

## Yellow Fever information for pilots

### Introduction

Yellow fever has been known for over 400 years, and the name originates from the jaundice that some patients may acquire. The disease is caused by a mosquito spread virus. The virus is able to infect both humans and monkeys. The virus is endemic in African and American countries close to the equator. Most of those infected remain asymptomatic, but about 15% develop a haemorrhagic infection and about half of these patients die. The symptoms are fever, muscular pain, headache, chills, loss of appetite, nausea and/or vomiting, and often a low pulse rate despite of the fever. There is no specific treatment for the virus. Yellow fever vaccination is effective and one of the rare vaccinations that may be required to enter some countries. It is suggested that all pilots who fly to, or over the endemic yellow fever countries take this vaccination. The vaccination is effective for 10 years, which after a booster is required.

### Virus

Yellow fever virus belongs to the flavivirus group. The virus infects both humans and monkeys and is carried from one animal to another by a biting mosquito. Mosquitoes are also able to pass the virus via infected eggs to their offspring and thus the mosquitoes are the true reservoir of the virus.

The mosquitoes bite during daylight hours and at altitudes up to 2500 metres.

### Epidemics

The virus is constantly present with low levels of infection (i.e. endemic) in some tropical areas of Africa and the Americas, but this viral presence can amplify into epidemics. There are 200,000 estimated cases of yellow fever (with 30,000 deaths) per year. However, due to underreporting, only a small percentage of these cases are identified. Small numbers of imported cases also occur in countries free of yellow fever. Although yellow fever has never been reported from Asia, this region is at risk because the appropriate primates and mosquitoes are present.

### Transmission

There are three types of transmission cycle for yellow fever: sylvatic, intermediate and urban. All three cycles exist in Africa, but in South America, only sylvatic and urban yellow fever occur.

#### **Sylvatic (or jungle) yellow fever:**

In tropical rainforests, yellow fever occurs in monkeys that are infected by wild mosquitoes. The infected monkeys can then pass the virus onto other mosquitoes that feed on them. These infected wild mosquitoes bite humans entering the forest resulting in sporadic cases of yellow fever. The majority of cases are young men working in the forest (logging, etc). On occasion, the virus spreads beyond the affected individual.

#### **Intermediate yellow fever:**

In humid or semi-humid savannahs of Africa, small-scale epidemics occur. These behave differently from urban epidemics; many separate villages in an area suffer cases simultaneously, but fewer people die from infection. Semi-domestic mosquitoes infect both monkey and human hosts. This area is often called the “zone of emergence”, where increased contact between man and infected mosquito leads to

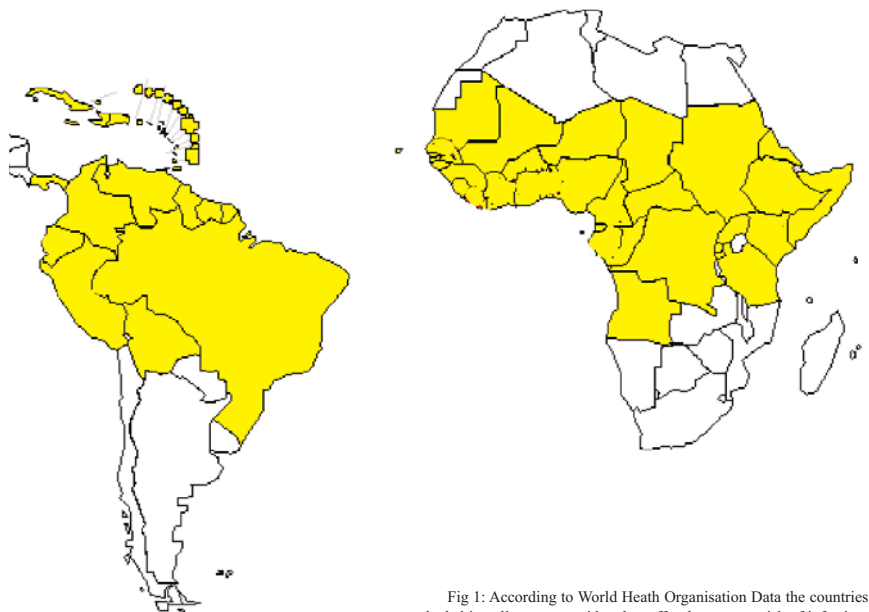


Fig 1: According to World Health Organisation Data the countries shaded in yellow are considered to offer the greatest risk of infection.

disease. This is the most common type of outbreak seen in recent decades in Africa. It can shift to a more severe urban-type epidemic if the infection is carried into a suitable environment (with the presence of domestic mosquitoes and unvaccinated humans).



### **Urban yellow fever:**

Large epidemics can occur when migrants introduce the virus into areas with high human population density. Domestic mosquitoes (of one species, *Aedes aegypti*) carry the virus from person to person; no monkeys are involved in transmission. These outbreaks tend to spread outwards from one source to cover a wide area.

### *Geography*

In Africa, yellow fever exists in countries within a band from 15°N to 10°S of the equator. In the Americas, yellow fever is endemic in nine South American countries and in several Caribbean islands. Bolivia, Brazil, Colombia, Ecuador and Peru are considered at greatest risk. See Fig 1.

### *Symptoms*

The incubation period (i.e. the time in which the symptoms develop) is three to six days and most of the infections seem to be asymptomatic. However, if the symptoms develop, there are two different phases: “acute” and “toxic”. “Acute” phase is characterized by fever, muscle pain, headache, shivers, loss of appetite, nausea and/or vomiting and the paradoxically slow pulse despite the fever. 15% of the patients enter a “toxic phase” within 24 hours. Fever reappears and several body systems are affected. Patients develop jaundice and abdominal pain with vomiting. They also suffer from different haemorrhagic manifestations, including bleeding from the mouth, nose, eyes and/or stomach. Kidney function deteriorates; this can range from mild dysfunction to a complete renal failure. Half of the patients in the “toxic phase” die within 10-14 days. The remainder recover without significant organ damage.

### *Diagnosis*

Yellow fever is difficult to recognise, especially during the early stages. Antibodies, or the virus itself, can be detected from the blood, but these tests require highly trained laboratory staff using specialised equipment and materials.

### *Treatment*

There is no specific antiviral treatment available and thus the treatment is symptomatic. Dehydration and fever can be corrected with oral rehydration solution and pain killers. Any superimposed bacterial infection should be treated with an appropriate antibiotic. Intensive care may improve the outcome of seriously ill patients.

### *Vaccination*

Yellow fever vaccine is safe and highly effective. The protective effect (immunity) occurs within one week in 95% of people vaccinated. A single dose of vaccine provides protection for 10 years and probably for life. There have been recent reports of a small number of serious adverse reactions, including deaths, following yellow fever vaccination; most of these reactions occurred in elderly persons. However, the risk to unvaccinated individuals who visit endemic countries is far greater than the risk of a vaccine-related adverse event. It remains important for all travellers at risk to be vaccinated; nonetheless, yellow fever vaccination should not be prescribed for individuals who are not at risk of exposure to infection.

Side effects of the vaccination are usually slight. They include local reactions at the site of inoculation (up to 10 % of those vaccinated), after four to six days there may be more general reactions, such as an elevated body temperature, malaise, headache and muscle pain which usually subside within 24 hours.

Contraindications for vaccination are acute febrile diseases within the last two weeks, immuno suppression and immune defects, corticoid medication, allergy against chicken protein and age (<6 months).

Only Authorised Vaccination Centres may give the yellow fever vaccine and one needs to have an official vaccination certificate as a proof of the vaccination. This is mandatory when entering certain countries of the endemic zones and, after having visited endemic zones within the last six days, when entering certain other countries of the endemic zones and outside. The list of countries that require vaccination can be found for example from the International Travel and Health booklet that is accessible from WHO web pages [www.WHO.int](http://www.WHO.int) The validity of the certificate begins 10 days from the vaccination day as by then the person has developed immunity against yellow fever.

JAA Manual of Aviation Medicine recommends that flight crews should be vaccinated even if they only fly over endemic areas, because an immunisation might be required after a diversion to an airport, which is in the endemic zone. Therefore all flight crew operating in Africa or South America should be vaccinated against yellow fever.

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