

# Mosquito-borne diseases in Brazil

Practical Guidance

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## Foreword

Apart from the ever-present risk of international spread, mosquito-borne diseases are particularly threatening for seafarers who are often isolated and away from appropriate medical assistance.

In this practical guide, we have compiled basic information on the most common diseases disseminated by mosquitos in Brazil that are of particular significance to shipping, outlining control measures and prevention initiatives that shipmasters and crews should take to reduce their exposure.



Diseases transmitted to humans by mosquitoes have been growing over the last decades and now affect about half of the world's population, particularly in Asian and Latin American countries. In recent years, Brazil has recorded numerous outbreaks of mosquito-borne infectious diseases that are of significant concern to the health of seafarers and passengers with potential impact on the safe operation of vessels.

The most significant of the ongoing epidemics posing a hazard to seafaring are spread through human-to-vector-to-human contact, and the Zika virus is probably the most worrying due to the ease of transmission and its association between infected pregnant women and congenital disabilities. Nevertheless, numerous other diseases transmitted by mosquitos, such as malaria, yellow fever, dengue and chikungunya, can also be life-threatening.

While this material is not intended to be comprehensive or replace loss prevention guidelines issued by public health authorities, we hope it will be a useful source of reference and practical information for our clients and associates. We will endeavour to keep an updated copy of this publication available on our website.

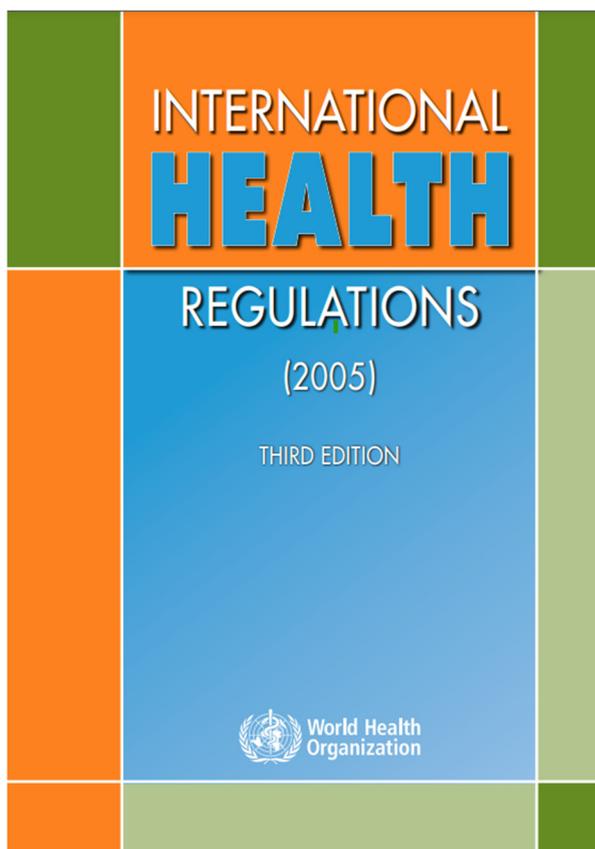
**REPRESENTAÇÕES PROINDE LTDA.**

May 2016 (updated June 2022)

## 1. Port health regulations

### 1.1. International health regulations (IHR 2005)

Brazil is a member of the World Health Organization (WHO) and the Pan American Health Organization (PAHO). The country maintains the purpose and principles enshrined in the International Health Regulations of 2005 (IHR 2005), which was introduced into its domestic legal system in 2009.



Picture 1: Cover of the International Health Regulations (2005), 3<sup>rd</sup> Edition (Source: WHO)

The IHR 2005 forms the underlying framework for domestic regulations on health surveillance and control of airports, ports, ground crossings, aircraft, ships and other conveyances. (Picture 1)

### 1.2. National health authorities

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 *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, among other regulatory functions, for enforcing compliance with the IHR 2005, issuing ship sanitation certificates and carrying out health surveillance of ports, airports and ground crossings in Brazil through the *Sistema Nacional de Vigilância Sanitária* (National System of Health Surveillance).

### 1.3. Legal framework

In accordance with the International Health Regulations (IHR 2005) and relevant Brazilian laws and regulations<sup>1</sup>, all vessels arriving from abroad are required to carry a set of mandatory health-related documents, which include the Maritime Declaration of Health (MDS) and the Ship Sanitation Control Exemption Certificate (SSCEC) or the Ship Sanitation Control Certificate (SSCC) strictly in WHO approved formats<sup>2</sup>.

Currently, ANVISA does not require proof of immunisation against yellow fever; however, in the event of outbreaks or epidemics, as is the case with COVID-19<sup>3</sup>, the health authority might require a vaccination certificate as a condition to allow vessels to enter a port and disembark crew and passengers.

**MODEL SHIP SANITATION CONTROL EXEMPTION CERTIFICATE/SHIP SANITATION CONTROL CERTIFICATE**

Port of ..... Date: .....

This Certificate records the inspection and 1) exemption from control or 2) control measures applied

Name of ship or inland navigation vessel ..... Flag ..... Registration/IMO No. ....

At the time of inspection the holds were unladen/laden with ..... tonnes of ..... cargo

Name and address of inspecting officer .....

Ship Sanitation Control Exemption Certificate			
Areas, systems, and services inspected	Evidence found <sup>1</sup>	Sample results <sup>2</sup>	Documents reviewed
Cabin			Medical log
Kitchen			Ship's log
Stores			Other
Hold(s)/cargo			
Quarters			
- crew			
- officers			
- passengers			
- deck			
Potable water			
Sewage			
Ballast tanks			
Solid and medical waste			
Standing water			
Engine room			
Medical facilities			
Other areas specified - see attached			
Note areas not applicable, by marking N/A.			

No evidence found. Ship/vessel is exempted from control measures.

Name and designation of issuing officer ..... Signature and seal: ..... Date: .....

(a) Evidence of infection or contamination, including: vectors in all stages of growth, animal reservoirs for vectors; rodents or other species that could carry human disease, microbiological, chemical and other risks to human health; signs of inadequate sanitary measures. (b) Information concerning any human cases (to be included in the Maritime Declaration of Health).

<sup>2</sup> Results from samples taken on board. Analysis to be provided to ship's master by most expeditious means and, if re-inspection is required, to the nearest appropriate port of call coinciding with the re-inspection date specified in this certificate.

Sanitation Control Exemption Certificates and Sanitation Control Certificates are valid for a maximum of six months, but the validity period may be extended by one month if inspection cannot be carried out at the port and there is no evidence of infection or contamination.

**MODEL OF MARITIME DECLARATION OF HEALTH**

To be completed and submitted to the competent authority by the master of ships arriving from foreign ports

Submitted at the port of ..... Date: .....

Name of ship or inland navigation vessel ..... Registration/IMO No. .... arriving from ..... sailing to .....

(Continuation of Page of vessel) Master's name .....

Gross tonnage (ship) .....

Gross tonnage (cargo) .....

Valid Sanitation Control Exemption Certificate carried on board? Yes ..... No ..... Issued on ..... date .....

Re-inspection required? Yes ..... No .....

Has ship/vessel visited an affected area (identified by the World Health Organization)? Yes ..... No .....

Port and date of visit .....

Last port of call from commencement of voyage with dates of departure, or within past thirty days, whichever is shorter: .....

Upon request of the competent authority at the port of arrival, list crew members, passengers or other persons who have joined ship/vessel since international voyage began or within past thirty days, whichever is shorter, including all ports/locations visited at this period (add additional names to the attached schedule):

(1) Name ..... joined from: (1) ..... (2) ..... (3) .....

(2) Name ..... joined from: (1) ..... (2) ..... (3) .....

(3) Name ..... joined from: (1) ..... (2) ..... (3) .....

Number of crew members on board: .....

Number of passengers on board: .....

**Health questions**

(1) Has any person died on board during the voyage otherwise than as a result of accident? Yes ..... No .....  
If yes, state particulars in attached schedule. Total no. of deaths: .....

(2) Is there on board or has there been during the international voyage any case of disease which you suspect to be of an infectious nature? Yes ..... No ..... If yes, state particulars in attached schedule.

(3) Has the total number of ill passengers during the voyage been greater than normal/expected? Yes ..... No .....

(4) Is there any ill person on board now? Yes ..... No ..... If yes, state particulars in attached schedule.

(5) Was a medical practitioner consulted? Yes ..... No ..... If yes, state particulars of medical treatment or advice provided in attached schedule.

(6) Are you aware of any condition on board which may lead to infection or spread of disease? Yes ..... No .....  
If yes, state particulars in attached schedule.

(7) Are any sanitary measures (e.g. quarantine, isolation, disinfection or decontamination) been applied on board? Yes ..... No .....  
If yes, specify type, place and date: .....

(8) Have any stowaways been found on board? Yes ..... No ..... If yes, where did they join the ship (if known)? .....

(9) Is there a sick animal on board? Yes ..... No .....

Note: In the absence of a suspect, the master should report the following symptoms as grounds for suspecting the existence of a disease of an infectious nature:

(a) fever, persisting for several days or accompanied by (i) prostration, (ii) decreased consciousness, (iii) glandular swelling, (iv) jaundice, (v) cough or shortness of breath, (vi) unusual bleeding, or (vii) rash/sores.

(b) with or without fever: (i) any acute skin rash or eruption, (ii) severe vomiting (other than sea sickness), (iii) severe diarrhoea, or (iv) recurrent convulsions.

I hereby declare that the particulars and answers to the questions given in this Declaration of Health (including the schedule) are true and correct to the best of my knowledge and belief:

Signed: .....  
Master

Countersigned: .....  
Ship's Surgeon (if carried)

Date: .....

Picture 2: Models of ship sanitation certificate (left) and maritime declaration of health in the IHR 2005 format (Source: WHO)

Other health-related documents such as logs of drinking water supply and control, ballast water, cleaning and disinfection plans, integrated vector management (IVM), and heating, ventilation and air conditioning (HVAC) systems may also be required by ANVISA during document review for health clearance<sup>4</sup>. (Picture 2)

<sup>1</sup> Law 6,295 of 1975 (provides for the organization of Epidemiological Surveillance actions on the National Immunisation Program and establishes rules for the compulsory notification of diseases, and other sanitary measures); ANVISA's Collegiate Directorate Resolution (RDC) 72 of 2009, as amended (provides for the Technical Regulation aimed at promoting health in national ports and on board vessels that transit or operate in them), among other regulations

<sup>2</sup> Articles 37 and 38 of the WHO International Regulations 2005, as amended (IHR 2005), by WHO. Retrieved 13 Jun 2022

<sup>3</sup> ANVISA RDC 574 of 2021 and Interministerial Ordinance 670 of 2022. Require that COVID-19 vaccinated travellers (Brazilians or foreigners) coming from abroad must present to the company or person responsible for the vessel, before boarding, a proof of vaccination, either printed or electronic. Vaccinated travellers are exempt from presenting any proof of a negative or undetectable Covid-19 test. Brazilians or foreigners residing in Brazilian territory who are not fully vaccinated: if they have a health condition that contraindicates vaccination (attested by a medical report), if they are not eligible for vaccination due to age or if they are coming from countries with low vaccination coverage, in those conditions, those travellers must present to the vessel operator or person responsible, before disembarking in the country, a proof of a negative or undetectable Covid-19 test, such as an antigen test or RT-PCR laboratory carried out one day before boarding time. Foreigners who are not fully vaccinated are not allowed to enter the national territory (with exceptions)

<sup>4</sup> For detailed information on port health clearances in Brazil, please refer to our publication "Shipboard Sanitary Inspections in Brazil – Practical Guidance, available for free download on our website

## 2. The winged vectors

### 2.1. Endemic diseases

While *Anopheles* mosquitoes are long-known malaria vectors in much of Brazilian territory, almost all malaria cases occur in the Amazon region, where the potentially deadly disease is endemic. Therefore, specific precautions are only needed for those visiting affected areas for malaria.



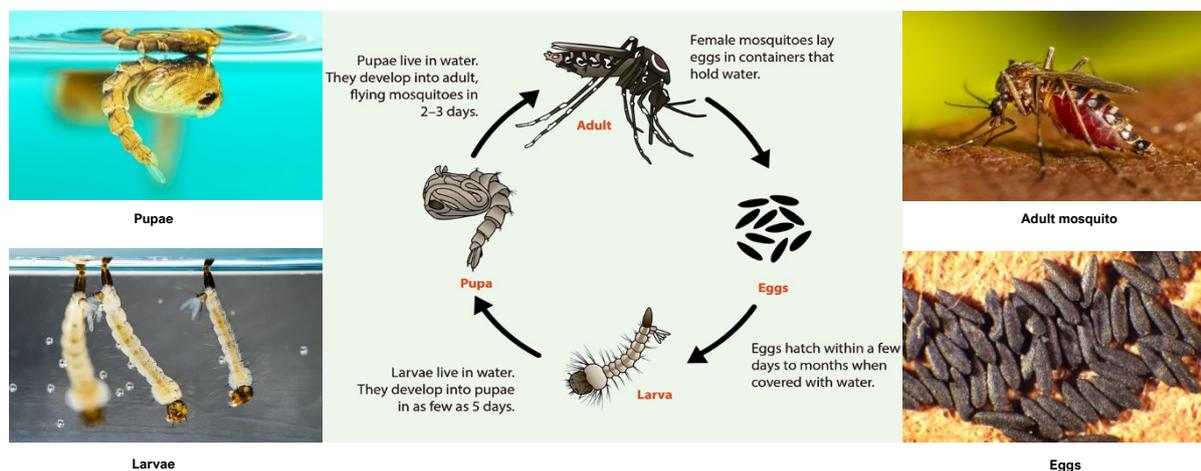
Picture 3: (top) *Aedes*, 4 (left) *Sabethes*, 5 (right) and *Anopheles* mosquitoes that transmit yellow fever, dengue, chikungunya, Zika and malaria (Source: Shutterstock/Fiocruz)

On the other hand, although also present in the Amazon, where they are vectors of sylvatic yellow fever, *Aedes* mosquitoes present a much broader and far-reaching threat, as they are also common and well adapted to urban areas, where more than 84% of the Brazilian population lives.

### 2.2. Mosquitoes' life cycle

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

The *Ae. aegypti* species has four life stages (eggs, larvae, pupae and adulthood) and takes about 7 to 10 days to become an adult flying mosquito. Only the female mosquito bites to suck the blood it needs to mature its eggs. It usually breeds its eggs in water-filled structures and containers and only requires a small amount of liquid to lay eggs, so any object that can hold some water can make a good nursery for the eggs. These include but are not limited to cups, tires, vases and uneven terrain where puddles of water can form. Unlike eggs that lay just above the waterline and adhere to inner walls, hatched egg larvae live in the water until they pupae, emerge as mosquitoes, and fly away<sup>5</sup>. (Pictures 3 to 6)



Picture 6: *Aedes aegypti* (and *Ae. Albopictus*) life cycle (Source: CDC Division of Vector-Borne Diseases)

The mosquito bites during the day, with biting peaks in the early morning and before dusk, and it tends to fly within a radius not greater than 400 metres from its birthplace.

Despite the relatively short flight range of *Ae. aegypti*, the spread 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 begin disseminating diseases by biting multiple other persons for the rest of their lifetime, which may be from two to four weeks or longer, depending on the condition of their habitat and food availability.

<i>Anopheles</i>	<i>Aedes</i>	<i>Culex</i>	<i>Mansonia</i>	Others
<b><i>Anopheles (Ano.)</i></b> <i>calderoni</i> <i>pseudo punctipennis</i> <i>punctimacula</i> <b><i>Anopheles (Ker.)</i></b> <i>bellatorcruzii</i> <i>lepidotus</i> <i>neivai</i> <b><i>Anopheles (Nys.)</i></b> <i>albimanus</i> <i>albitarsis</i> <i>aquasalis</i> <i>argyritarsis</i> <i>benarrochi</i> <i>braziliensis</i> <i>darling</i> <i>marajoara</i> <i>nuneztovaris.l. oswaldi</i> <i>triannulatus</i>	<b><i>Aedes (Och.)</i></b> <i>albifasciatus angusti</i> <i>vittatus scapularistae</i> <i>niorhynchus</i> <b><i>Aedes (Stg.)</i></b> <i>aegypti</i> <i>albopictus</i>	<b><i>Culex (Cux.)</i></b> <i>Nigripalpuspiens-quinquefasciatus</i> <b><i>Culex (Mel.)</i></b> <i>ocossa</i> <i>Portesi</i> <i>spissipestaeniopus</i> <i>vomerifer</i>	<b><i>Mansonia (Man.)</i></b> <i>titillans</i>	<b><i>Coquillettidia (Rhy.)</i></b> <i>venezuelensis</i> <b><i>Haemogogus (Hag.)</i></b> <i>janthinomys</i> <b><i>Psorophora (Jan.)</i></b> <i>ferox</i> <b><i>Trichoprosopon</i></b> <i>digitatum</i>

Table 1: Species of mosquitos endemic in South America (Source: WHO/Water Reed Biosystematics Unit)

<sup>5</sup> "Life Cycle of *Aedes aegypti* and *Ae. albopictus* Mosquitoes", by the Centers for Disease Control and Prevention (CDC), National Center for Emerging and Zoonotic Infectious Diseases (NCEZID), Division of Vector-Borne Diseases (DVBD). Retrieved: 13 Jun 2022

Other mosquito species also act as vectors for many other diseases that pose public health risks, including filariasis, Japanese encephalitis and West Nile virus. These wing vectors, alongside sandflies, flies, fleas, lice, ticks and mites, can potentially be transported by vessels. (Tables 1 & 2)

Disease	Vector	Causal organism	Reservoir	Risk at point of entry
Malaria	<i>Anopheles</i> species	<i>Plasmodium</i> species	Humans	High/Moderate
Filariasis	<i>Culex, Anopheles</i>	<i>W. bancrofti</i> (nocturnal, periodic)	Humans	Low
	<i>Aedes niveus</i> group	<i>W. bancrofti</i> (diurnal sub-periodic)	Humans	High
	<i>Mansonioid</i> species	<i>W. bancrofti</i> (diurnal sub-periodic)	Humans	High
Chikungunya	<i>Aedes</i> species	<i>Brugia malayi</i>	Humans	High
Dengue fever & Zika virus	<i>Aedes</i> species	<i>Alphavirus</i>	Humans	Moderate
Yellow fever	<i>Aedes</i> species	<i>Flavivirus</i>	Humans/monkeys	Moderate to high
Japanese encephalitis and	<i>Aedes &amp; Culex</i> species.	<i>Flavivirus</i>	Mammals/ birds	
West Nile virus	<i>Culex spp</i>	<i>Flavivirus</i>	Birds	

Table 2: Mosquito vectors and diseases (Source: WHO)

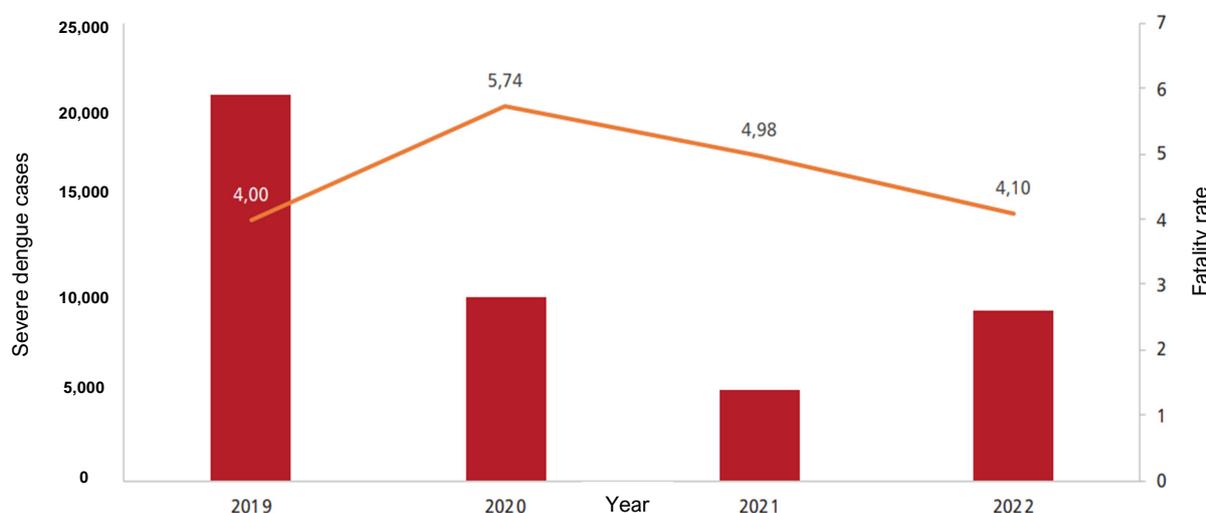
### 3. Mosquito-borne diseases of significance to shipping

#### 3.1. Dengue and severe dengue

Dengue is an arbovirus infection spread through the bite of an infected female mosquito of the genus *Aedes*, chiefly *Ae. aegypti*, and is currently widespread in almost all regions of Brazil. The incidence of the disease in Latin America has considerably increased over the past four decades<sup>6</sup>.

Four dengue virus (DENV) serotypes can cause dengue and severe dengue: DENV-1, DENV-2, DENV-3 and DENV-4<sup>7</sup>. Infection with one subtype provides lifelong immunity against that subtype but not against the others; thus, a person can be infected with the dengue virus up to four times.

A severer and life-threatening form of this mosquito-borne disease is dengue haemorrhagic fever (DHF), also known as severe dengue<sup>8</sup>. Nevertheless, early detection and adequate medical care can reduce death rates to less than one per cent<sup>9</sup>.



Picture 7: Severe dengue deaths cases in numbers and fatality rates in % (Source: Sinan Online/Ministry of Health)

Between 2019 and early 2022, the Brazilian Ministry of Health reported 45,283 severe dengue cases, resulting in 2,042 people losing their lives to the consequences of this illness. During this period, 2019 was the year with the largest number of confirmed cases and deaths (21,016 and 840, respectively), and 2020 experienced the highest fatality rate (5.7% of confirmed cases)<sup>10</sup>.

Until mid-May this year, 1,036,505 cases of probable dengue<sup>11</sup> were registered, 191% more than the same period of last year. The highest incidence of dengue in Brazil is in the Central-West region, with 1,473 cases per 100,000 inhabitants, followed by the South (884/100k), Southeast (394/100k), North (202/100k), and Northeast regions (225 cases/100k). So far this year, the health authorities recorded 744 cases of severe dengue plus 9,790 cases with warning signs<sup>12</sup>, resulting in 438 deaths from the disease and a fatality rate of 4.1%. (Pictures 7 and 8)

<sup>6</sup> "Dengue Factsheet" by the Pan American Health Organization (PAHO). Retrieved 13 Jun 2022

<sup>7</sup> According to the Ministry of Health, of the four dengue fever serotypes that belong to the genus *Flavivirus*, Family *Flaviviridae*, the most prevalent in Brazil (about 94% of the cases) is the DEN-1

<sup>8</sup> 'Severe dengue' features severe plasma leakage leading to dengue shock syndrome (DSS) and fluid accumulation with respiratory distress, severe bleeding and severe organ involvement

<sup>9</sup> "Dengue and severe dengue factsheet", by the World Health Organization (WHO). Retrieved: 13 Jun 2022

<sup>10</sup> "Epidemiological Bulletin Week 21, Vol. 53, Version 1, May 2022", by the Ministry of Health's Secretariat of Health Surveillance. Retrieved 13 Jun 2022

<sup>11</sup> '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 for leukopenia and any 'warning signs'

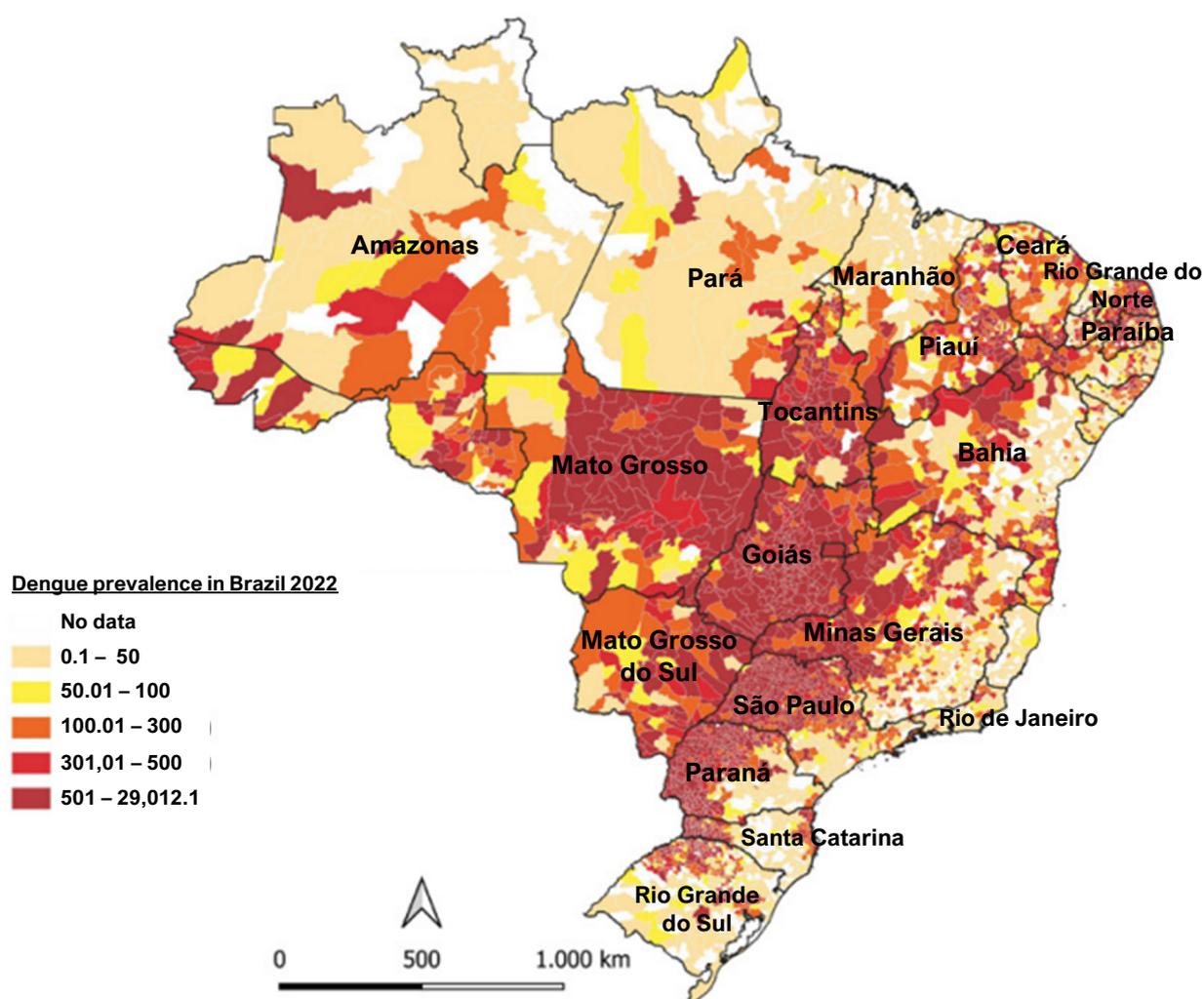
<sup>12</sup> 'Warning signs' consist of abdominal pain or tenderness, persistent vomiting, clinical fluid accumulation, mucosal bleed, lethargy and restlessness, liver enlargement > 2 cm, laboratory test showing an increase in HCT concurrent with a rapid decrease in platelet count

### 3.1.1. Symptoms

Symptoms of infection by DENV characteristically include:

- Fever above 38°C lasting 2 to 7 days
- Intense headache
- Pain behind the eyes
- Severe joint and muscle pain
- Extreme fatigue lasting for days or weeks
- Rash
- Nausea, vomiting, and sometimes diarrhoea

DHF causes abdominal pain, bleeding, vomiting of blood, blood in the faeces, and nosebleeds. In sporadic cases, neurological complications such as encephalitis, Guillain-Barré syndrome (GBS), and myelitis may be observed.



Picture 8: Dengue cases from Jan to May 2022 by state (Source: Sinan Online/Ministry of Health)

### 3.1.2. Treatment

No specific treatment is currently available in Brazil<sup>13</sup>.

<sup>13</sup> The Center for Disease Control and Prevention (CDC) of the US Department of Health and Human Services has approved and recommends the recently-developed and commercially available dengue vaccine (Dengvaxia CYD-TDV) for children 9 through 16 years old who have had laboratory-confirmed dengue in the past and who live in areas where dengue infection is endemic, but it advises against use in US travellers visiting but not living in an area where the disease is common. However, the Pan American Health

Those infected with dengue need to rest, sleep, control high fever with medication (except), and take plenty of fluids to prevent dehydration. Due to an increased risk of bleeding, dengue sufferers should not take acetylsalicylic acid, ibuprofen, or non-steroidal anti-inflammatory drugs (NSAIDs).

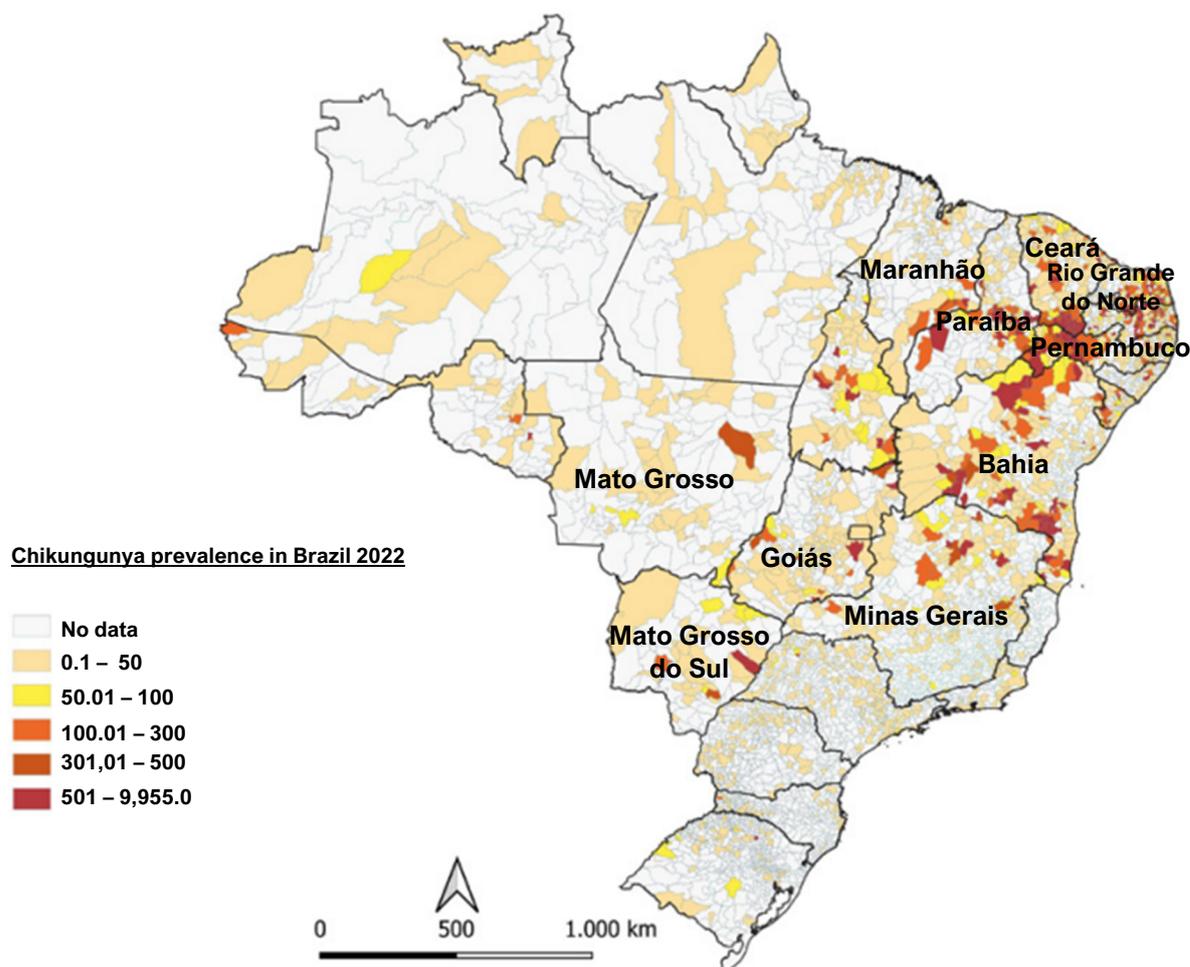
Dengue (or severe dengue) patients do not need to be isolated; yet, they should take precautions to stay away from mosquitoes and adopt personal protection measures for at least a week after infection to prevent the spread of the disease. Sufferers need to seek immediate medical assistance if any warning signs appear.

### 3.1.3. Measures for vessels

ANVISA did not put any specific health control restrictions on ships due to the ongoing dengue outbreak, in addition to enhancing the verification of shipboard integrated vector management (IVM) plans and overall hygiene and sanitary conditions prevailing on board, in particular vessels arriving from endemic areas. Otherwise, the Brazilian port health authority follows the protocols, manuals, and standards adopted by the WHO and PAHO.

## 3.2. Chikungunya

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



Picture 9: Chikungunya cases from Jan to May 2022 by state (Source: Sinan Online/Ministry of Health)

Chikungunya virus (CHIKV) was first identified in Brazil in April 2014. Its symptoms and clinical signs are similar to those of the dengue virus (DENV), often leading to misdiagnosis in areas where dengue fever is more prevalent. The primary differentiation between the two viruses is joint and tendon pain (called arthralgia) which tends to be more intense and debilitating in persons infected with CHIKV than those diagnosed with DENV<sup>14</sup>.

Latest data from the Brazilian Ministry of Health indicate that, by mid-May 2022, 98,540 cases of chikungunya fever had been recorded, a rise of 32.9% compared to 2019 and a staggering 91.5% in comparison with 2021 year on year. During this year, the viral disease has a higher incidence in the Northeast region, seconded by the Central-West and North regions, with the city port of Fortaleza leading the ranking<sup>15</sup>. (Picture 9)

### 3.2.1. Symptoms

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

Typical symptoms of infection by CHIKV include:

- Abrupt onset of fever above 38°C lasting 2 to 3 days
- Moderate headache
- Moderate-to-intense joint and tendon pain and swelling (arthralgia)
- Intense muscle pain
- Fatigue
- Rash
- Conjunctivitis/eye redness

This disease shares some clinical signs with dengue and Zika fever. It is frequently misdiagnosed, making it difficult for the WHO and national health authorities in affected countries to properly assess the number of people infected with the disease globally and annually.

Severe illness and deaths from CHIKV are rare and are often associated with other existing comorbidities. Sporadic cases include neurological manifestations in the form of encephalitis, GBS, and myelitis, amongst other complications<sup>16</sup>.

Chikungunya sufferers do not need to self-isolate but should take measures to avoid further mosquito bites and adopt personal protection measures for at least one week to prevent transmission. Sufferers need to seek immediate medical assistance if any warning signs appear.

### 3.2.2. Treatment

There is no vaccine or specific drug treatment for chikungunya. Those affected with CHIKV must relieve the symptoms with antipyretics and optimal analgesics, rest, sleep and maintain body hydration. Given similar symptoms to other mosquito-borne diseases, suspected patients should avoid aspirin, ibuprofen or NSAIDs until a dengue diagnosis is ruled out.

### 3.2.3. Measures for vessels

ANVISA follows WHO and PAHO protocols and procedures and has not implemented specific measures to deal with the disease on board vessels.

<sup>14</sup> "Chikungunya Factsheet" by the PAHO. Retrieved 13 Jun 2022

<sup>15</sup> "Epidemiological Bulletin Week 21, Vol. 53, Version 1, May 2022", by the Ministry of Health's Secretariat of Health Surveillance. Retrieved 13 Jun 2022

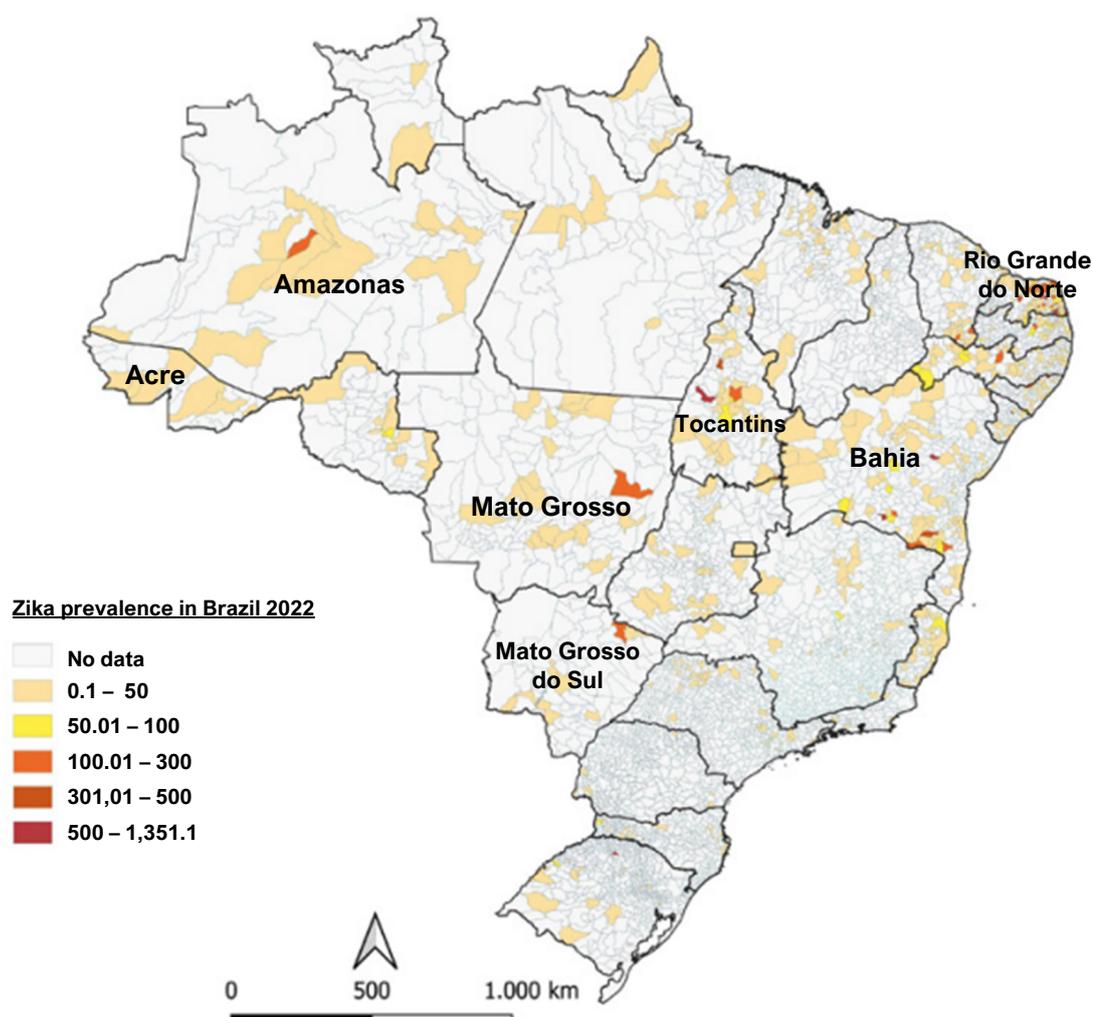
<sup>16</sup> "Chikungunya Factsheet" by the PAHO. "Dengue and severe dengue factsheet", by the WHO. Retrieved: 13 Jun 2022

As with other viral diseases transmitted by mosquitoes, visiting vessels must enhance and comply with their IVMS plans and maintain overall hygiene and sanitary conditions prevailing on board, particularly those arriving from or calling at areas infested with *Aedes* mosquitoes.

### 3.3. Zika

Zika virus (ZIKV) transmission occurs primarily through the bite of an infected mosquito from the *Aedes* genus, predominantly *Ae. aegypti*, and is rapidly spreading in tropical and subtropical regions. However, unlike dengue or chikungunya, this viral disease can be transmitted from a pregnant woman to her fetus and also through sex. It is likely – but not confirmed – that it can be spread through blood transfusion.

Vertical transmission (mother-to-child in the womb) has already been established in the face of multiple cases of congenital disabilities, including microcephaly, in babies born to ZIKV-infected mothers. There are reports of Guillain-Barré syndrome (GBS) in areas affected by Zika, but there is no indication of infants getting Zika through breastfeeding<sup>17</sup>.



Picture 10: Zika cases from Jan to May 2022 by state (Source: Sinan Online/Ministry of Health)

ZIKV was first diagnosed in Brazil in April 2015. By May 2022, 4,839 Zika suspect cases were recorded, corresponding to an incidence of 2.3 cases per 100 thousand inhabitants, with no deaths so far. It means an increase of 7.2% compared to the cases of 2019 and 102.1% in relation to the same period of 2021<sup>18</sup>. (Picture 10)

<sup>17</sup> "Zika Factsheet" by the PAHO; "Zika factsheet", by the WHO; "Zika Basics", by The US CDC. Retrieved: 13 Jun 2022

<sup>18</sup> "Epidemiological Bulletin Week 21, Vol. 53, Version 1, May 2022", by the Ministry of Health's Secretariat of Health Surveillance. Retrieved 13 Jun 2022

### 3.3.1. Symptoms

Most people infected with ZIKV do not develop symptoms that otherwise are generally mild and similar to those of dengue. Symptoms typically last two to seven days and include:

- Fever above 38°C lasting 2 to 7 days
- Headache or malaise
- Conjunctivitis (red eyes)
- Joint and muscle pain
- Rash
- Nausea, vomiting, and sometimes diarrhoea

There is no evidence that pregnant women are more susceptible or develop more severe symptoms than those who are not pregnant. However, it has been established that the Zika virus can be transmitted to the fetus by an infected mother. Microcephaly has been identified as one of the features of a pattern of birth disabilities, termed congenital Zika syndrome, among fetuses and infants of women infected with ZIKV during pregnancy.

ZIKV infection can also trigger GBS, neuropathy, and myelitis in adults and older children<sup>19</sup>.

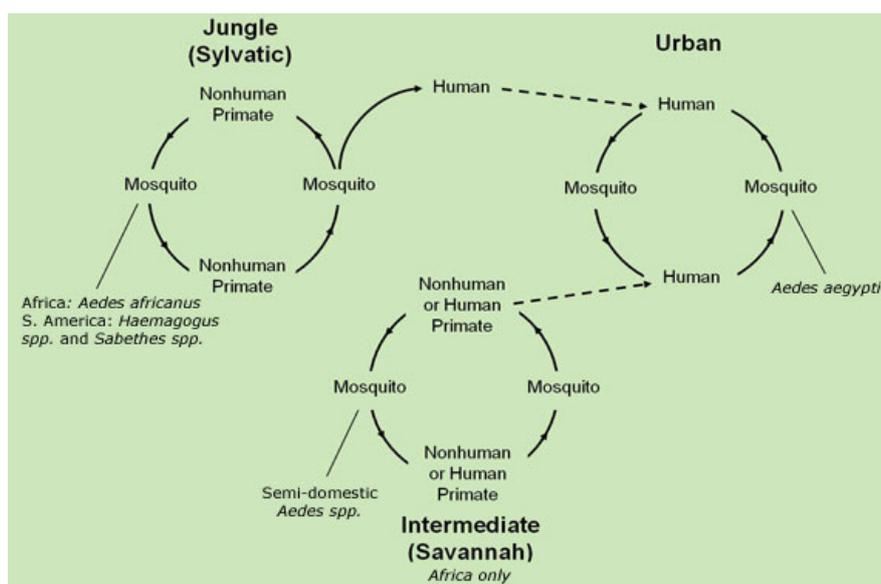
### 3.3.2. Treatment

No vaccine or specific treatment for Zika fever is commercially available.

ZIKV infection must be adequately diagnosed by medical examination and laboratory testing of bodily fluids (blood, urine, or semen) to rule out other mosquito-borne diseases with similar symptoms.

### 3.3.3. Measures for vessels

There are no particular measures implemented by the port health authority, ANVISA, concerning the current Zika outbreak other than heightening shipboard health surveillance, with an emphasis on the IVM plans and the health conditions of the vessel, especially those arriving from or calling at areas endemic to the *Aedes* mosquitoes.



Picture 11: Yellow fever transmission cycles (Source: CDC/DVBD)

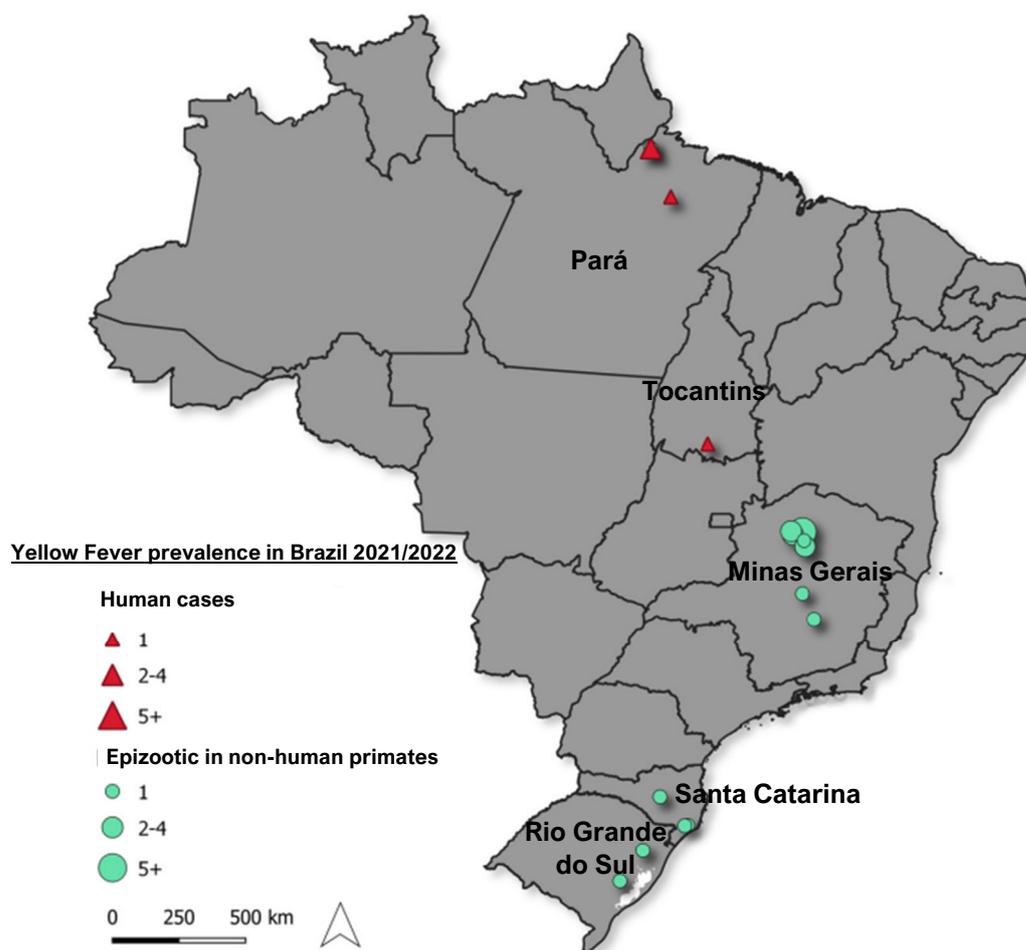
<sup>19</sup> "Morbidity and Mortality Weekly Report – Update: Interim Guidance for the Evaluation and Management of Infants with Possible Congenital Zika Virus Infection – United States, August 2016", by the US CDC; "Zika factsheet", by the WHO. Retrieved: 13 Jun 2022

### 3.4. Yellow fever

Yellow fever virus (YFV) is a flavivirus transmitted by infected female *Aedes* and *Haemagogus* mosquitoes. This acute hemorrhagic disease is endemic in tropical areas of Africa and South America, including Brazil, notably its North and Centre-West regions.

The mosquitoes become infected with YFV and spread it after feeding on infected monkeys and humans and biting other primates (humans and non-humans). There is no human-to-human transmission. Due to the high level of viremia, infected humans begin to transmit YFA through mosquitoes shortly before the onset of fever in the first three to five days.

YFV has three types of transmission cycles: sylvatic (or jungle) yellow fever, occurring in tropical forests; intermediate (or savannah) yellow fever, transmitted by semi-domestic mosquitoes only in Africa; and urban yellow fever, which involves transmission between viremic humans who visited the jungle or savannah and urban mosquitoes, chiefly *Ae. aegypti*, in densely populated areas. (Picture 11)



Picture 12: Human cases and epizootics on non-human primates from July 2021 to May 2022 (Source: Ministry of Health)

In Brazil, urban yellow fever –transmitted mainly by *Ae. aegypti*– is rare. On the other hand, sylvatic yellow (through *Haemagogus* and *Sabethes* mosquitoes) is endemic in the Amazon Basin and in most states in the North and Centre-West Regions. Transmission peaks tend to occur between December and May (yellow fever season) due to high temperatures and constant rainfalls, which provide ideal breeding conditions for the mosquitoes, and a high concentration of unvaccinated humans in tourist and recreational activities in endemic areas.

Between July 2021 and May 2022, 1,267 suspect cases of YFV were registered by the Ministry of Health, but just over 2% of the cases were eventually confirmed through laboratory tests. Active transmission among non-human primates has been reported in the states of Pará, Minas Gerais, Santa Catarina, and Rio Grande do Sul, where the risk of spread to the human population increases during the yellow fever season<sup>20</sup>. (Picture 12)



Picture 13: Yellow fever vaccination recommendation in South America, 2022 (Source: WHO/PAHO/PHE)

### 3.4.1. Symptoms

The majority of people infected with YFV develop no symptoms or have mild symptoms, recovering completely from the disease. Those who survive the infection tend to acquire long-lasting immunity against the disease.

The virus incubates for three to six days, and when they do occur, symptoms usually include:

- Fever above 38°C lasting 2 to 7 days
- Headache or malaise
- Loss of appetite
- Fatigue and weakness
- Muscle pain with prominent backache
- Nausea and vomiting

<sup>20</sup> "Epidemiological Bulletin Week 21, Vol. 53, Version 1, May 2022", by the Ministry of Health's Secretariat of Health Surveillance. Retrieved 13 Jun 2022

For most infected, symptoms disappear after three or four days. Few people may enter a second, more severe phase within 24 hours of initial symptoms remission. They experience high fever and failure of organs, typically the liver and the kidneys. Infected people who go through this toxic phase tend to develop jaundice (yellowing of the skin and eyes, hence the name of the disease), dark urine, abdominal pain with nausea and vomiting, bleeding, and shock. More than half of the people with a severe yellow fever infection are likely to die within seven to ten days<sup>21</sup>.

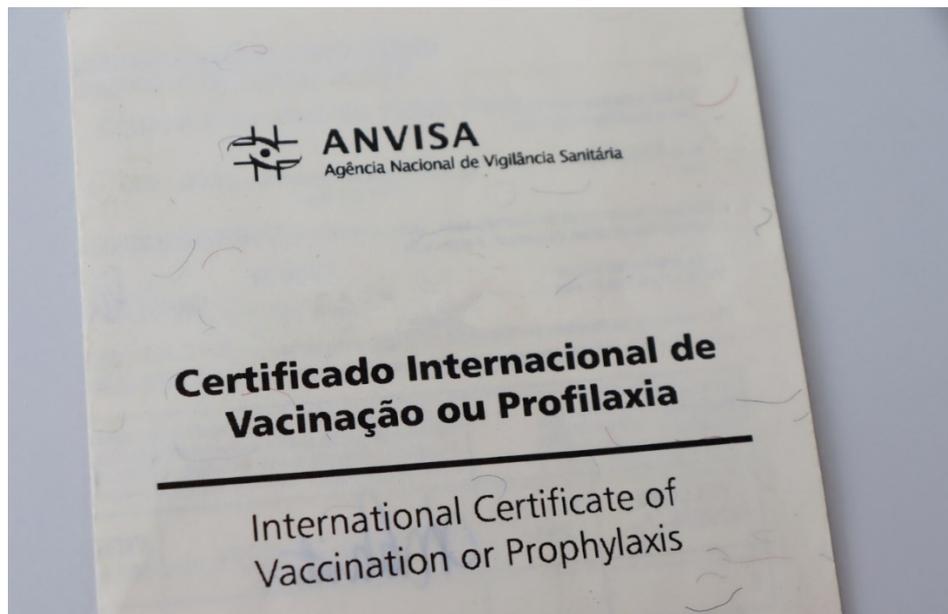
### 3.4.2. Treatment

There is no specific antiviral drug to treat yellow fever. Adequate and early supportive hospitalisation increases the chances of survival for those suffering from the most acute form of the disease.

Because yellow fever infection may be confused with other hemorrhagic fevers such as dengue, arenavirus, and hantavirus, establishing a diagnosis can sometimes be challenging, particularly during the early stages of the disease. Severer cases with similar symptoms may be misdiagnosed as malaria, leptospirosis, viral hepatitis, and other infections.

### 3.4.3. Vaccination

Although no treatment is currently offered for this disease, a safe, affordable, and single-dose vaccine can easily prevent yellow fever infection. The widely available vaccine provides effective lifelong protection against YFV without the need for a booster dose. Since July 2016, the yellow fever vaccination certificate has been valid for the life of the vaccinated person<sup>22</sup>.



Picture 14: International Certificate of Vaccination or Prophylaxis issued by ANVISA (Source: ANVISA)

The vaccine takes effect after ten days of administration and is the only efficient means of personal protection against the yellow fever virus. It does not immunise the vaccinated person against other mosquito-borne diseases<sup>23</sup>.

<sup>21</sup> "Yellow Fever Factsheet" by the PAHO; "Yellow Fever factsheet", by the WHO; "Yellow Fever Factsheet" by The US CDC. Retrieved: 13 Jun 2022

<sup>22</sup> World Health Assembly Resolution WHA67.13 of May 2014, which amended the IHR 2005, stipulated that, as of July 2016, the period of validity of the yellow fever vaccination will be changed from 10 years to the duration of the life of the person vaccinated without the need for a booster

<sup>23</sup> WHO does not recommend the yellow fever vaccine "for infants aged 6-8 months, except during epidemics when the risk of yellow fever virus transmission may be very high. The risks and benefits of vaccination in this age group should be carefully considered before vaccination. The vaccine should be used with precaution during pregnancy or breastfeeding; however, pregnant or breastfeeding women may be vaccinated during epidemics or if travel to a country or area with risk of transmission is unavoidable". WHO International Travel and Health Country List (ITH2021), 12 May 2021. Retrieved 15 Jun 2022

Yellow fever is the only mosquito-borne disease for which proof of vaccination or prophylaxis, in the form of a standardised certificate, may be required as a condition of entry into a State Party to the International Health Regulations 2005 (IHR 2005).

Although there is a risk of yellow fever transmission in parts of the country, Brazil does not require travellers to be vaccinated against yellow fever. However, the International Health Organization (WHO) currently recommends that all persons nine months or older visiting specific states in the country be inoculated against IFV at least ten days prior to travel<sup>24</sup>. The recommendation is not only to protect individual travellers who may be exposed to the infection but also to avoid transmission within and between countries.

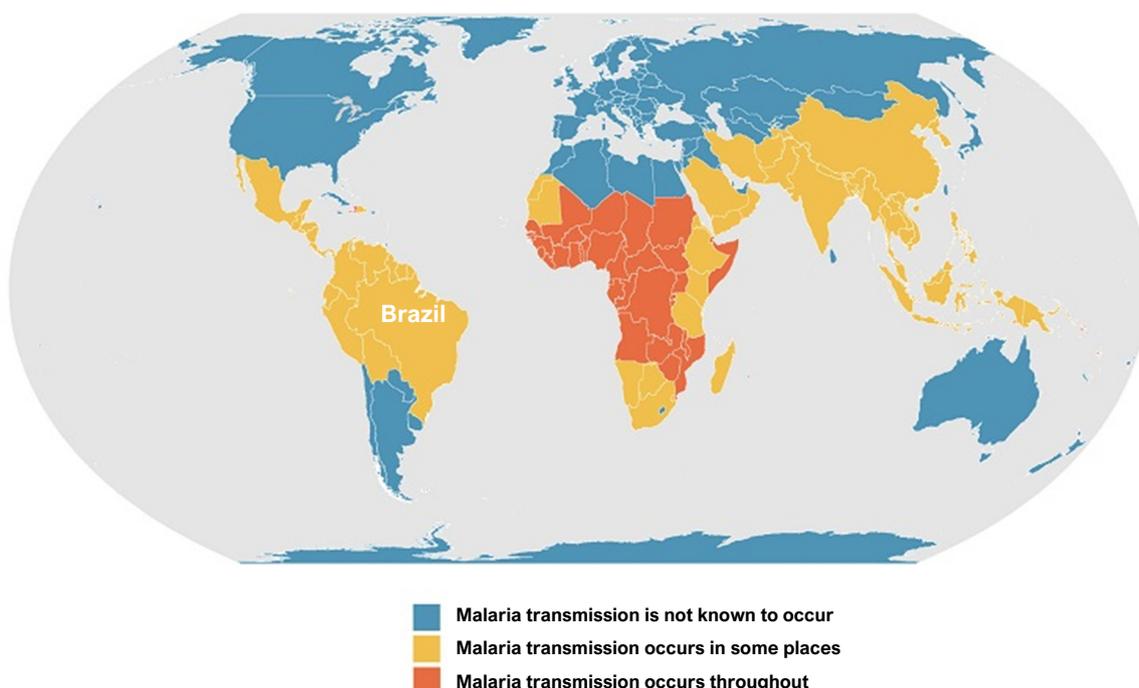
### 3.4.4. Measures for vessels

The port health authority does not require a yellow fever vaccination certificate to authorise disembarkation or embarkation of seafarers from ships and platforms operating in Brazilian waters. Still, vaccination is strongly advised, as most Brazilian ports are located in or near geographical yellow fever areas where WHO recommends inoculation.

Where required, ANVISA issues the international vaccination certificate on the WHO standard form, free of charge, through authorised public vaccination centres throughout the country. (Picture 14)

### 3.5. Malaria

Malaria is a serious infectious disease transmitted exclusively by the bite of infected female *Anopheles* mosquitoes. The most common malaria parasites affecting humans are *Plasmodium vivax* and *Plasmodium falciparum*, the latter being the deadliest species.



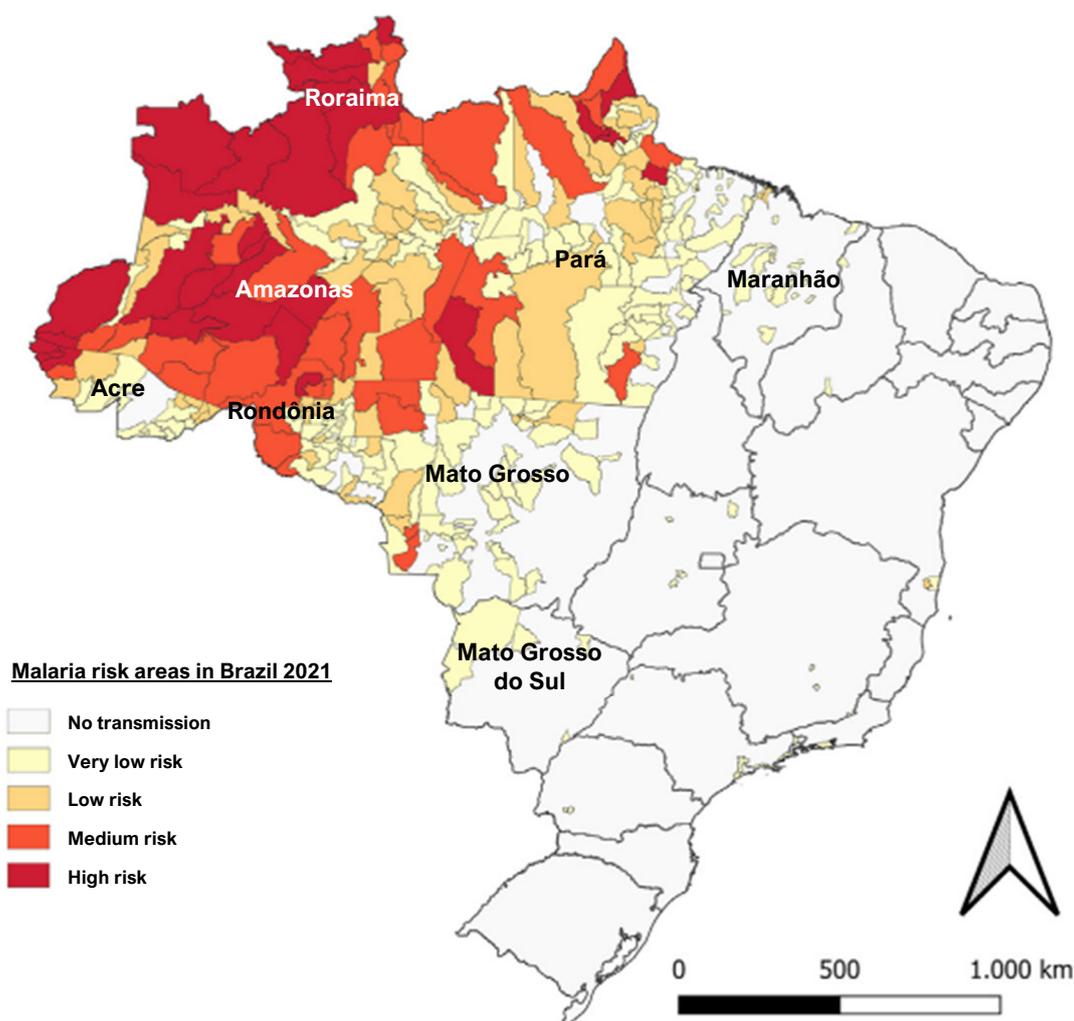
Picture 15: Approximation of the parts of the world where malaria transmission occurs. (Source: US CDC/WHO)

<sup>24</sup>Travellers should check WHO International Travel and Health website (<http://www.who.int/ith/en/>) to check the list of Brazilian states in which yellow fever vaccination is recommended. As of May 2021, WHO recommendations are: “for all travellers aged 9 months or over going to the states of Acre, Amapá, Amazonas, Distrito Federal (including the capital city of Brasília), Espírito Santo, Goiás, Maranhão, Mato Grosso, Mato Grosso do Sul, Minas Gerais, Pará, Paraná, Piauí, Rio de Janeiro, Rio Grande do Sul, Rondônia, Roraima, Santa Catarina, São Paulo, Tocantins; as well as to designated areas of Bahia State. 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 and Recife”. WHO International Travel and Health Country List (ITH2021), 12 May 2021. Retrieved 15 Jun 2022

The incubation period for malaria is between seven and fifteen days, though antimalarial drugs taken for prophylaxis can delay the onset of symptoms by weeks, sometimes months, particularly in the case of *P. vivax*, the most prevalent malaria parasite outside Sub-Saharan Africa.

WHO estimates that nearly half of the world's population is at risk of contracting malaria, a mosquito-borne disease that has afflicted humanity for millennia. The number of cases and deaths worldwide has continued to rise over the years, compounded by disruptions caused by the recent coronavirus (COVID-19) pandemic. The African continent, where *P. falciparum* predominates, is home to more than 90% of global malaria cases and deaths, of which about 80% were children under five years of age.

In Latin America, Venezuela, Brazil and Colombia account for more than three-quarters of all cases in the region, with a prevalence of *P. vivax*. At the same time, Argentina, El Salvador and Paraguay were certified by WHO as malaria-free countries<sup>25</sup>. (Picture 15)

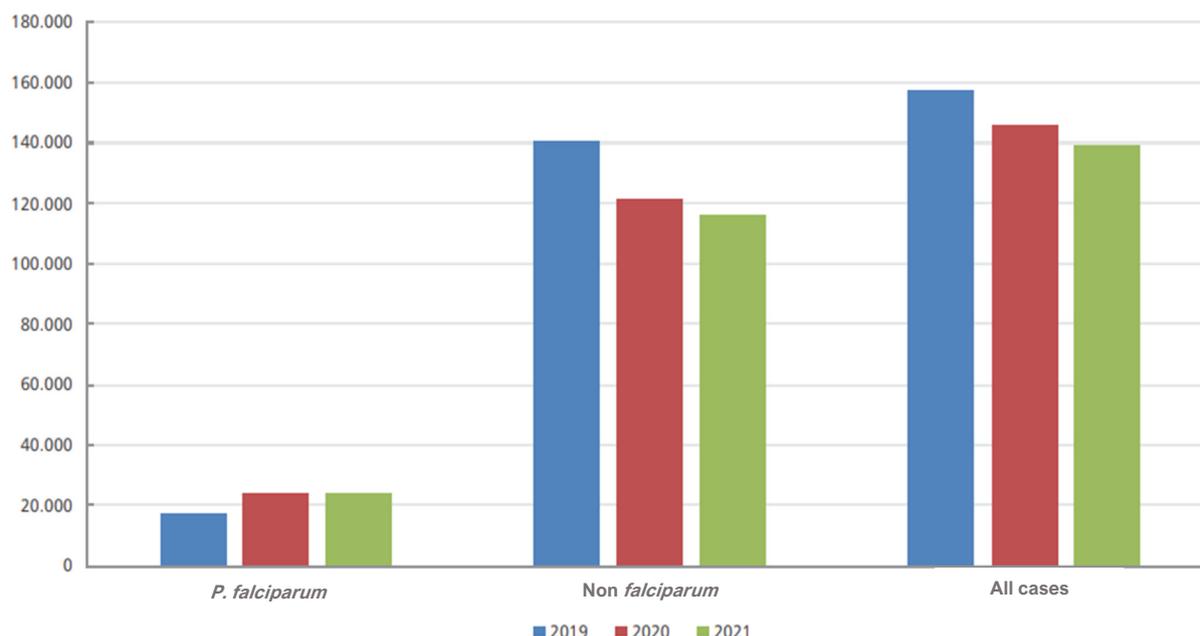


Picture 16: Malaria risk areas in Brazil in 2021 (Source: Ministry of Health)

*P. vivax* is responsible for 84% of malaria cases in Brazil, with *P. falciparum* and mixed infections accounting for 16% of cases. Malaria risks are higher in and around Amazon states (Acre, Amapá, Amazonas, Maranhão, Mato Grosso [north], Pará [except Belém City], Rondônia, Roraima and Tocantins), including urban areas and large cities in this vast region where 99.9% of malaria transmission occurs. About 33 municipalities shouldered 80% of all domestic malaria cases in 2021. (Picture 16)

<sup>25</sup> "Malaria Factsheet" by the PAHO; "Malaria factsheet", by the WHO; "Malaria Factsheet" by The US CDC; "World Malaria Report 2021", by WHO. Retrieved: 15 Jun 2022

The risk outside the Amazon region is deemed negligible, with residual risk of infection with *P. vivax* in areas of what remains of the Atlantic Rainforest across the states of São Paulo, Minas Gerais, Rio de Janeiro and Espírito Santo in the Southeast region<sup>26</sup>.



Picture 17: Malaria cases in Brazil from 2019 to 2021 (Source: Ministry of Health)

While the number of cases and fatalities of malaria is growing globally, Brazil has seen a drop in reported occurrences. In 2020, there was a 7.8% reduction from 2019 numbers. Last year, a 4.1% decline from 2020 cases amid COVID-19 disruptions. The point of concern in 2021 was a notable increase in *P. falciparum* cases compared to 2019. (Picture 17)

Since 2003, Brazil has maintained the *Programa Nacional de Prevenção e Controle de Malária* – PNMC (National Program of Malaria Prevention and Control). The PNMC involves information, prevention, surveillance campaigns, vector controls and, more specifically, prompt laboratory investigation of suspected cases for diagnosis and treatment within the first 24 hours after symptoms appear.

Earlier this year, the Ministry of Health, through the PNMC, launched the "*Plano Nacional de Eliminação de Malária*" (National Plan for Eradication of Malaria). The plan sets ambitious goals and strategies, following WHO guidelines, to reduce malaria cases to less than 68 thousand per year by 2025, end *P. falciparum* malaria, decrease autochthone malaria cases to less than 14 thousand a year by 2030, and finally, eradicate the disease until 2035<sup>27</sup>.

### 3.5.1. Symptoms

Early malaria diagnosis can be difficult at times as the symptoms appear after ten to fifteen days from infection and are generally mild; however, if left untreated, malaria can cause severe illness and death.

<sup>26</sup> As of May 2021, WHO recommendations reads "Malaria risk due to *P. vivax* (84.3%), *P. falciparum* and mixed infections (15.7%) exists in most forested areas below 900 m within the nine states of the Amazon region (Acre, Amapá, Amazonas, Maranhão, Mato Grosso [northern part], Pará [except Belém City], Rondônia, Roraima and Tocantins [western part]). Transmission intensity varies from one municipality to another and is higher in jungle-mining areas, in agricultural settlements, in indigenous areas, and in some peripheral urban areas of Cruzeiro do Sul, Manaus, and Porto Velho. Malaria also occurs on the periphery of large cities such as Boa Vista, Macapá, and Rio Branco. In the states outside the administrative region of Amazonas, the risk of malaria transmission is negligible or nonexistent, but there is a residual risk of *P. vivax* transmission in Atlantic forest areas of the states of São Paulo, Minas Gerais, Rio de Janeiro and Espírito Santo. WHO recommended prevention in risk areas: B in *P. vivax* risk areas; C in *P. falciparum* risk areas". WHO International Travel and Health Country List (ITH2021), 12 May 2021. Retrieved 15/06/2022

<sup>27</sup> "Epidemiological Bulletin Week 17, Vol. 53, Version 1, May 2022", by the Ministry of Health's Secretariat of Health Surveillance. Retrieved 15 Jun 2022

Typical uncomplicated malaria symptoms include:

- Fever, typically in paroxysms<sup>28</sup>
- Headache
- Chills
- Flu-like illness
- Vomiting

Other serious complications (severe malaria) resulting from *falciparum* malaria involve<sup>29</sup>:

- Cerebral malaria<sup>30</sup>
- 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



Picture 18: *Anopheles* species mosquito, the carrier of malaria (Source: Shutterstock)

### 3.5.2. Treatment

Malaria can be deadly, particularly to young children and pregnant women, but illness and deaths from this mosquito-borne disease can be prevented and treated. Prevention is achieved through effective vector control and chemotherapies with antimalarial medicines to avert the disease.

<sup>28</sup> Paroxysmal fever is the sensation of cold and shivering followed by fever, headaches and vomiting daily in *falciparum* malaria and every two days in *vivax* malaria

<sup>29</sup> "Malaria Factsheet – updated 18/05/2022", by the Ministry of Health. Retrieved 15 Jun 2022

<sup>30</sup> Cerebral malaria is abnormal behaviour, impairment of consciousness, seizures, coma, or other neurologic abnormalities

Prompt treatment for all stages of the disease, ideally within 24 hours of the onset of symptoms, is highly recommended. The treatment of malaria typically involves artemisinin-based combination therapy (ACT) drugs, against which the parasites are increasingly developing resistance. Nevertheless, the type of treatment adopted is dictated by several factors, such as the disease's severity, the parasite's species, the geographical region where the infection was acquired, and the medical facilities available to treat the infected person<sup>31</sup>.

### 3.5.3. Vaccination

WHO has recommended the broad use of the malaria vaccine, the RTS,S/AS01 (RTS,S), to prevent *P. falciparum* in children living in places with moderate to high transmission of this parasite, notably in African countries. (Picture 19)



Picture 19: Healthcare professional injecting intramuscular malaria vaccine into an African schoolboy (Source: Shutterstock)

The RTS,S is the first vaccine ever against a human parasite<sup>32</sup>. However, as most cases of *falciparum* malaria are imported – and over 90% of the autochthone cases consist of *vivax* malaria – the novel vaccine is not applicable in Brazil.

### 3.5.4. Measures for vessels

The vast majority of malaria cases on board vessels are imported from overseas ports, chiefly those in Sub-saharan Africa. In most cases, symptoms of the disease begin during sea passage. Still, there are instances when the illness is only detected and diagnosed days, sometimes weeks, after the vessel arrives at a Brazilian anchorage or port.

When a vessel arrives with crewmembers infected with malaria, ANVISA may, at its discretion, condition the granting of free pratique to a malaria test of the entire crew. All positive cases must be taken ashore for hospitalisation and epidemiologic control. The port health authority may also require the operator to arrange disinsection and disinfection of the vessel before allowing cargo operations or crew changes, except for those who need medical assistance. The same procedure applies to other infectious diseases, including COVID-19.

<sup>31</sup> "WHO Guidelines for Malaria – 3 June 2022", by WHO. Retrieved 15 Jun 2022

<sup>32</sup> "World Malaria Report 2021", by WHO. Retrieved: 15 Jun 2022. The RTS,S/AS01 (Mosquirix™) is a recombinant protein-based malaria vaccine approved by the WHO for broad use in children (aged 6 weeks to 17 months) to help protect against malaria caused by *Plasmodium falciparum*, according to official recommendations for affected areas

## 4. Recommended precautions

### 4.1. Significance of vessels to health

In addition to transporting cargo and people across seas, ocean-going vessels play a significant role in the spread of communicable diseases around the world, as they can carry infected persons and vectors such as mosquitoes, rats and waterborne pathogens from port to port within and between countries.

On board, early diagnosis and proper treatment are limited for most known infectious diseases. Besides, shipboard health events may disrupt or jeopardise the operation and safety of the vessel and lead to substantial costs to the operators and their insurers with medical treatment, repatriations, quarantine, and implementation of health measures required by the local authorities.

Therefore, vessels calling at Brazilian ports must adopt transmission prevention procedures, including vector controls and, when available, preventive drugs, such as antimalarials, and vaccination, as in the case of yellow fever.

### 4.2. Preventive health measures

#### 4.2.1. Vector control



IHR 2005 establish that transport operators must keep conveyances free from sources of infection or contamination, including vectors and reservoirs. WHO recommends that vessels leaving mosquito-endemic areas be disinfected according to methods prescribed in international regulations and supporting guidelines. The global health authority regularly publishes a list of areas where disinsection and other vector control measures are advisable.

Annexe 5 of the IHR 2005 describes measures to be adopted by vessels and operators for effective integrated vector management (IVM). It stipulates that a vessel may be regarded as suspect if there are cases of vector-borne diseases on board, a possible health event on the vessel during an international voyage, or when the vessel left an affected area within a period where vectors could still breed and carry the disease to other ports.

The crew must handle the shipboard IVM plan and carefully document prevention, monitoring and control measures. When necessary or required, licensed and qualified agents must perform the vessel's disinsection, disinfection or decontamination. Written evidence of implementation of these measures must be issued by the service provider and kept on board for verification by the port health authority.

#### 4.2.2. immunisation

The only mosquito-transmission disease against which an effective commercial vaccine is widely available is yellow fever.

Regardless of the vessel's typical trade pattern, unless there is a medical contraindication, all seafarers should take the single-dose yellow fever vaccine, which affords sustainable lifelong protection to those vaccinated. Indeed, some countries require a yellow fever vaccination certificate to allow travellers to enter or transit, which is currently not the case in Brazil.



### 4.2.3. Chemoprophylaxis

Antimalarial drugs help prevent (or treat) malaria infection. None offers complete protection but significantly reduces the risk of a fatal disease. Upon medical advice, prophylactic antimalarial medication should be administered to seafarers on short-term visits to areas where the risk of malaria is known to be moderate to high, as is currently the case in most Amazon ports.



Specific treatments depend on local epidemiology, type and severity of malaria, age and comorbidities, as directed by healthcare professionals.



When planning a voyage to malarial areas, as defined by the health authorities, ship operators and masters should properly assess local risks based on the vessel rotation, length of stay and time to the next destination to decide which antimalarial drugs should be carried out on board.

Medicines to treat or relieve symptoms of other vector-borne diseases should also be available in the vessel's medical chest.

### 4.2.4. Personal protection

Apart from vector control, seafarers must also protect themselves against mosquito bites. During visits to ports within or next to affected areas, the crew should stay indoors with window screens or air-conditioning, if possible.



When working outdoors, crewmembers should wear long-sleeved shirts, trousers, or overalls, spray permethrin and natural pyrethrins on the inside and outside of clothes and socks and let them dry before wearing them. These insecticides should never be applied directly to the skin.

Personal insect repellent lotions or creams should be applied to all exposed skin. The best choice for repellent is prepared with DEET (N, N-diethyl-3-methylbenzamide). Alternatively, icaridin and p-menthane-3,8-diol (PMD) repellents are just as effective but do not last as long as DEET formulations.



Insect repellents should be applied following the manufacturer's directions for use and reapplication, and if using sunscreen, the repellent should be applied after sunscreen<sup>33</sup>.



The crew should sleep under permethrin-treated mosquito bed nets if not in a screened, air-conditioned room.

<sup>33</sup> "International Medical Guide for Ships: Including the Ship's Medicine chest. 3rd Edition", by WHO; "Mosquito-Borne Diseases", by the CDC's National Institute for Occupational Safety and Health (NIOSH); "Prevent Mosquito Bites", by the CDC 'sd Division of Vector-Borne Diseases (DVBD). Retrieved 20 Jun 2022

## 5. Authoritative sources of information

### 5.1. World Health Organization (WHO)



## World Health Organization

- International Health Regulations (2005) (3<sup>rd</sup> Edition) – 2016
- International Medical Guide for Ships: Including the Ship's Medicine Chest (3<sup>rd</sup> Edition) – 2007
- International Health Regulations (2005): Handbook for Inspection of Ships and Issuance of Ship Sanitation Certificates – 2011
- Vector Surveillance and Control at Ports, Airports, and Ground Crossings – 2016
- WHO Guide to Ship Sanitation (3<sup>rd</sup> Edition) – 2011
- WHO Handbook for Managing Public Health Events on Board Ships – 2016
- Global Vector Control Response 2017-2030 – 2017
- Global Strategy for Malaria 2016-2030 – 2021
- WHO Malaria, Fact Sheet – 2022
- World Malaria Report 2021 – 2021
- WHO Guidelines for Malaria – 2022
- A Global Strategy to Eliminate Yellow Fever Epidemics 2017-2026 – 2018
- WHO Yellow Fever, Fact Sheet – 2019
- WHO Situation Report: Yellow Fever – 2016
- WHO Dengue and Severe Dengue, Fact Sheet – 2022
- WHO Situation Report: Dengue – 2022
- WHO Chikungunya, Fact Sheet – 2020
- WHO Guidelines for Prevention & Control of Chikungunya Fever – 2009
- WHO Zika Virus, Fact Sheet, updated July 2018 – 2018
- WHO Situation Report: Zika Virus, Microcephaly, Guillain-Barre Syndrome – 2016
- WHO World Health Assembly Resolution WHA67.13 dated May 2014 – 2014
- WHO International Travel and Health ([www.who.int/ith/en/](http://www.who.int/ith/en/))

### 5.2. Pan American Health Organization (PAHO)



## Pan American Health Organization

- Health in the Americas. Summary: Regional Outlook and Country Profiles – 2017
- PAHO Factsheet for Malaria – 2022
- PAHO Factsheet for Yellow Fever – 2022
- PAHO Factsheet for Dengue – 2022
- PAHO Factsheet for Chikungunya – 2022
- PAHO Factsheet for Zika Virus – 2022

### 5.3. US Centers for Disease Control and Prevention (CDC)



- Morbidity and Mortality Weekly Report – Update: Interim Guidance for the Evaluation and Management of Infants with Possible Congenital Zika Virus Infection – 2016
- CDC Yellow Book 2020: Health Information for International Travel - 2020
- CDC Factsheet for Malaria – 2022
- CDC Factsheet for Yellow Fever – 2022
- CDC Factsheet for Dengue – 2022
- CDC Factsheet for Chikungunya – 2022
- CDC Factsheet for Zika Virus - 2022

### 5.4. Brazilian Ministry of Health (MS)



- Law 6,295 of 1975 (organisation of Epidemiological Surveillance actions on the National Immunisation Program and establishes rules for the compulsory notification of diseases and other sanitary measures) – 1975
- ANVISA Collegiate Directorate Resolution RDC 72 of 2009 (Technical Regulation for promoting health in national ports and on board vessels that transit or operate in them), as amended – 2020
- ANVISA Collegiate Directorate Resolution RDC 574 of 2021 (health requirements for the embarkation, disembarkation and transport of travellers on cruise ships located in Brazilian jurisdictional waters, including those with travellers from another country, due to the Public Health Emergency of International - PHEIC resulting from the pandemic of SARS-CoV-2) – 2021
- ANVISA Collegiate Directorate Resolution RDC 584 of 2021 (sanitary measures for the operation, embarkation and disembarkation from platforms and cargo vessels in Brazilian jurisdictional waters due to the Public Health Emergency of International Concern - PHEIC arising from the SARS-CoV-2 pandemic) – 2021

## 6. Conclusion

Almost all shipboard malaria are 'imported cases', chiefly from Sub-Saharan Africa, where the *P. falciparum* is prevalent. While there are no public statistics on the number of visiting seafarers who have contracted other mosquito-borne diseases, such as dengue and Zika, this appears to be minor. Nevertheless, the risk of exposure of the crew to infected mosquitos in affected areas is significant, even if their stay in port is short.

Female mosquitoes can survive on board a vessel for several weeks, and their eggs in hibernation can outlive for months in stagnant waters at a suitable temperature. Apart from the crew being exposed to mosquitoes, there is also the danger of vessels exporting mosquitos to other regions of the globe and seafarers unknowingly bringing severe infectious diseases, notably Zika, into their homes and infecting their partners through sexual transmission.

Therefore, the vessel's integrated vector management (IVM) must be followed in every detail, and the surveillance heightened in places where mosquitoes and other disease vectors are known to occur.

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Editor: Ricardo Martins  
ricardo.martins@proinde.com.br

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<b>SANTOS (MAIN OFFICE)</b>	<b>REPRESENTAÇÕES PROINDE LTDA.</b>
<b>Address</b>	Rua Itororó, 3 – Sala 31 11010-071 – Santos-SP Brazil
<b>Telephone</b>	+ 55 13 4009 9550
<b>General E-mail</b>	<a href="mailto:proinde@proinde.com.br">proinde@proinde.com.br</a>
<b>RIO GRANDE</b>	<b>REPRESENTAÇÕES PROINDE LTDA.</b> <i>c/o FARINON, CARVALHO DA SILVA</i>
<b>Address</b>	Rua Barão de Cotegipe, 443 – Sala 610 96200-290 – Rio Grande-RS Brazil
<b>Telephone</b>	+55 53 3233 1500
<b>General E-mail</b>	<a href="mailto:proinde.riogrande@proinde.com.br">proinde.riogrande@proinde.com.br</a>
<b>RIO DE JANEIRO</b>	<b>REPRESENTAÇÕES PROINDE (RIO) LTDA.</b>
<b>Address</b>	Av. Rio Branco, 45 – Sala 2402 20090-003 – Rio de Janeiro-RJ Brazil
<b>Telephone</b>	+ 55 21 2253 6145
<b>General E-mail</b>	<a href="mailto:proinde.rio@proinde.com.br">proinde.rio@proinde.com.br</a>
<b>VITORIA</b>	<b>REPRESENTAÇÕES PROINDE LTDA.</b> <i>c/o WS COMÉRCIO E SERVIÇOS MARÍTIMOS LTDA.</i>
<b>Address</b>	Rua Professor Elpidio Pimentel, 320 – Sala 401 29065-060 – Vitória-ES Brazil
<b>Telephone</b>	+55 27 3337 1178
<b>General E-mail</b>	<a href="mailto:proinde.vitoria@proinde.com.br">proinde.vitoria@proinde.com.br</a>
<b>SALVADOR</b>	<b>REPRESENTAÇÕES PROINDE LTDA.</b> <i>c/o PERINÁUTICA LTDA.</i>
<b>Address</b>	Rua Miguel Calmon, 19 – Sala 702 40015-010 – Salvador-BA Brazil
<b>Telephone</b>	+55 71 3242 3384
<b>General E-mail</b>	<a href="mailto:proinde.salvador@proinde.com.br">proinde.salvador@proinde.com.br</a>
<b>RECIFE</b>	<b>REPRESENTAÇÕES PROINDE (NORDESTE) LTDA.</b>
<b>Address</b>	Av. Visconde de Jequitinhonha, 209 - Sala 402 51021-190 – Recife-PE Brazil
<b>Telephone</b>	+55 81 3328 6414
<b>General E-mail</b>	<a href="mailto:proinde.recife@proinde.com.br">proinde.recife@proinde.com.br</a>
<b>FORTALEZA</b>	<b>REPRESENTAÇÕES PROINDE LTDA.</b> <i>c/o ABACUS REPRESENTAÇÕES LTDA.</i>
<b>Address</b>	Rua Osvaldo Cruz, 01 – Sala 1408 60125-150 – Fortaleza-CE Brazil
<b>Telephone</b>	+55 85 3099 4068
<b>General E-mail</b>	<a href="mailto:proinde.fortaleza@proinde.com.br">proinde.fortaleza@proinde.com.br</a>
<b>BELÉM</b>	<b>REPRESENTAÇÕES PROINDE (BELÉM) LTDA.</b>
<b>Address</b>	Travessa Joaquim Furtado, Quadra 314, Lote 01 – Sala 206 68447-000 – Barcarena-PA Brazil
<b>Telephone</b>	+55 91 99393 4252
<b>General E-mail</b>	<a href="mailto:proinde.belem@proinde.com.br">proinde.belem@proinde.com.br</a>
<b>MANAUS</b>	<b>REPRESENTAÇÕES PROINDE (NORTE) LTDA.</b>
<b>Address</b>	Av. Theomario Pinta da Costa, 811 – Sala 204 69050-055 – Manaus-AM Brazil
<b>Telephone</b>	+55 92 3307 0653
<b>General E-mail</b>	<a href="mailto:proinde.manaus@proinde.com.br">proinde.manaus@proinde.com.br</a>

Our offices are open Mondays to Fridays from 08:30 to 12:00 and from 14:00 to 18:00. Any matter requiring attention outside office hours should be communicated through our after-hours numbers. Emails are not monitored outside office hours.

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