



Mosquito-borne diseases in Brazil

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Practical Guidance

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1. Foreword

Brazil is currently experiencing various outbreaks of mosquito-borne infectious diseases of significant concern to the health of those onboard vessels with potential impact on the safe operation of the vessels, besides the ever-present risk of international spread.

The most significant of the ongoing epidemics are being spread through human-to-vector-to-human contact and the Zika virus is certainly the most worrying outbreak due to the ease of transmission and its association between infected pregnant women and birth defects.



Aedes aegypti mosquito blood-feeding from a human (Photo: James Gathany)

We prepared this handbook with basic information and practical guidance covering the most common mosquito-borne diseases occurring in Brazil that are of particular significance to shipping, outlining control measures and prevention initiatives that the shipmasters and crews should take to reduce their exposure to health risk.

While this material is not intended to be comprehensive or replace loss prevention material and guidelines issued by P&I Clubs, shipping and international health authorities, we hope it is useful as a source of practical reference to the shipmasters, operators and insurers.

REPRESENTAÇÕES PROINDE LTDA.

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2. Port health regulations

Brazil is a Member of both the World Health Organization (WHO) and the Pan American Health Organization (PAHO) and upholds the purpose and principles of the International Health Regulations of 2005 (IHR 2005), which was introduced into the Brazilian legal system in 2009¹ to form the basic framework of the domestic sanitary and health regulations pertaining to surveillance and control of airports, ports, ground crossings, aircrafts, ships and other conveyances.

The national healthcare system *Sistema Único de Saúde – SUS* (Unified Health System) involves public organs and institutions at federal, state and municipal levels. It is composed of the *Secretaria de Vigilância em Saúde* (Secretariat of Health Surveillance), the *Departamento de Vigilâncias das Doenças Transmissíveis* (Department of Surveillance of Transmissible Diseases) and the *Agência Nacional de Vigilância Sanitária – ANVISA* (National Health Surveillance Agency).

ANVISA is the regulatory body under the purview of the *Ministério da Saúde* (Ministry of Health) that plays the institutional role of Port Health Authority (PHA) and National IHR Focal Point (NFP) for the IHR 2005. It is responsible, amongst other regulatory duties, to enforce compliance with the IHR 2005, issue ship sanitation certificates and perform surveillance of ports, airports and ground crossings in Brazil, through the *Sistema Nacional de Vigilância Sanitária* (National System of Health Surveillance).

¹ IHR 2005 was approved by the Legislative Decree no. 395 of 2009 as “*Regulamento Sanitário Internacional (RSI 2005)*”

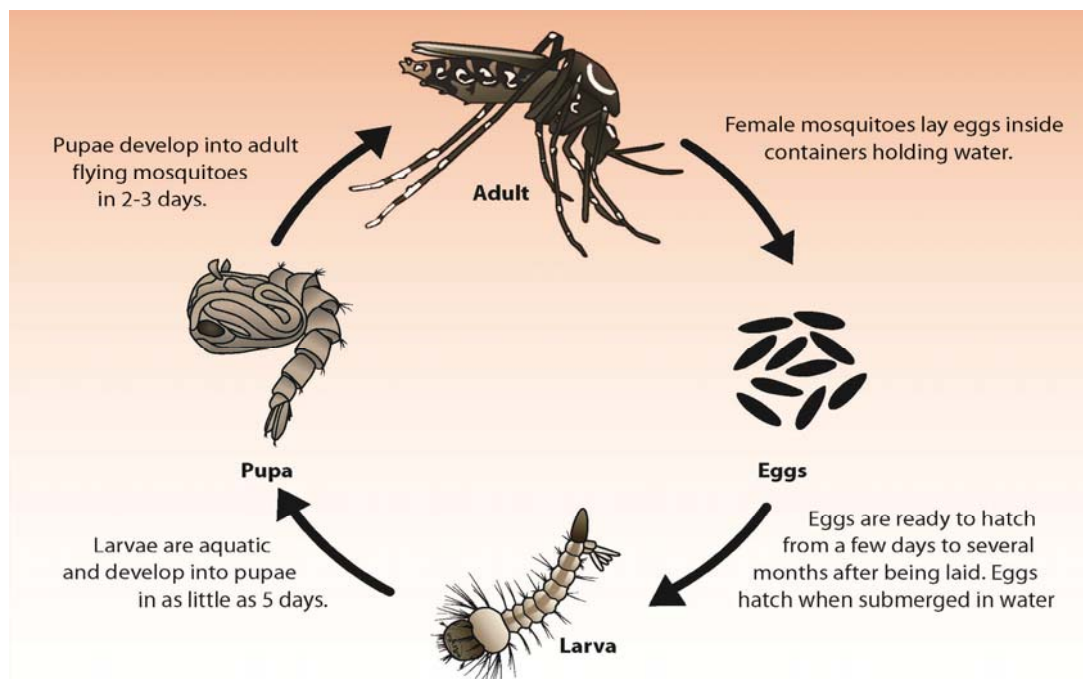
3. The winged vectors

While the *Anopheles* mosquitoes, long well-known malaria vectors, are present in much of Brazilian territory, almost all malaria cases occur in the Amazon region where the disease is endemic, therefore specific precautions are only required for those visiting affected areas for malaria. On the other hand, although also present in the Amazon region, where they are common vectors of sylvatic yellow fever, the *Aedes* mosquitoes present a much wider and far-reaching threat because they are also common and well-adapted to urban areas, where about 84% of Brazil population lives.

Apart from transmitting yellow fever, the *Aedes* mosquitoes – the *Aedes aegypti* species in particular – also spread other debilitating and life-threatening diseases such as dengue fever, chikungunya and Zika virus for which there is no immunisation or specific treatment at hand.

The *Ae. aegypti* species has four life stages (egg, larva, pupa and adult) and take 8 to 10 days to become adult flying mosquitoes. Only the female mosquito bites for blood that it needs to mature her eggs that are usually bred in water-filled manmade structures and containers within dwellings. It bites during daytime, with biting peaks early in the morning and before dusk, and tends to fly within a radius of no more than 400 metres around the site where it was born.

Despite the relatively short flight range of the *Ae. aegypti*, the dissemination is rapidly amplified by infected humans who serve as a source of the virus for uninfected mosquitoes that bite, suck the person's blood with the virus, become infected and then start spreading the virus by biting multiple other persons for the rest of their lifespan which may be from two to four weeks or longer depending on the condition of its habitat and food availability.



Aedes aegypti life cycle (Source: CDC Division of Vector-Borne Diseases)

4. Preventive measures

Vessels visiting all Brazilian ports should take measures to prevent local mosquito transmission through an effective integrated vector management (IVM) plan, including extensive disinsection of the vessel and removal of any stagnant water where the mosquitoes can possibly lay their eggs.

Personal protective measures to reduce exposure to mosquito biting should also be taken by those staying on board and coming ashore, as follows:

- Be informed about the time where the mosquitoes' activities are more prevalent in the region visited (usually early in the morning and before dusk)
- Try to stay indoors in screened or air-conditioned rooms with closed doors and windows
- Sleep under permethrin-treated bed nets if not in an air-conditioned room
- Wear long-sleeved shirts and trousers, ideally light-coloured and permethrin-treated covering as much of the body as possible
- Use insect repellent based on DEET², IR3535³ or Icaridin (Picaridin)⁴ on exposed skin and over – never under – the clothing as directed on the product label and reapply no more than 3 times a day (apply 15 minutes after use of sunscreen, make-up or moisturizing cream)

Most of the vector-borne diseases contracted during port stay would only be detected days or even weeks after vessel's departure from the port.

Physicians and medical facilities are usual in cruise vessels, but would rarely be available on board cargo vessels that trade for long distances with reduced crew and limited medical resources. Therefore, before departure, the Master must ensure that not only the required vector-control measures foreseen in the vessel's IVM plan have been efficiently implemented but also that the vessel is free from contaminations and other sources of health hazards with any suspected cases of illness being readily reported.

² Products containing DEET (chemical name: N,N-Diethyl-meta-toluamide, also called diethyltoluamide or N,N-diethyl-3-methyl-benzamide) include, but are not limited to, *Off!*, *Cutter*, *Sawyer*, *Ultrathon*, *Autan* and *Repelex!* – ANVISA finds this repellent to pregnant women and children above 2 years old, under physician guidance

³ Products containing IR3535 or EBAAP ((chemical name: 3-[N-butyl-N-acetyl]-aminopropionic acid, ethyl ester) include, but are not limited to, *Skin So Soft Bug Guard Plus Expedition*, *SkinSmart*, *Jonhson Loção Antimosquito* and *Repelente infantil Huggies Turma da Mônica* – ANVISA finds this repellent safe for pregnant women and children between 6 months and 2 years old, under physician guidance

⁴ Products containing Picaridin (KBR 3023 [Bayrepel] or icaridin outside the United States (chemical name: 2-(2-hydroxyethyl)-1-piperidinecarboxylic acid 1-methylpropyl ester) include, but are not limited to, *Cutter Advanced*, *Skin So Soft*, *Bug Guard Plus*, *SkinSmart* and *Exposis* - ANVISA finds this repellent safe to pregnant women and children above 2 years old, under physician guidance

5. Mosquito-borne diseases of significance to shipping

5.1. Dengue fever

Dengue is an arbovirus infection spread through the bite of an infected female mosquito of the *Aedes* genus, chiefly the *Ae. aegypti*, and is currently widespread in almost all regions of Brazil.

There are four serotypes of the virus that causes dengue fever and infection by one subtype provides lifelong immunity against that subtype but not against the others⁵. Symptoms of infection by dengue fever characteristically include:

- Fever above 38°C lasting 4 to 7 days
- Intense headache
- Pain behind the eyes
- Severe joint and muscle pain
- Extreme fatigue lasting for days or weeks
- Rash (after the 4th day in 30-50% of the cases)
- Nausea, vomiting and sometimes diarrhoea (30-50% of the cases)

A severer and life-threatening dengue haemorrhagic fever (DHF), also known as severe dengue, may occasionally develop. DHF causes abdominal pain, bleeding, vomiting of blood, blood in the faeces and nosebleeds. In very rare cases, neurological complications, such as encephalitis, Guillain–Barré syndrome (GBS) and myelitis may be observed.

In Brazil, in 2015 there were over 1,6 million reported cases of probable dengue⁶, including 1,547 cases of severe dengue⁷, 19,935 cases of dengue with warning signs⁸ resulting in 854 deaths. 62.2% of the cases occurred in the Southeast Region (where the ports of Santos, Rio de Janeiro and Vitoria are located), and 18.9% in the Northeast Region (where the main ports are Fortaleza, Salvador and Recife)⁹.

Dengue's fatality rate in 2015 increased 81.3% in relation to 2014, when 471 persons died, mostly infected with the DEN-1 serotype. Between January and April 2016, 1,054,127 cases, including 340 cases of severe dengue and 3,626 cases of dengue with warning signs, were notified. 59.3% of the cases occurred in the Southeast Region and 19.5% in the Northeast Region, with 190 deaths confirmed so far¹⁰.

⁵ Dengue virus (DEN) comprises of four closely related serotypes (DEN-1, DEN-2, DEN-3 and DEN-4) that belong to the genus *Flavivirus*, Family *Flaviviridae*, the most prevalent in Brazil (about 94% of the cases) being the DEN-1. Infection with one subtype provides lifelong immunity against that subtype only

⁶ 'Probable dengue' includes patients who live in or travelled to dengue endemic areas, present fever and at least two of the following symptoms: nausea and vomiting, rash, aches and pains, tourniquet test positive leukopenia and any 'warning signs'

⁷ 'Severe dengue' features severe plasma leakage leading to dengue shock syndrome (DSS) and fluid accumulation with respiratory distress, severe bleeding and severe organ involvement

⁸ 'Warning signs' consist of abdominal pain or tenderness, persistent vomiting, clinical fluid accumulation, mucosal bleed, lethargy and restlessness, liver enlargement > 2 cm, laboratorial test showing increase in HCT concurrent with rapid decrease in platelet count

⁹ 'Boletim Epidemiológico' (Epidemiologic Bulletin), Volume 47, No. 2, 2016, *Monitoramento dos casos de dengue, febre de chikungunya e febre pelo vírus Zika até a Semana Epidemiológica 51, 2015* (Monitoring of the cases of dengue, Chikungunya fever and Zika virus until the epidemiologic week 51, 2015 – 04/01/2015 to 26/12/2015), issued by the Ministry of Health's Health Surveillance Secretariat

¹⁰ 'Boletim Epidemiológico' (Epidemiologic Bulletin), Volume 47, No. 20, 2016, *Monitoramento dos casos de dengue, febre de chikungunya e febre pelo vírus Zika até a Semana Epidemiológica 16, 2016* (Monitoring of the cases of dengue, Chikungunya fever and Zika virus until the epidemiologic week 16, 2016 – 03/01/2016 to 23/04/2016), issued by the Ministry of Health's Health Surveillance Secretariat

No specific treatment is currently available for dengue or severe dengue other than administering analgesics (except acetylsalicylic acid) to treat fever and pain and encouraging the sufferer to take plenty of fluids otherwise rest and eat normally as most dengue cases are resolved spontaneously with fatality rates below one per cent¹¹.

Dengue sufferers do not need to be isolated but should take precautions to stay away from mosquitoes and adopt personal protection measures for at least one week after infection to avoid further spread of the disease.

The Brazilian Ministry of Health, through ANVISA, did not put any specific health control restriction on vessels as a result of the ongoing dengue outbreak other than enhancing the verification of vessel's IVM plans and overall hygiene and sanitary conditions prevailing on board the vessel, in particular those arriving from areas where the *Aedes* mosquitoes are endemic. Otherwise, it follows the protocols, manuals and procedures adopted by the WHO and PAHO.

Although there is no publicly available record of shipboard imported cases of dengue fever, many seafarers, passengers and employees of vessels are known to have contracted the virus when exposed to mosquitoes while onboard, during shore leave or transfer to or from the airport for crew change.

5.2. Chikungunya

Chikungunya is another arbovirus transmitted by the bite of an infected female mosquito *Ae. aegypti* and, to a lesser extent, the *Ae. albopictus* species.

The chikungunya virus (CHIKV) was first identified in Brazil in April 2014 and its symptoms and clinical signs are similar to those of the dengue virus often leading to misdiagnosis in areas where dengue fever is more prevalent. The main differentiation between the two viruses is the joint and tendon pain that tends to be more intense with persons infected with CHIKV than with dengue sufferers¹².

CHIKV may go unnoticed in about 30% of the affected population. In the majority of the cases, a full recovery is achieved with the person acquiring lifelong immunity against the disease.

Typical symptoms of infection by CHIKV are:

- Abrupt onset of fever above 38°C lasting 2 to 3 days
- Moderate headache
- Moderate-to-intense joint and tendon pain and swelling
- Intense muscle pain
- Fatigue
- Rash (between the 2nd and 5th day in 50% of the cases)
- Conjunctivitis/eye redness (30% of the cases)

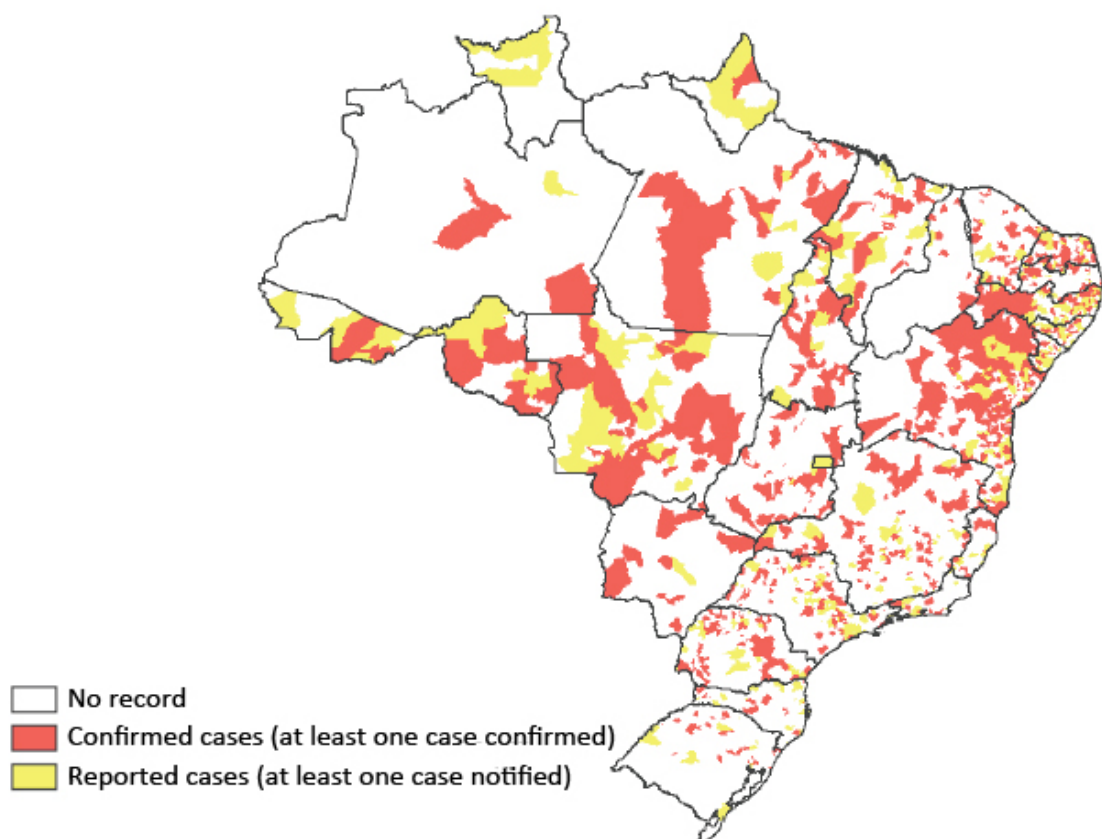
¹¹ WHO Dengue and Severe Dengue, Fact Sheet, updated April 2016

¹² PAHO Factsheet on Chikungunya, updated June 2014

Very rare cases include neurological manifestations in the form of encephalitis, GBS and myelitis amongst other complications¹³.

Brazilian Ministry of Health data indicate 38,332 reported cases of chikungunya fever in 2015, with 13,236 confirmed cases and the remainder under investigation. Six infected persons aged 75 in average died in 2015 as a consequence of CHIKV; five of them lived in the North Region and one in the Southeast Region¹⁴.

From January to April 2016, 64,349 cases were reported with 11,182 cases already confirmed. That is more than double the number of cases recorded in 2015, when the rate of incidence in 2015 was 18.7 cases per 100k inhabitants, against the current ratio of 31.5/ 100k.



Notified and confirmed cases of chikungunya virus (CHIKV) in Brazil, as at April 2016 (Source: Brazilian Ministry of Health)

About 85% of the reported cases this year occurred in the Northeast Region, followed at a far distance by the Centre-West Region with 6%. At least 15 persons (aged 57 in average) have died of complications caused by CHIKV, 14 of them lived in States of the North Region and one in the State of Rio de Janeiro in the Southeast Region.

¹³ WHO Chikungunya, Fact Sheet, updated April 2016

¹⁴ 'Boletim Epidemiológico' (Epidemiologic Bulletin), Volume 47, No. 20, 2016, *Monitoramento dos casos de dengue, febre de chikungunya e febre pelo vírus Zika até a Semana Epidemiológica 16, 2016* (Monitoring of the cases of dengue, Chikungunya fever and Zika virus until the epidemiologic week 16, 2016), issued by the Ministry of Health's Health Surveillance Secretariat

No specific treatment for chikungunya fever is available at this stage. The infected person should take analgesics to treat fever (except acetylsalicylic acid) and anti-inflammatory for the joint pain, apart from drinking fluids aplenty, resting and eating normally and taking precautions against mosquito biting to prevent spread.

Similar to dengue and Zika, no inoculation against chikungunya fever exists and prevention must focus on effective IVM control and surveillance and personal mosquito-protection measures.

ANVISA follows WHO and PAHO protocols, manuals and procedures and, so far, did not implement any specific measure to deal with the disease on visiting vessels, other than increasing the rigour of verification of IVM plans and checking of overall hygienic-sanitary inspection, mainly on vessels originating from areas infested with *Aedes* mosquitoes.

5.3. Zika virus

The transmission of the Zika virus (ZIKV) also occurs through biting by female *Aedes* mosquitoes, predominantly the *Ae. aegypti* species, and is rapidly spreading across the Americas and beyond.

Vertical transmission (mother-to-child in the womb) has now been established in face of multiple cases of birth defects, including microcephaly, in babies delivered by mothers infected with ZIKV, though additional scientific researches are in progress to elucidate the relationship between the viral disease and the congenital anomalies.

Transmission through sexual intercourse has been documented and although it pends further scientific investigation, WHO issued interim recommendations to avoid infection by this mode¹⁵.

While not documented, transmission through breastfeeding is theoretically possible since ZIKV has been found in the breast milk of infected women¹⁶.

Other possible means of transmission, such as through saliva, urine and other bodily fluids of infected persons are also being investigated, though so far there are no scientific grounds to validate this possibility.

Brazil identified this arbovirus for the first time in April 2015 and later that year detected an unprecedented spike in the number of cases of Guillain–Barré syndrome (GBS), microcephaly and other foetal malformations among mothers in the Northeast Region of the country coincident with ongoing epidemics of ZIKV in the region.

The symptoms of the infection by the ZIKV are generally mild to none in about 80% of the cases and share similarities with other viruses transmitted by the same mosquitoes, such as dengue fever and chikungunya fever. They typically appear after an incubation period ranging from about 3 (three) to about 12 (twelve) days and consist of:

¹⁵ WHO Prevention of sexual transmission of Zika Virus – Interim guidance update, 30 May 2016 (WHO/ZIKV/MOC/16.1 Rev.1)

¹⁶ PAHO Guideline for Zika virus disease and complications surveillance, 2016

- Light fever lasting 1 to 2 days
- Moderate headache
- Moderate joints pain that may last for weeks after recovery
- Moderate muscle pain and swelling
- Moderate to intense rash, sometimes itchy (after the 1st or 2nd day)
- Conjunctivitis/eye redness (50% to 90% of the cases)

Neurologic complications resulting from ZIKV infection, such as encephalitis, myelitis and other manifestations are not frequent but tend to be more prevalent than amongst dengue and chikungunya sufferers.

In response to the clusters of microcephaly and other neurological disorders reported by the Brazilian health authorities – and retrospectively from outbreaks in French Polynesia – in February 2016, the Director-General of WHO declared the disease a public health emergency of international concern (PHEIC)^{17 18} and confirmed there is sufficient scientific consensus that ZIKV is a cause of microcephaly and other congenital anomalies and GBS¹⁹. Also in February 2016, the U.S. Centers for Disease Control and Prevention (CDC) of the US Department of Health and Human Services activated its emergency response systems to Level 1, the highest level at the American public health agency.

From the onset of the disease last year until April 2016, there were 120,161 reported cases of ZIKV in Brazil, mostly from States in the Centre-West region, of which 39,993 were laboratory-confirmed, including three deaths of individuals with average age of 20, two from the North Region and one from the Northeast Region²⁰. During the same period, staggeringly 7,623 cases of microcephaly and/or central nervous system (CNS) malformation were reported by the Ministry of Health²¹, which is in sharp contrast with the period between 2001 and 2014, when an average of 163 cases were recorded per year²².

Among the reported cases, 1,434 were confirmed for microcephaly and/or CNS malformation suggestive of congenital infection. 53% of the cases originated in the Northeast Region, notably in the State of Pernambuco (where the first case of microcephaly associated with ZIKV in Brazil was ever recorded), seconded by 24% of the cases arising in the North Region.

Of the reported cases, 285 foetal or neonatal deaths were recorded (3.7% of the total reported cases) with 187 cases under investigation, 60 cases confirmed as associated with the ZIKV and 38 cases ruled out.

¹⁷ Under IHR 2005 definition, a public health emergency of international concern – PHEIC “means an extraordinary event which is determined, as provided in these Regulations: (i) to constitute a public health risk to other States through the international spread of disease and (ii) to potentially require a coordinated International response”

¹⁸ WHO statement on the first meeting of the International Health Regulations (2005) Emergency Committee on Zika virus and observed increase in neurological disorders and neonatal malformations, 1 February 2016

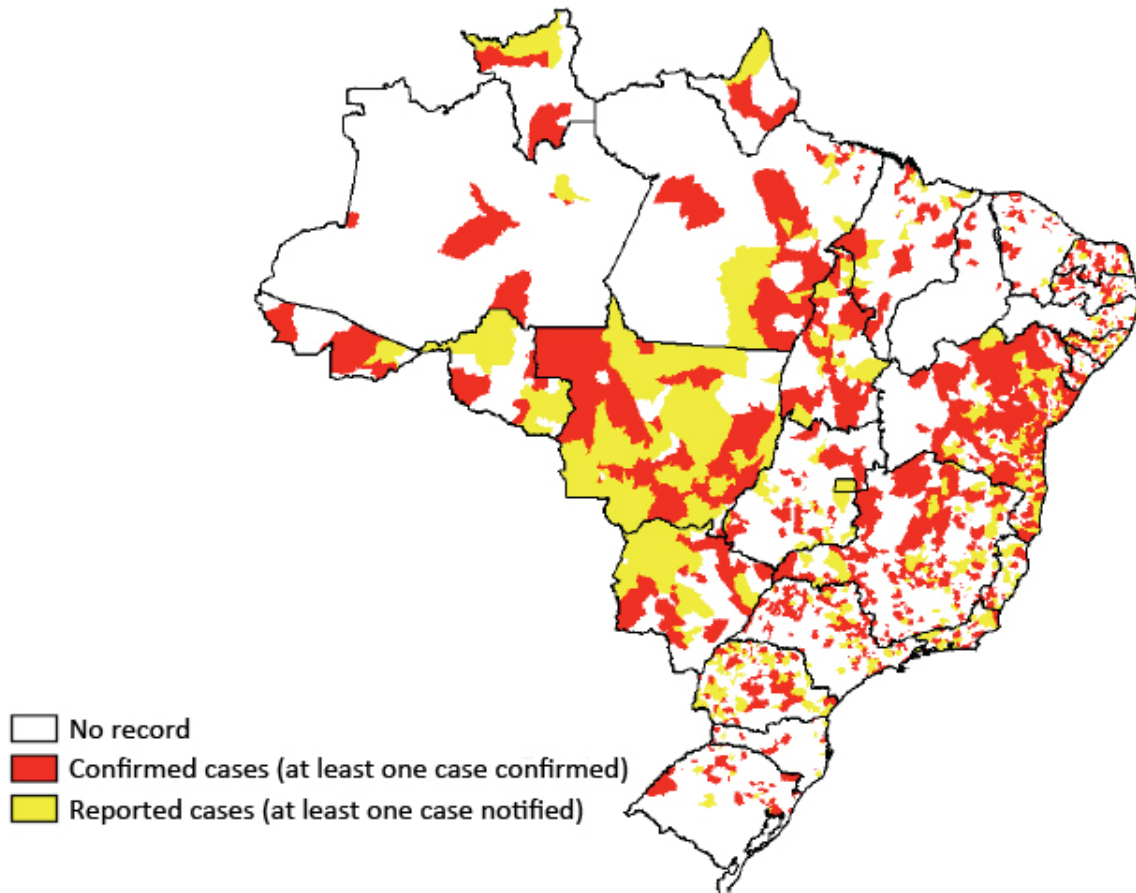
¹⁹ WHO Situation Report: Zika Virus, Microcephaly, Guillain-Barre Syndrome, 19 May 2016

²⁰ *Boletim Epidemiológico* (Epidemiologic Bulletin), Volume 47, No. 20, 2016, *Monitoramento dos casos de dengue, febre de chikungunya e febre pelo vírus Zika até a Semana Epidemiológica 16, 2016* (Monitoring of the cases of dengue, Chikungunya fever and Zika virus until the epidemiologic week 16, 2016), issued by the Ministry of Health’s Health Surveillance Secretariat

²¹ *Informe Epidemiológico* (Epidemiologic Report), No. 27, *Semana Epidemiológica 20/2016 (15/05 a 21/05/2016)* (Epidemiologic Week 20/2016 (15/05 to 21/05/2016)) *Monitoramento dos Casos de Microcefalia no Brasil, Centro de Operações de Emergências em Saúde Pública Sobre Microcefalias, Ministério da Saúde*. Monitoring of Microcephaly Cases in Brazil, Operational Centre for Public Health Emergency About Microcephaly, Ministry of Health

²² WHO Situation Report: Zika Virus, Microcephaly, Guillain-Barre Syndrome, updated 7 April 2016

There is no vaccination or treatment presently available for ZIKV and recommended supportive care is relief of symptoms that are otherwise mild in the vast majority of the cases – and often mistaken as Dengue fever or chikungunya. Common analgesics (except acetylsalicylic acid) and anti-inflammatories should be taken in case of need. The infected person should drink enough fluids, rest and maintain normal eating habits. In case symptoms worsen, especially in pregnant women or women seeking to become pregnant, medical assistance should be sought.



Notified and confirmed cases of Zika virus (ZIKV) in Brazil, as at April 2016 (Source: Brazilian Ministry of Health)

Infected persons do not need to be isolated but should not be exposed to mosquito bites at least during the first week after detection of the infection to avoid further spread.

CDC advises women who are pregnant not to travel to any area of Brazil below 2,000 metres, which is virtually everywhere in the country; women who are planning pregnancy to talk to a doctor first. CDC also recommends men who have recently travelled to affected areas to wear condom or else not to have sex with a pregnant partner²³.

While WHO declared there are no general restrictions on travel or trade to areas of Zika outbreaks, it advises pregnant women not to travel to these areas and pregnant women's sex partners returning from affected areas to practice safe sex or abstain from having sex during pregnancy²⁴.

²³ CDC's Zika Virus in Brazil, Travel Notices, updated 28 April 2016

²⁴ WHO Emergencies, preparedness, response: Information for travellers visiting Zika affected countries, updated 2 May 2016

In Brazil, ANVISA follows standard WHO and PAHO recommendations, protocols and guidelines for dealing with the ongoing outbreaks and did not put in practice any specific health restriction on vessels, except enhancement of sanitary inspections and verification of vessel's IVM plans, especially of those that previously called at ports within Aedes endemic areas.

Some countries, notably Morocco, P.R. China and Republic of Korea demand vessels arriving from affected areas for Zika virus, which is the case of Brazil, to hold a mosquito eradication certificate issued or endorsed by the authorities of the affected countries or a self-disinfection certificate.

Although ANVISA itself does not issue nor endorse such certificates, it does allow private licensed companies to provide vector-management services to vessels. The cost varies from port to port and depends on the size of the vessel and her location²⁵.

When procuring vector control services, the Owners should instruct the agents to make sure the contractors are reliable and in fact licensed by ANVISA and that their standard certificate meets the requirements of the country of destination.

5.4. Yellow fever

Yellow fever virus (YFV) is a flavivirus transmitted by infected female of *Aedes* and *Haemagogus* mosquitoes. YFV is endemic in in tropical areas of Africa, Central and South America, including certain areas of Brazil, notably the North and Centre-West Regions.

The mosquitoes become infected with YFV after biting infected monkeys and humans. No human-to-human transmission occurs.

Due to high level of viremia, the infected human starts transmitting the virus via mosquitoes shortly before the onset of fever in the first 3 to 5 days²⁶.

YFV has three types of transmission cycles: sylvatic – or jungle – yellow fever (in tropical forests), intermediate – or savannah – yellow fever (transmitted by semi-domestic mosquitoes in Africa only) and urban yellow fever (large epidemics in densely populated areas).

Many people are asymptomatic and those showing symptoms following incubation from 3 to 6 days would normally suffer²⁷:

- Moderate fever
- Muscle pain with prominent backache
- Intense headache
- Loss of appetite
- Nausea
- Fatigue and weakness

²⁵ As at May 2016, disinsection costs at major ports such as Santos and Rio de Janeiro are in average BRL 1,800 (alongside) and BRL 2,100 (inner anchorage, when so permitted). In other smaller ports, the agents should be asked to obtain various quotations

²⁶ CDC Health Information for International Travel 2016

²⁷ WHO Yellow Fever Fact Sheet, updated May 2016

Only in about 15% of cases the symptoms worsen to include high fever, jaundice, vomiting, pain in the upper abdomen and eventually bleeding from the bowel, urinary tract and gums and low urine output, with 75% of sufferers from this group recovering and 25% dying²⁸.

In Brazil, urban yellow fever – transmitted by the *Ae. aegypti* – is very rare. On the other hand, sylvatic yellow through *Haemagogus* and *Sabethes* mosquitoes is endemic in the Amazon Basin region and in most States of the North and Centre-West Regions, with peaks of cases between the months of December and May due to high temperature and rainfalls that provides for ideal breeding conditions for the mosquitoes, and a larger concentration of unvaccinated humans in touristic and recreational activities.



Yellow fever vaccination recommendations for Brazil as at September 2015 (Source: CDC Travel Advice)

Between 2014 and 2015, 344 suspected cases were notified to the Brazilian health authorities. All reported cases occurred within well-known endemic areas for sylvatic yellow fever and occurred during the usual peak season. So far, 322 of these cases were discarded, 15 are under investigation and 7 cases were confirmed – they were unimmunised male rural workers or tourists and 4 of them have died²⁹.

There is no specific treatment or medication for YFV infection. Early hospitalisation with adequate supportive care including rest, intake of plenty fluids, food and administration of common medicines to relieve the pain and fever significantly improves survival rates.

²⁸ WHO International Medical Guides for Ships, 2007

²⁹ *Boletim Epidemiológico* (Epidemiologic Bulletin), Volume 46, No. 29, 2015: *Reemergência da Febre Amarela Silvestre no Brasil, 2014/2015: situação epidemiológica e a importância da vacinação preventiva e da vigilância intensificada no período sazonal*, Secretaria de Vigilância Sanitária – Ministério da Saúde (Re-emergence of Sylvatic Yellow Fever in Brazil 2014/2015: epidemiologic situation and the importance of preventive vaccination and intense surveillance during the seasonal period, Sanitary Surveillance Secretariat – Ministry of Health)

Those who survive YFV generally acquire long-lasting immunity against the disease.

Vaccination against yellow fever is safe, affordable and abundantly available. It produces effect after ten days of administration and a single dose provides lifelong protection against the disease³⁰. It represents the only effective means of personal protection against the infection.

At present, yellow fever is the only transmissible disease for which proof of vaccination or prophylaxis may be required as a condition of entry into a State Party of the International Health Regulations 2005 (IHR 2005).

Brazil currently does not require yellow fever vaccination from visitors as a condition of entry; however, the Ministry of Health recommends vaccination to all persons older than 9 months who are going to visit affected areas in the country³¹.

ANVISA provides yellow fever inoculation and issues the vaccination certificate in the WHO standard format, free of charge, through vaccination centres across all major Brazilian ports and airports.

A list of Brazilian ports with recommendation of vaccination against yellow fever is attached.

5.5. Malaria

Malaria is an infectious disease transmitted through the bite of infected female *Anopheles* mosquitoes that spread five types of *Plasmodium* parasites. The most common malaria parasites affecting persons are the *Plasmodium vivax* and the *Plasmodium falciparum*, the latter being the deadliest species.

The incubation period of the malaria is between 7 and 15 days, though antimalarial drugs taken for prophylaxis can delay the appearance of the symptoms by weeks or months, particularly in the case of vivax malaria.

The symptoms are generally mild and difficult to diagnose as malaria as they typically appear between 12-30 days after the infection³². These consist of:

- Fever, typically in paroxysms (cyclical sensation of cold, shivering followed by fever, headaches and vomiting daily in falciparum malaria and every two days in vivax malaria)
- Headache
- Chills
- Flu-like illness

³⁰ World Health Assembly resolution WHA67.13 of May 2014, which amended the IHR 2005, stipulates that as from 11 July 2016, the period of validity of the yellow fever vaccination will be changed from the current 10 years to the duration of the life of the person vaccinated

³¹ Travellers should check WHO International travel and health website (<http://www.who.int/ith/en/>) to check the list of Brazilian states to which yellow fever vaccination is recommended. As at May 2016, WHO recommendations are: "travellers aged 9 months or over going to the states of Acre, Amapá, Amazonas, Distrito Federal (including the capital city of Brasília), Goiás, Maranhão, Mato Grosso, Mato Grosso do Sul, Minas Gerais, Pará, Rondônia, Roraima and Tocantins, and designated areas of the following states: Bahia, Paraná, Piauí, Rio Grande do Sul, Santa Catarina and São Paulo. Vaccination is also recommended for travellers visiting Iguazu Falls. Not recommended for travellers whose itineraries are limited to areas not listed above, including the cities of Fortaleza, Recife, Rio de Janeiro, Salvador and São Paulo".

³² WHO Malaria fact sheet, April 2016

If malaria infection by *P. falciparum* is not treated within 24 hours, it can develop severe illness possibly leading to death. Complications resulting from falciparum malaria include³³:

- Cerebral malaria (abnormal behaviour, impairment of consciousness, seizures, coma, or other neurologic abnormalities)
- Severe anaemia due to haemolysis
- Haemoglobinuria due to haemolysis
- Acute respiratory distress syndrome (ARDS)
- Abnormalities in blood coagulation
- Low blood pressure caused by cardiovascular collapse
- Acute kidney failure
- Hyperparasitemia
- Metabolic acidosis
- Hypoglycaemia

There is no approved vaccination against malaria and the best way to avoid it is through an efficient IVM program to eradicate vectors. Otherwise malaria is curable and the type and length of the treatment required depends on many factors including the severity of the infection, the species of the parasite, the location where the infection was contracted and the medical facilities available to treat the infected persons.

WHO figures indicate that malaria cases globally fell from an estimated 262 million in 2000 to 214 million in 2015, representing a decline of 18%. In that period, the incidence of the disease among populations at risk fell by 37% worldwide.

The reported number of death by malaria has also declined globally. In 2000, an estimate 839,000 deaths were reported and in 2015 a total of 438,000, a reduction of 48%, which represents a decline in the mortality rate during same period of 60%.

Most of the cases reported in 2015 occurred in the African region (88%) followed by Southeast Asia (10%) and the Eastern Mediterranean region (2%)³⁴.

In Brazil, almost all cases of malaria transmission occur in the Amazon basin (North and Midwest Regions), the most common vectors being the *P. vivax* followed by the *P. falciparum* and the *P. malariae*³⁵. WHO recommends prevention in the risk areas in the Amazon basin and certain other regions of the country³⁶.

Most if not all imported cases of malaria occurred on board vessels arriving in Brazil from West African ports and involve infection by *P. falciparum*.

³³ CDC Health Information for International Travel 2016

³⁴ WHO World Malaria Report 2015

³⁵ "Guia para profissionais de saúde sobre prevenção da malária em viajantes", 2008 (Guide for health professionals about malaria prevention for travellers, 2008, by the Brazilian Ministry of Health)

³⁶ Travellers should check WHO International travel and health website (<http://www.who.int/ith/en/>) to check the list of Brazilian states to which prevention against malaria is recommended

6. Conclusion

Although we do not have records of foreign crewmembers contracting any of the mosquito-borne diseases commented above – all cases of malaria affecting seafarers in Brazil were ‘imported cases’, mostly from West Africa – it is a fact that there is a great risk of vessels visiting the country being exposed, either because of their proximity to affected areas within the ports or because vessels may theoretically present ideal conditions for virus-infected mosquitos to breed either in the vessel’s structures or within some types of cargoes.

Female mosquitos can live for several weeks and their eggs can outlive in hibernation for months in stagnant waters at adequate temperature; therefore, apart from crew being exposed to the mosquitos while in Brazilian ports, there is also a danger of the vessel ‘exporting’ the mosquitos to other regions in the globe and, indeed, male seafarers unknowingly bringing diseases such as the Zika Virus to their homes and infecting their partners through sexual transmission.

Therefore, it is essential that vessel’s IVM plan is followed in every detail and vigilance heightened in locations where the mosquitos are known to occur.

The next chapter offers recommendations for further reading and authoritative guidance.

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Editor: Ricardo Martins

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7. References and annexes

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Annex 1: Brazilian ports with yellow fever vaccination recommendation³⁹

Vaccination recommended:	YES	NO
Rio Grande do Sul		
Rio Grande		X
Laguna		X
Pelotas		X
Porto Alegre	X	
Santa Catarina		
Imbituba		X
Itajai		X
Tramandaí		X
Navegantes		X
São Francisco do Sul		X
Itapoá		X
Paraná		
Paranaguá		X
Antonina		X
São Paulo		
Santos (including Piaçaguera)		X
São Sebastião		X
Rio de Janeiro		
Angra dos Reis		X
Itaguaí (formerly Sepetiba)		X
Rio de Janeiro		X
Niterói		X
Porto do Forno		X
Porto do Açu		X
Espirito Santo		
Vitoria		X
Vila Velha		X
Praia Mole		X
Tubarão		X
Ponta Ubu		X
Barra do Riacho (Portocel)		X
Bahia		
Ilhéus		X
Salvador		X
Aratu		X

Sergipe		
Aracajú		X
Barra dos Coqueiros		X
Alagoas		
Maceió (Jaraguá)		X
Pernambuco		
Suape		X
Recife		X
Paraíba		
Cabedelo		X
Rio Grande do Norte		
Natal		X
Areia Branca		X
Ceará		
Fortaleza (Mucuripe)		X
Pecém		X
Maranhão		
Itaqui	X	
Ponta da Madeira	X	
São Luis	X	
Pará		
Belém	X	
Vila do Conde	X	
Santarém	X	
Itaituba	X	
Trombetas	X	
Amapá		
Macapá	X	
Santana (Fazendinha)	X	
Amazonas		
Manaus	X	
Itacoatiara	X	
Tabatinga	X	

³⁹ Last updated Nov/2015. Source of information: CGDT/DEVIT/SVS/MS (Brazilian Ministry of Health) – Full list available at: <http://portalsaude.saude.gov.br/images/pdf/2015/novembro/19/Lista-de-Municipios-ACRV-Febre-Amarela-Set-2015.pdf>

SANTOS	REPRESENTAÇÕES PROINDE LTDA.		
Address	Rua Itororó, 3 – sala 31 11010-071 – Santos-SP Brazil		
Telephone	+ 55 13 4009 9550		
General Email	proinde@proinde.com.br		
After-hours Numbers	Name	Mobile	Home Telephone
	Ricardo Martins	+55 13 9976 26626	+55 13 3252 7229
	Mauricio Alves	+55 13 99750 6654	+55 13 3288 4416

RIO DE JANEIRO	REPRESENTAÇÕES PROINDE (RIO) LTDA.		
Address	Av. Rio Branco, 45 – sala 2405 20009-003 – Rio de Janeiro-RJ Brazil		
Telephone	+ 55 21 2253 6145		
General Email	proinde.rio@proinde.com.br		
After-hours Numbers	Name	Mobile	Home Telephone
	Roosevelt Derossi Lomba	+55 21 98778 8962	+55 21 2590 8032
	Jorge Tavares	+55 21 98778 8963	+55 21 3502 4664

RECIFE	REPRESENTAÇÕES PROINDE (NORDESTE) LTDA.		
Address	Av. Visconde de Jequitinhonha, 209 - Sala 402 51021-190 - Recife, PE Brazil		
Telephone	+55 81 3328 6414		
General Email	proinde.recife@proinde.com.br		
After-hours Numbers	Name	Mobile	Home Telephone
	Marcos Vitor Magalhães	+55 81 9194 4669	+55 81 3048 4317
In case of communication difficulties, please call Santos or Rio de Janeiro after-hours numbers			

MANAUS	REPRESENTAÇÕES PROINDE (NORTE) LTDA.		
Address	Rua Dr. Theomario Pinto da Costa, 811 – sala 204 69079-210 – Manaus-AM Brazil		
Telephone	+55 92 3307 0830		
General Email	proinde.manaus@proinde.com.br		
After-hours Numbers	Name	Mobile	Home Telephone
	Max Peixoto Pomar	+55 92 98216 0220	+55 92 3237 7229
In case of communication difficulties, please call Santos or Rio de Janeiro after-hours numbers			

SALVADOR	REPRESENTAÇÕES PROINDE LTDA. c/o PERINÁUTICA LTDA.		
Address	Rua Miguel Calmon, 19 – Sala 702 40015-010 – Salvador-BA Brazil		
Telephone	+55 71 3242 1128		
General Email	proinde.salvador@proinde.com.br		
After-hours Numbers	Name	Mobile	Home Telephone
	Ali Hilly	+55 71 9971 6515	+55 71 3240 2152
In case of communication difficulties, please call Santos or Rio de Janeiro after-hours numbers			

VITORIA	REPRESENTAÇÕES PROINDE LTDA. c/o WS COMÉRCIO E SERVIÇOS MARÍTIMOS LTDA.		
Address	Rua Professor Eupidio Pimentel, 320 – Sala 401 29065-060 – Vitória-ES Brazil		
Telephone	+55 27 3337 1178		
General Email	proinde.vitoria@proinde.com.br		
After-hours Numbers	Name	Mobile	Home Telephone
	Wagner Campagnaro	+55 27 9998 1592	+55 27 3314 2526
In case of communication difficulties, please call Santos or Rio de Janeiro after-hours numbers			

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