to be considered.
- 2) Host-related considerations such as immune status, comorbid conditions, age and specific contraindications for vaccination are also important considerations.
- 3) Vaccine-related considerations are efficacy, safety and cost.

Spacing of Vaccines

Inactivated vaccines generally do not interfere with the immune response to other inactivated or live-virus vaccine. An inactivated vaccine may be given in combination with another inactivated or live-virus vaccine.

Live virus vaccines should be administered with the exception of oral poliovaccine and measles-mumps-rubella vaccine.

Individuals tend to forget to return for follow up dose of vaccine or booster at specified time (Table 1). It is generally

unnecessary in these cases to restart the interrupted series or to add any extra doses. This is true for most vaccines except the oral typhoid vaccine.

The maximum number of vaccines to be administered on the same day is 4 vaccines according to WHO recommendations or up to 7 vaccines in children according to CDC and ACIP.

RECOMMENDED READING

- 1 Centers for Disease Control and Prevention. Health Information for International Travel 2005-2006. Department of Health Human Services.
- 2 World Health Organisation, International Travel and Health. Geneva, Switzerland. World Health Organisation, 2006.
- 3 Dupont HL, Steffen R eds. Textbook of Travel Medicine and Health, Hamilton UK, BC Decker.
- 4 Pickering LK ed. 2000 Red Book: Report of the Committee on Infectious Diseases, 25th ed, Illinois, USA: American Academy of Paediatrics, 2000.
- 5 Steffen R, Connor BA. Vaccines in Travel Health: From Risk Assessment to Priorities. J Travel Med 2005; 12: 26-35.

Table 1: Dose Intervals for Travel Vaccines

Vaccine	Primary course			Booster Intervals
	Number of Doses	Interval between 1st and 2nd dose	Interval between 2nd and 3rd dose	
Yellow fever	1	-	-	10 years
Cholera – Inactivate doral (Dukoral)	2	7 or 21 days	-	2 years
Typhoid – oral* (Ty21a)	3 (4 doses in USA)	On alternate days	On alternate days	5 years
Typhoid – injectable (Vi Vaccine)	1	-	-	3 years
Tetanus	3 wks	4 wks	4 wks	10 years
Polio – oral*	3	At least 6 wks	8 to 12 mths	5 to 10 yrs
Polio – injectable (IPV)	3	6 to 8 wks	2 to 8 mths	Preferred in adults
Rabies (pre-exposure)	3	7 days	21 days	2 years
Meningococcal (quadrivalent)	1	-	-	3 years
Japanese B Encephalitis	3	1 to 2 wks	1 to 2 wks	> 3 years
Hepatitis A	2	6 to 12 mths	-	20 years
Hepatitis B	3	1 mth	5 mths	5 years
Combined Hepatitis A/B (Twinrix)	3	1 mth	5 mths	
Pneumococcal Capsular polysaccharide vaccine (23-valent)	1	-	-	5 years (for high risk persons only)
Varicella (chicken pox)	2 (adults) 1 (child)	4 to 8 wks		

* Live vaccines

LEARNING POINTS

- o Immunity to pertussis wanes about 5-10 years after completion of childhood pertussis vaccination.
- o The 2 vaccines to be regarded as routine for adults are the pneumococcal and influenza vaccines.
- o Pneumococcal (23-valent) Polysaccharide vaccine is indicated for healthy adults > 65 years of age, younger adults with chronic illness such as cardiovascular or pulmonary diseases, or individuals at risk of invasive pneumococcal disease.
- o The risk of contracting cholera increases for travelers who drink untreated water or consume poorly cooked or raw seafood in disease-endemic areas.
- o The maximum number of vaccines to be administered on the same day for adults is 4 (WHO recommendation).