Epidemiological Alert
Yellow Fever

31 August 2022

Situation Summary

Although immunization is one of the most successful public health interventions, vaccination coverage has stagnated in the last decade. The COVID-19 pandemic and associated disruptions have strained health systems, with 25 million children unvaccinated in 2021, an increase of 5.9 million from 2019. By 2021, the vaccine against yellow fever has been included into routine childhood immunization programs in 36 of the 40 countries and territories at risk for yellow fever in Africa and the Americas. In these 40 countries and territories, coverage is estimated at 47%[1], which is considered too low for effective control of this disease.

In the Region of the Americas, the risk of new yellow fever outbreaks of varying magnitudes is high. Although health systems have begun to recover from the impact of the COVID-19 pandemic, an alarming decrease has been observed in the proportion of the population vaccinated against yellow fever and, consequently, an increase in the gap in immunizations has accumulated over the last decade. The COVID-19 pandemic, among other factors, has led to vaccination activities that were previously routinely carried out becoming a challenge.

In the Region of the Americas, according to estimates by the World Health Organization (WHO) and the United Nations Children's Fund (UNICEF), between 2020 and 2021, vaccination coverage for yellow fever decreased in 6 of the 13 countries and territories with yellow fever endemic areas. In 2021, yellow fever vaccination coverage equal to or greater than 95% was not achieved in 12 of the 13 endemic countries/territories, and it was less than 80%[2] and in 9 countries.

Health authorities of the countries in the Region are making great efforts to restore services, close coverage and immunity gaps, and expand routine immunization services. However, there are significant challenges related to ensuring the supply of the yellow fever vaccine, a situation that could be aggravated by delays in the supply chain due to the pandemic and the current conflict in Eastern Europe.

Due to the aforementioned, it is **urgent that health authorities ensure they have a strategic reserve inventory that allows them to maintain routine vaccination and at the same time respond to eventual outbreaks**. In addition, it is necessary that the countries that have scheduled preventive vaccination campaigns for increasing coverage resume their plans and guarantee vaccination coverage greater than or equal to 95% in a homogeneous manner.

[1] WHO. Immunization coverage. 14 July 2022. Available at: https://bit.ly/2Gn9lzl

[2] UNICEF. COVID-19 pandemic fuels largest continued backslide in vaccinations in three decades. 15 July 2022. Available at: https://uni.cf/3CHYBYM and https://bit.ly/3aTfMLG

Suggested citation: Pan American Health Organization / World Health Organization. Epidemiological Alert: Yellow Fever. 31 August 2022, Washington, D.C.: PAHO/WHO; 2022

Yellow Fever epidemiological update in the Region of the Americas

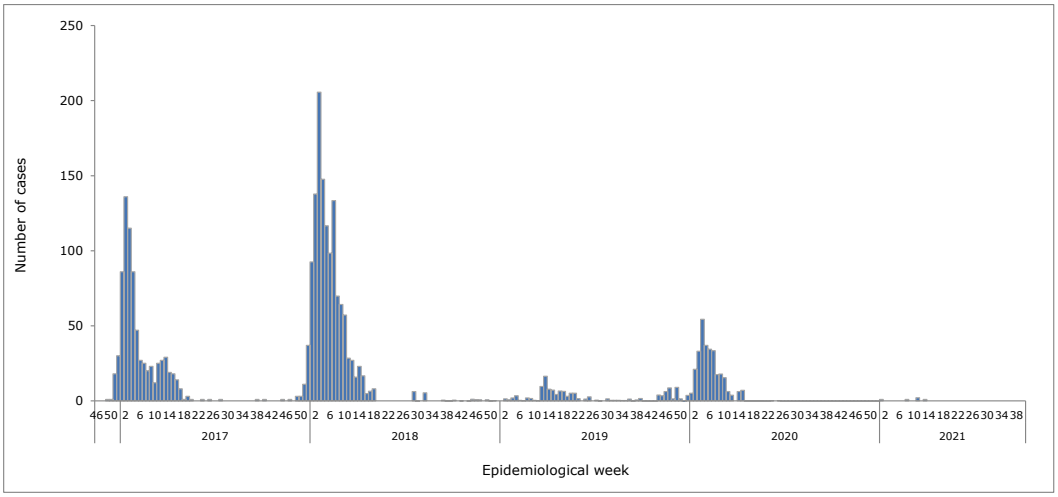
In 2022, as of epidemiological week (EW) 27, confirmed cases of yellow fever were reported in three countries of the Region: Bolivia[3] (5 confirmed cases), Brazil (5 confirmed cases), and Peru (3 confirmed cases).

Below is a summary of the situation in selected countries.

In **Brazil**, during the 2014-2015 seasonal period, the transmission that initially occurred in the northern region (with epizootics among non-human primates in Tocantins, Federal District, and Minas Gerais and human cases in Goiás and Mato Grosso do Sul) expanded from the east to the south, and affecting mainly the states in the center-west region during the 2015-2016 period (with epizootics in Tocantins, Goiás, Federal District and Minas Gerais and human cases in Goiás and São Paulo).

A large outbreak of yellow fever was observed during the end of 2016 until June 2017 that mainly affected the states of the southeastern region, reaching non-endemic areas (Bahía--except for the western part of the state, which only had epizootics among non-human primates and no reported cases in humans; Minas Gerais, Espírito Santo, Rio de Janeiro, and the coast of São Paulo). A second wave of transmission was observed since the end of 2017 to June 2018, again affecting the southeast region, although with greater transmission in the states of Minas Gerais and São Paulo. The cases reported during both periods, 2016-2017 and 2017-2018, were in the states of Minas Gerais, Espírito Santo, São Paulo, and the Federal District, which exceeded the number of cases reported during the last 50 years (**Figure 1** and **Figure 4**). During the 2018-2019 period, 80% of the cases were reported in São Paulo.

Figure 1. Distribution of confirmed human cases of yellow fever, by epidemiological week (EW) of occurrence. Brazil, 2016–2021.



Source: Data provided by the Brazil Ministry of Health and reproduced by PAHO/WHO.

Between July 2019 and June 2020, 19 confirmed cases were reported in 3 states (Acre, Pará and Santa Catarina) and between July 2020 and June 2021, a total of 9 confirmed cases were reported in 2 states (Pará and Santa Catarina). Recently, between July 2021 and June 2022, 5 confirmed cases, including 4 deaths, were reported in the states of Pará (municipalities of Afuá and Oeiras do

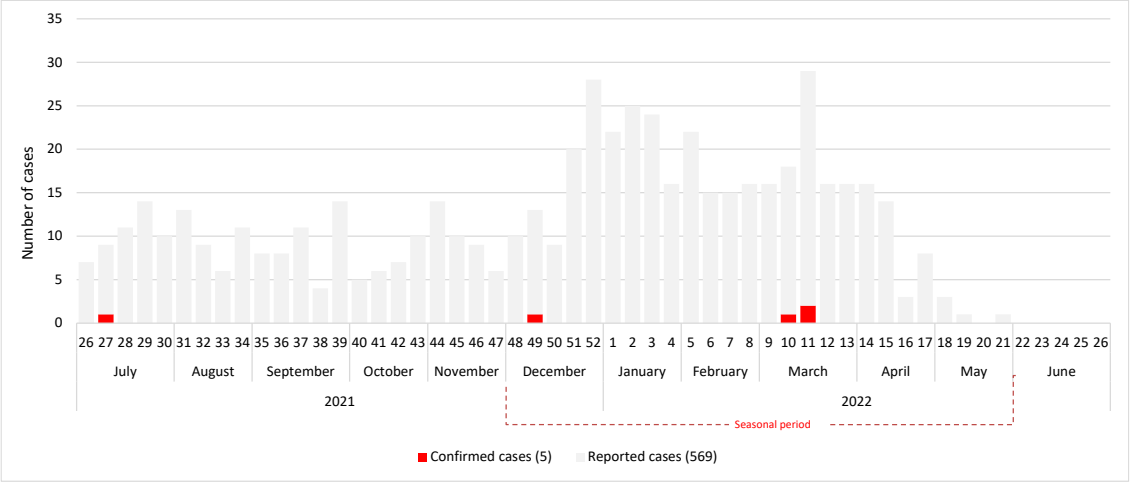
[3] Additional information on the cases reported in Bolivia was published on 26 May 2022, in the document, Yellow Fever in the Region of the Americas: Vaccine reserve stockpile management (26 May 2022). Available at: https://bit.ly/3KyHM4o

Pará) and Tocantins (municipality of São Salvador do Tocantins). All the cases were male, aged 20 to 29 years, and 4 had no history of vaccination and one had a history of vaccination in 2018. The 5 confirmed cases had a history of exposure to wild and/or forested areas, due to work and/or leisure activities (**Figure 2**).

During the same period, 1,267 epizootics among non-human primates (NHP) suspected of yellow fever were reported, of which 26 (2.1%) were confirmed by laboratory criteria in the states of Pará (1), Minas Gerais (20), Santa Catarina (3), and Rio Grande do Sul (2). Confirmed epizootics were recorded between July 2021 and March 2022 (**Figure 3**).

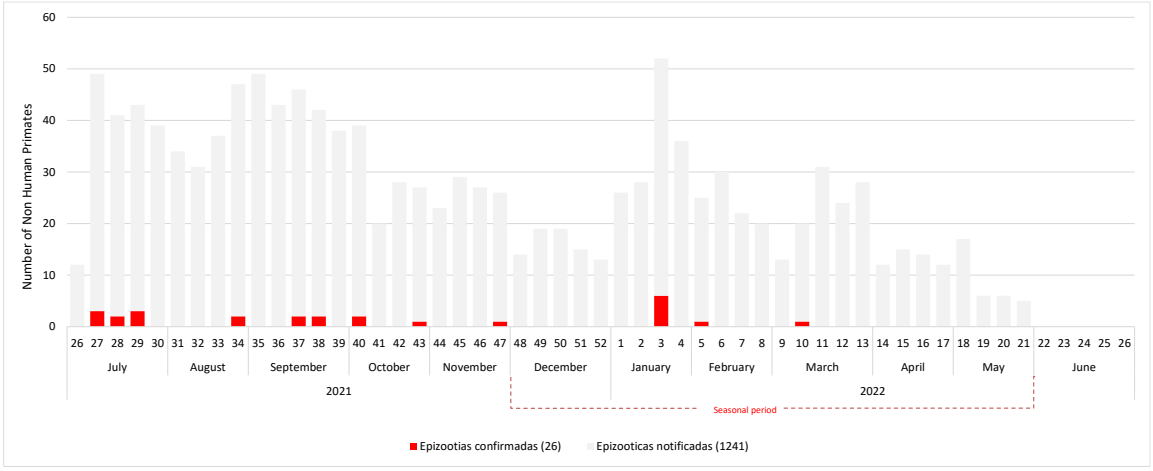
Between 2016 and 2022, based on the spatial-temporal distribution, the wave of yellow fever appears to move towards the south of Brazil. In 2021, the epizootics were located along the Iguazú River, which is a tributary of the Paraná River and heads towards Paraguay, Argentina, and Uruguay (**Figure 4**), representing a risk of viral circulation in those countries, especially in areas that share a similar ecosystem.

Figure 2. Distribution of yellow fever cases in humans by epidemiological week (EW). Brazil, July 2021 to June 2022.



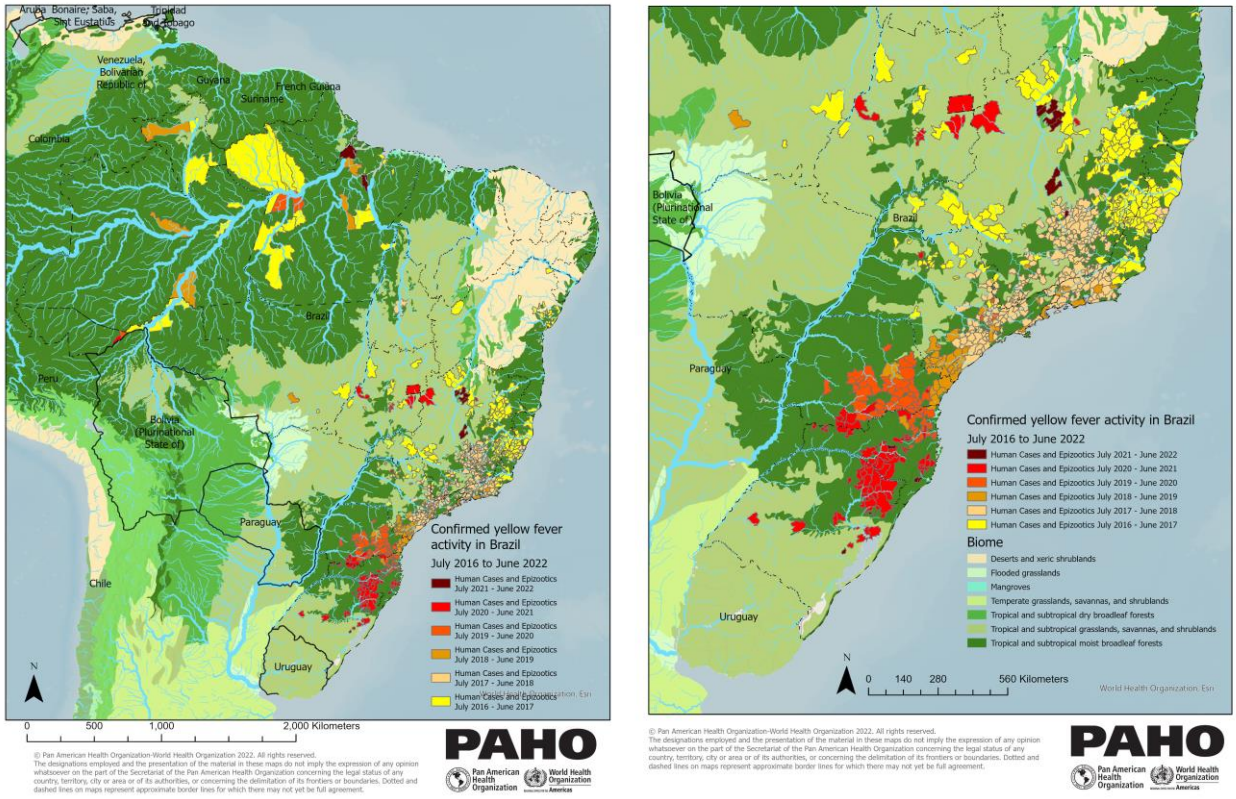
Source: Data published by the Brazilian Ministry of Health and reproduced by PAHO/WHO

Figure 3. Distribution of yellow fever epizootics among non-human primates by epidemiological week (EW). Brazil, July 2021 to June 2022.



Source: Data published by the Brazilian Ministry of Health and reproduced by PAHO/WHO

Figure 4. Geographical distribution of yellow fever cases in humans and epizootics among non-human primates. Brazil, January 2017 to June 2022.



Source: Data published by the Brazilian Ministry of Health and reproduced by PAHO/WHO

Between 2017 and 2021, yellow fever vaccination coverage at the national level was between 62.4% and 47.4%. In 2021, a national yellow fever vaccination coverage of 57.6% was achieved, with all states reporting less than 80% vaccination coverage. During the same period, in the states that reported confirmed cases of yellow fever and/or confirmed epizootics, vaccination coverage for yellow fever was 45.9% in Pará, 73.8% in Minas Gerais, 74.5% in % in Santa Catarina, 60.8% in Rio Grande do Sul, and 69% in Tocantins.

In **Paraguay**, no human cases of yellow fever have been reported since 2008, when 28 confirmed human cases and 11 deaths were reported. However, Paraguay presents favorable areas for the reactivation of jungle transmission cycles with the presence of yellow fever vectors from the genera *Sabethes* and *Haemagogus*. Since 2020, surveillance of suspected yellow fever epizootics has begun in 2 departments of the country (Alto Paraná and Canindeyú). All notifications have been discarded to date.

Between 2017 and 2021, yellow fever vaccination coverage at the national level ranged from 52% to 80%. In 2021, a national yellow fever vaccination coverage was 52%, with the lowest coverage in the department of San Pedro Sur (39%) and the highest in the department of Boquerón (91%). In the same year, yellow fever vaccination coverage in the departments that share a similar ecosystem with Brazil was as follows: 51% in Alto Paraná, 72% in Alto Paraguay, 60% in Amambay, 52% in Canindeyú, and 52% in Concepción.

In **Argentina**, the National Vaccination Calendar schedules yellow fever vaccinations only for residents of the provinces of Misiones, Corrientes, Formosa, and some departments of Chaco, Salta, and Jujuy. The schedule consists of a dose between 12 and 18 months of age and a booster at 11 years of age.

Since June 2017, and based on the evidence presented by the country, the scientific-technical advisory group on geographic mapping of yellow fever risk (GRYF per its acronym in Spanish) considers that Argentina is outside of the yellow fever endemic zone, except during increases in epizootics in the northern part of the country, which occur at irregular intervals. Therefore, the province of Misiones and areas of Corrientes, in the northern part of the country, are considered "transition" territories with respect to the risk of yellow fever transmission.

On the other hand, while Argentina does not require the presentation of the international vaccination certificate to enter these territories, vaccination is recommended for all travelers over 9 months old who travel to the provinces of Corrientes and Misiones. Between 2017 and 2020, in the jurisdictions considered to be at risk for yellow fever transmission, the following vaccination coverage was reported on average: 83% (2017), 79% (2018), 89% (2019), and 81% (2020).

In 2021, an average coverage of 79.4% was reached; however, in the provinces that are on the border with Brazil, the coverage was: 92.5% in Corrientes and 82.4% in Misiones. Between 2020 and 2021, as with the rest of the scheduled vaccines, a significant decrease in yellow fever vaccination coverage was observed.

In **Peru**, between EW 1 and EW 26 of 2022, 5 probable cases were reported, of which 3 were laboratory-confirmed and 2 cases remain under investigation. All had a history of exposure to wild and/or forested areas due to agricultural work activities. The 3 confirmed cases are young adults between 19 and 35 years old. The cases were reported in the departments of Junín (2 cases), San Martín (1), and Ucayali (2 cases). Of the 5 reported cases, 3 died; the deaths occurred in the departments of Junín (2 deaths, including one who had a history of vaccination with probable vaccine failure under investigation) and Ucayali (one death, co-infection with leptospirosis).

Between 2017 and 2021, yellow fever vaccination coverage at the national level was between 50.2% and 74.9%. In 2021, a national yellow fever vaccination coverage of 60.7% was achieved. Among the 7 departments with endemic yellow fever areas, all reported a vaccination coverage of less than 80%. During the same period, in the departments that reported probable cases of yellow fever, coverage was as follows: 71.47% in Junín, 71.05% in San Martín, and 39.54% in Ucayali. In the other departments that have endemic yellow fever areas, coverage was as follows: 60.44% in Amazonas, 70% in Huánuco, 45.12% in Madre de Dios, and 45.21% in Loreto.

Guidance for national authorities

The Pan American Health Organization / World Health Organization (PAHO/WHO) encourages Member States with risk areas for yellow fever to continue their efforts to strengthen surveillance in yellow fever endemic areas, in addition to **immunizing the at-risk population, taking the necessary actions to keep them informed, and to vaccinate travelers** going to areas where yellow fever vaccination is recommended. Similarly, PAHO/WHO recommends for Member States to **have a vaccine reserve stockpile**, depending on the availability of vaccines in the country, which will allow for responding to potential outbreaks.

Vaccination

The yellow fever vaccine is safe and affordable and provides effective immunity for the disease among 80%-100% of persons vaccinated after 10 days and 99% immunity after 30 days. A single dose is enough to confer immunity and protection for life, without the need for a booster dose.

PAHO/WHO reiterates its recommendations to national authorities:

1. **Universal vaccination** of children in endemic countries at 12 months of age, administered simultaneously with the measles, mumps, and rubella (MMR) vaccine.

2. Endemic countries that have follow-up campaigns for measles/rubella among children under 5 years of age should take advantage of the opportunity to **integrate** yellow fever vaccination and administer these two vaccines simultaneously.

3. Update the **risk assessment and estimates of the susceptible population**, considering changes in ecological factors, migrations, vaccination coverage, socio-economical activities, as well as the risk of urbanization, to guide vaccination measures and control.

4. Vaccination of the population in risk areas, **reaching at least 95% coverage** among residents in these areas (urban, rural, and jungle), through different strategies:

    a. In healthcare facilities, make rational use of the vaccine and avoid missed vaccination opportunities.

    b. In the community, when the yellow fever vaccine is more widely available, countries should carry out **catch-up campaigns**, identifying under-vaccinated populations, professional and occupational risk groups, and age groups with suboptimal coverage; for example, young males who do not readily accept vaccination.

5. Ensure vaccination of all travelers to endemic areas at least 10 days before travel.

6. **Maintain a reserve inventory in the country** which allows for ensuring routine vaccination and responding in a timely manner if there are outbreaks.

Yellow fever vaccination recommendations for international travelers are available at: https://www.who.int/es/travel-advice.

The guidelines for laboratory diagnosis and vaccination are the same as those published in the 7 December 2018 Yellow Fever Epidemiological Update[4].

[4] PAHO/WHO. Epidemiological Update: Yellow Fever, 7 December 2018, Washington, D.C. PAHO/WHO. 2018, available at: https://bit.ly/3LK7Fxj

Sources of information

1. Report from the **Argentina** International Health Regulations (IHR) National Focal Point (NFP), received by PAHO/WHO by email.

2. Report from the **Brazil** International Health Regulations (IHR) National Focal Point (NFP), received by PAHO/WHO by email.

3. **Brazil** Ministry of Health. Yellow Fever Epidemiological Bulletin. Available in Portuguese at: https://bit.ly/3izoTBU

4. Report from the **Paraguay** International Health Regulations (IHR) National Focal Point (NFP), received by PAHO/WHO by email.

5. Report from the **Peru** International Health Regulations (IHR) National Focal Point (NFP), received by PAHO/WHO by email.

6. **Peru** Ministry of Health. Health Situation room for the analysis of Yellow Fever. Available in Spanish at: https://bit.ly/3ipBreL

7. PAHO/WHO. Epidemiological Alerts and Updates on Yellow Fever. Available at: https://bit.ly/3Ay2dKq

Related link:

- PAHO/WHO – Yellow fever. Available at: https://bit.ly/3MIC7co
- PAHO/WHO. Laboratory Diagnosis of Yellow Fever Virus Infection. Available at: https://bit.ly/3wLJtVU
- PAHO/WHO. Updated requirement for the International Certificate of Vaccination or Prophylaxis (ICVP) with proof of vaccination against yellow fever. 22 March 2017. Available at: https://bit.ly/3MMCF0O
- WHO/UNICEF. Progress and Challenges with Achieving Universal Immunizations Coverage. 15 July 2022. Available at: https://bit.ly/3of7AIE
- WHO Immunization Agenda 2030: A Global Strategy to Leave No One Behind. 1 April 2022. Disponible en: https://bit.ly/3aZmVdc
- UNICEF. Immunization coverage estimates dashboard. Available at: https://bit.ly/3zmyJzT
- UNICEF. Immunization data. Available at: https://bit.ly/3IVcO64
- PAHO/WHO. WHO/UNICEF Immunization Analysis and Insights. October 2021. Available at: https://bit.ly/3zjFYIy