# Prevalence and evolution of clinical cases of Yellow Fever in Brazil between the years 2007 to 2016

Prevalência e evolução clínica dos casos de Febre Amarela no Brasil entre os anos de 2007 a 2016

Prevalencia y evolución de casos clínicos de Fiebre Amarilla en Brasil entre los años 2007 a 2016

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**Abstract**
Yellow Fever (YF) is a non-contagious infectious disease of variable symptoms that occurs mainly in tropical forests regions of the Americas and Africa and is caused by a Flavivirus belonging to the Flaviviridae family. Its vectors are mosquitoes of the genus *Haemagogus*, *Sabethes* and *Aedes,* and these have non-human primates as the main source of infection. In Brazil, there has been no record of urban AF since 1942, although the increase in cases of the wild form combined with low vaccination coverage contribute to the risk of re-urbanization of the disease Material and methods: For the study, epidemiological data were obtained from confirmed cases of Yellow Fever reported in the Notification System for Health Disorders (SINAN) available at the Informatics Department of the Unified Health System (DATASUS). Results and discussion: A total of 177 cases of were reported in Brazil, the year with the highest notification was in 2016 (52). The region with the highest occurrence of cases were the Southeast (95). Regarding the clinical evolution, of the 177 cases, 68 affected patients were cured, while 89 died from the reported injury, evidencing a high rate of lethality (50.2%). Conclusion: YF remains a public health problem, over the years there was a decrease in cases, this was due to immunization campaigns in the country, however, there was a significant increase in notifications in 2016, this whole panorama reinforces the need intensifying surveillance and expanding vaccine coverage.
**Keywords:** Yellow fever; Prevalence; Clinical evolution.

**Resumo**
A Febre Amarela (FA) é uma doença infecciosa não contagiosa de sintomatologia variável que ocorre, principalmente, nas regiões de florestas tropicais das Américas e da África, é causada por um Flavivírus pertencente à família Flaviviridae. Seus vetores são mosquitos do gênero *Haemagogus*, *Sabethes* e *Aedes* e esses possuem como principal fonte de infecção os primatas não humanos. No Brasil, não há registro de FA urbana desde 1942 embora o aumento dos casos da forma silvestre aliado a baixa cobertura vacinal contribuam para o risco de reurbanização da

patologia Material e métodos: Para o estudo, os dados epidemiológicos foram obtidos a partir dos casos confirmados de Febre Amarela informados no Sistema de Notificação de Agravos de Saúde (SINAN) disponível no Departamento de Informática do Sistema Único de Saúde (DATASUS). Resultados e discussão: Foram notificados um total de 177 casos de Febre Amarela no Brasil, o ano de maior notificação foi em 2016 (52). A região que apresentou maior ocorrência de casos foi a Sudeste (95). Em relação à evolução clínica, dos 177 casos, 68 pacientes acometidos apresentaram cura, enquanto 89 foram a óbito pelo agravo notificado evidenciando uma alta taxa de letalidade (50,2%). Conclusão: A FA permanece um problema de saúde pública, ao longo dos anos observou-se uma diminuição dos casos, isso ocorreu devido às campanhas de imunização no país, contudo, houve um aumento significativo das notificações em 2016, todo esse panorama reforça a necessidade da intensificação da vigilância e ampliação da cobertura vacinal.
**Palavras-chave:** Febre amarela; Prevalência; Evolução clínica.

**Resumen**
La Fiebre Amarilla (FA) es una enfermedad infecciosa no contagiosa de sintomas variables que se presenta principalmente em las regiones de bosques tropicales de las Américas y África, es causada por um Flavivirus perteneciente a la família *Flaviviridae*. Its vectors are mosquitoes of the genus *Haemagogus*, *Sabethes* and *Aedes,* and these have non-human primates as the main source of infection. In Brazil, there has been no record of urban AF since 1942, although the increase in cases of the wild form combined with low vaccination coverage contribute to the risk of re-urbanization of the disease Material and methods: For the study, epidemiological data were obtained from confirmed cases of Yellow Fever reported in the Notification System for Health Disorders (SINAN) available at the Informatics Department of the Unified Health System (DATASUS). Results and discussion: A total of 177 cases of were reported in Brazil, the year with the highest notification was in 2016 (52). La región con mayor ocurrencia de casos fue el Sureste (95). En cuanto a la evolución clínica, de los 177 casos, 68 pacientes afectados fueron curados, mientras que 89 fallecieron por la enfermedad reportada, evidenciando una alta tasa de mortalidad (50,2%). Conclusión: La FA sigue siendo un problema de salud pública, a lo largo de los años hubo una disminución de casos, esto se debió a las campañas de vacunación en el país, sin embargo, hubo un aumento significativo en las notificaciones en 2016, todo este panorama refuerza la necesidad de intensificar la vigilancia y ampliar la cobertura de vacunas.
**Palabras clave:** Fiebre amarilla; Prevalencia; Evolución clínica.

## 1. Introduction

Yellow Fever (FA) is a non-contagious infectious disease that occurs mainly in tropical forest regions of the Americas and Africa. It is caused by an enveloped virus whose genetic material is a single-stranded RNA belonging to the *Flavivirus* genus of the *Flaviviridae* family. Its viral genome is approximately 11kb in length, which has the capacity to produce about 10 distinct proteins, 3 of which are related to structural function (capsid, pre-membrane and envelope) and 7 are classified as non-structural (NS1, NS2A, NS2B, NS3, NS4A, NS4B and NS5) The main vectors related to the proliferation of AF are hematophagous arthropods (mosquitoes) belonging to the genera *Haemagogus* , *Sabethes* and *Aedes* , these insects have non-human primates as their main food source (Monath & Vasconcelos, 2015; Bacha & Johanson, 2017.; Rollins *et al.*, 2017; Waggoner *et al.*, 2018).

Regarding clinical manifestations, Yellow Fever has variable symptoms, which can be divided into three phases: infection, remission and intoxication. Early symptoms of YF include headache, body aches, nausea, chills, fever, vomiting, and fatigue. A large part of the patients affected by the disease improves after presenting these symptoms, however, in the most severe cases of this pathology, during the period of intoxication, hemorrhagic fever, hepatic and renal dysfunction occur in 20% to 50% of patients who progress to this disease. Stage die due to the aggravations of the disease. There is no specific antiviral treatment for YF, the best way to avoid contracting the disease is through vaccination (Rollins *et al*., 2017; Litvoc *et al*., 2018; Waggoner *et al*., 2018; Fantini *et al*., 2021).

From an epidemiological point of view, the disease has two distinct cycles: wild and urban. The wild cycle is a zoonosis, the virus is transmitted by mosquitoes of the genus *Haemagogus* and *Sabethes* in the Americas and in Africa the vector belongs to the genus Aedes, these arthropods infect non-human primates of the genus *Allouata*, *Cebus*, *Atelles* and *Callitbrix*. Humans acquire the disease when they enter forest areas, usually with the intention of carrying out extractive or

recreational activities, that is, man is an accidental host of this flavivirus (Barret & Monath, 2003; Jentes *et al.*, 2011; Lopes *et al.*, 2019; Noronha & Camacho, 2017; Ishak *et al.*, 2020).

The urban cycle behaves like an anthroponosis, that is, transmission occurs between humans in which the vector *Aedes aegypti* is contaminated with the Yellow Fever arbovirus when feeding on an infected individual, thus, this mosquito becomes a transmitter of disease in cities. In Brazil, there has been no record of urban AF since 1942, although the increase in cases of wild AF, combined with low vaccination coverage in regions prone to the occurrence of the disease, contribute to the risk of its re-urbanization (Beasley *et al*., 2015; Cavalcante *et al*., 2017; Noronha & Camacho, 2017; HO *et al*., 2019; Vieira *et al*., 2020). Given this panorama, this study aimed to assess the prevalence and evolution of clinical cases of Yellow Fever between the years 2007 to 2016.

## 2. Methodology

This is a descriptive, retrospective, cross-sectional study with a quantitative approach. Secondary data on the prevalence and evolution of Yellow Fever between 2007 and 2016 were obtained from confirmed cases of the disease reported in the Health Disorders Notification System (SINAN) available on the public data platform of the Department of Informatics of the Unified Health System (DATASUS).

## 3. Results

During the stipulated period of the research, a total of 177 confirmed cases of Yellow Fever in Brazil were reported, distributed between the years 2007 to 2016, as shown in Figure 1:

**Figure 1.** Distribution of Yellow Fever cases in Brazil according to the year of notification.
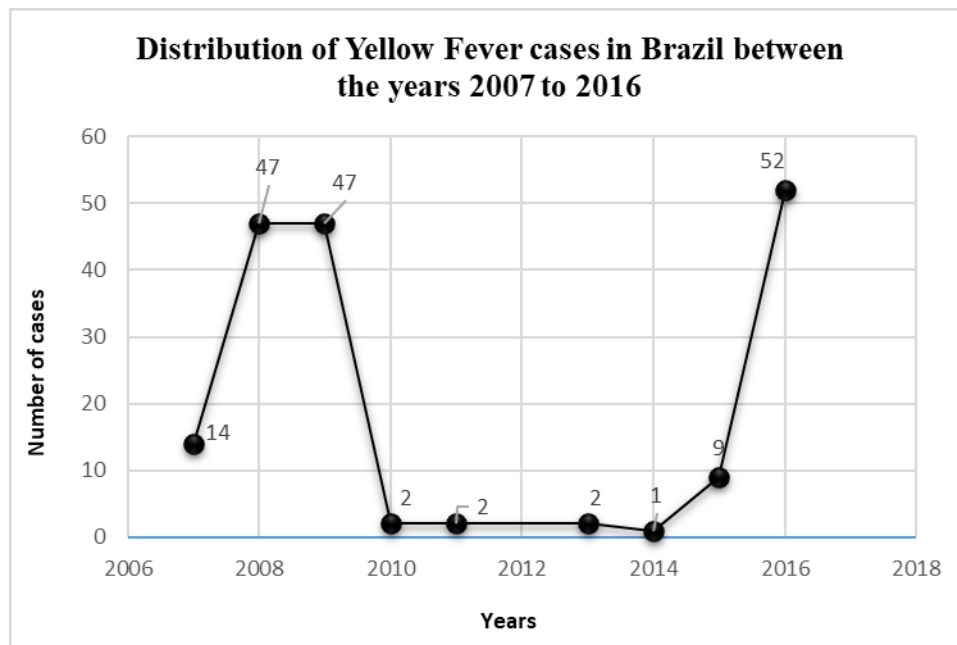


Source: SINAN/Departament Informatics of the Unified Health System (DATASUS) (2021).

The years with the highest notification of the disease were 2016 (52), 2008 (47) and 2009 (47) respectively. Regarding the periods of lowest confirmed cases of the pathology, 2014 was the year with the lowest occurrence of Yellow Fever, with only 1 reported case. The years 2010, 2011 and 2013 also had few notifications of the disease, although

underreporting is a reality in the country.

Regarding the distribution of confirmed cases by region, the Southeast was the region with the highest occurrence of the disease, with 95 confirmed cases, followed by the Midwest, with 39 notifications. The North region had the lowest prevalence of the disease with 18 cases, the South region reported 25 cases of the pathology, the Northeast region did not present reports of AF according to SINAN data (Figure 2).

**Figure 2.** Distribution of Yellow Fever cases in Brazil according to the region of notification.
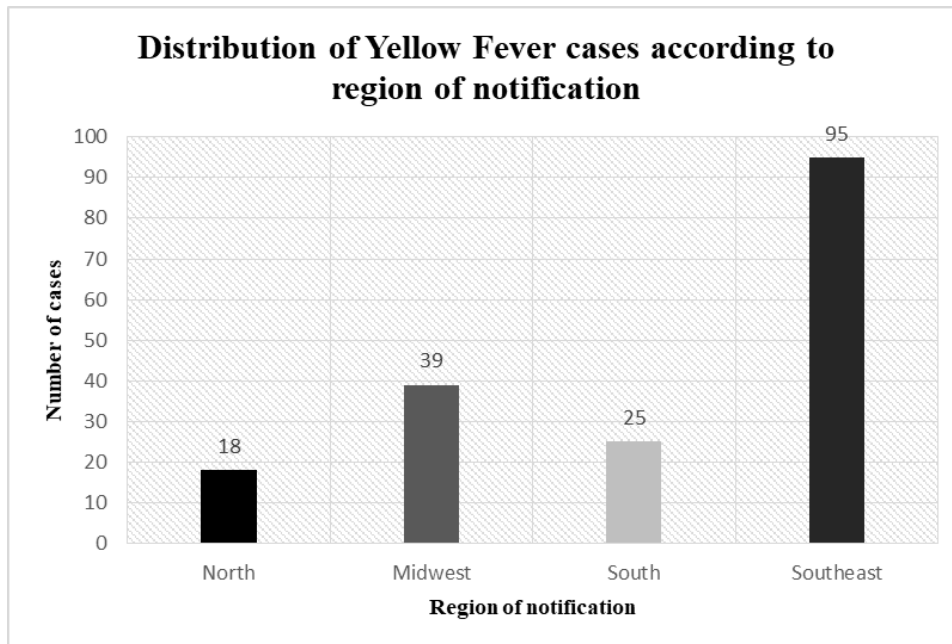


Source: SINAN/Departament Informatics of the Unified Health System (DATASUS) (2021).

Regarding the clinical evolution of Yellow Fever, of the 177 total affected, 19 cases were blank or ignored as to the clinical situation, 68 patients affected by the disease were cured, on the other hand, 89 died from the reported disease, showing a rate of lethality considered high (50.2%), only one person died due to other clinical problems.

## 4. Discussion

Noronha and Camacho (2017) emphasize that the exacerbated spread of the *Aedes aegypti* mosquito in large urban centers creates a favorable environment for the re-urbanization of Yellow Fever in Brazil, this is due to its ability to behave as a vector to propagate arboviruses, a fact this is also presented in the studies carried out by Cavalcante and Tauil (2016), who also reported that confirmed cases of wild Yellow Fever are increasingly closer to urban areas, a factor that, together with low vaccination coverage and epizootic surveillance in non- humans can contribute to the re-urbanization of this disease.

Yellow Fever is an acute febrile infectious disease, which has variable symptoms. In this sense, as in the present study, the authors Mascheretti *et al* (2013), Cavalcante and Tauil (2016), who carried out studies on the epidemiological characteristics of the yellow fever virus in Brazil, also identified lethality rates considered high, especially among the population males, who are also the most affected by the pathology because they are more exposed to areas prone to the occurrence of the infection, therefore, given the severity of the disease, it is important to continue monitoring and intensifying the prevention strategies for the control of Yellow Fever in Brazil.

In accordance with the above, Casali *et al* (2019) reinforces the need for the use of broader and multifactorial analysis mechanisms regarding the disease, as the epidemiological profile of the pathology must be considered in order to better direct

which will be the measures taken to combat the spread of Yellow Fever in the most vulnerable groups and in the general population.

The authors also emphasize the importance of strengthening epizootic surveillance, as the detection of the virus circulation still in its enzootic cycle, when non-human primates are affected by the yellow fever virus, allows control measures to be carried out previously in order to prevent the occurrence of cases of the disease in humans.

## 5. Conclusion

Yellow Fever remains a public health problem in Brazil, over the years it was possible to observe a decrease in cases in Brazil, however, in 2016, there was a significant increase in the notification of cases of the disease. The Southeast region had the highest number of confirmed cases of AF, although underreporting in the North and Center-West regions is a reality in the country.

As for the clinical evolution, 89 of the 177 confirmed cases of the disease evolved to death, which demonstrates that, if not properly diagnosed and treated, it has high lethality. Considering that there is still no specific treatment for AF, vaccination remains the most effective way to avoid contracting the disease. Therefore, the continuity of epidemiological and epizootic monitoring become important tools in directing public policies aimed at the control and prevention of Yellow Fever in Brazil.

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