



COUNTRY SITUATIONAL ANALYSIS

The Plurinational State of Bolivia is located in the center of South America. Over the past few decades, growth of large cities such as La Paz, Cochabamba, and Santa Cruz has accelerated, with almost 40% of the Bolivian population now living in these urban areas. The country still has foci of sylvatic yellow fever transmission. Cyclical outbreaks of varying magnitudes used to be common up to 2012, but since then only isolated cases have been reported.

Since the reintroduction of *Aedes aegypti*, dengue has become a major public health problem, with steady increases in both incidence and geographical spread. Two other arboviruses, chikungunya and Zika, have also emerged over the past decade. The dramatic spread and morbidity highlight the extraordinary ability of these viruses to invade a primarily susceptible population.

ECOLOGICAL FACTORS AND CLIMATE¹

The Plurinational State of Bolivia is home to great biodiversity, including forests, jungles, and mountains. The main ecoregions are the Amazon forest, the Beni savannah, and tropical rainforest that extends to the north and northeast of the country and includes plains and jungles, the Yungas, rain valleys, jungles, and mountain forests, in the south-southeast of the country.

In the mountainous areas to the west and southwest lies the Central Andean Wet Puna, an area of scrublands and grasslands with a climate ranging from cold semi-arid to tropical, and the Dry Puna with a cold desert climate.

To the east are the Chiquitano dry forests, the largest tropical forest in South America stretching south-southeast; the Bolivian Cerrado to the east, currently highly threatened due to expanding commercial agriculture; and the Bolivian Chaco, with a semi-arid climate and major oil reserves. The forest area makes up 47% of the land cover, with 35% used for agricultural activities.

The climate depends on the altitude, ranging from tropical rainforests in the north and east to subtropical in the Midwest, and desert in the southwestern highlands.

Vector distribution and incidence

Entomological surveillance surveys between 2002 and 2008 revealed widespread distribution of *Aedes aegypti*, and how this has increased steadily over the years³. In Santa Cruz, vertical transmission of dengue from an infected female mosquito to her offspring was also confirmed.⁴

YELLOW FEVER HIGHLIGHTS

EYE strategy risk categorization	High
Routine immunization introduction (year)	2004
Latest official coverage estimates (2021)	71%
Gavi eligibility	No
International Coordinating Group on vaccine provision requests	No
Last disruptive yellow fever outbreak	2006-2007
Yellow fever vaccination proof for entry/exit	No
Diagnostic capacity	Yes
Fragility, conflict, and violence status	No

DEMOGRAPHICS²

Total population	11 841 955
Annual population growth rate	1.4%
Life expectancy	75 (females) and 69 (males)
Percentage population living in urban dwellings	70%
Percentage urban population living in slums	49%

¹ World Bank. Climate Change Knowledge Portal for Development Practitioners and Policy Makers: Bolivia. Washington (DC): World Bank; 2021. Available from: <https://climateknowledgeportal.worldbank.org/country/bolivia>

³ Brémond P, Roca Y, Brenière SF, Walter A, Barja-Simon Z, Fernández RT, et al. Evolution of Dengue Disease and Entomological Monitoring in Santa Cruz, Bolivia 2002-2008. PLoS ONE. 2015;10(2): E0118337.

⁴ Le Goff G, et al. Natural vertical transmission of dengue viruses by *Aedes aegypti* in Bolivia. Parasite. 2011 Aug;18(3):277-80.

² World Bank. Understanding poverty: Open data. Washington (DC): World Bank; 2020. Available from: <https://www.worldbank.org/en/understanding-poverty>

Aedes aegypti was found at altitudes above 2200 meters above sea level (Cochabamba), with serious implications for *Aedes*-transmitted diseases in the country.⁵ In the Santa Cruz area, the vector competence of *Aedes aegypti* for yellow fever transmission was verified under experimental conditions.⁶

EPIDEMIOLOGY⁷

In the period 1960-2021, the Plurinational State of Bolivia notified the Pan American Health Organization (PAHO) of 1551 cases of yellow fever and 515 deaths. A high annual incidence of sylvatic transmission was recorded during this period. By 2000, after strengthening immunization programs, the number of cases had decreased, with only isolated events remaining. Case fatality rates range from 33 to 100%, with an average of 59%. Marked seasonality is observed, with signs of activity beginning in early summer (December-January) and diminishing toward the fall (May-June), clearly linked to the rainy season.

In total, about 85% of patients were male and 76% were between 15 and 40 years (i.e., the economically active population). About 56% were involved in agricultural, livestock, mining, hunting, and fishing activities, and 79% were unvaccinated.

Large cities such as Santa Cruz, Cochabamba, Beni, and La Paz attract migrant workers. This means that under-vaccinated migrant populations are at risk of entering high-risk areas. In 1998, a cluster of three cases resulted from urban transmission in the Santa Cruz de la Sierra metropolitan area. This serves as a warning to the Region of the inherent risk of the re-emergence of yellow fever driven by the uncontrolled growth of large cities.

Endemic areas

Endemic areas cover 65% of the territory (lowlands and humid subtropical plains and foothills of the Andes mountain range) in the eastern and central regions of the country.

PAST OUTBREAKS⁷

Year	Number	Region	Comments
1960-1980	619	Santa Cruz, Beni, La Paz, Cochabamba	
1981-2000	833	Santa Cruz, Beni, La Paz, Cochabamba	Includes a cluster of three urban cases in 1998 in Santa Cruz.
2003	6		Case fatality rate: 67%.
2004	8	Palos Blancos (Department of La Paz), San Ignacio de Velasco and Yapacani (Department of Santa Cruz)	Case fatality rate: 40%.
2015	0	Department of Chuquisaca (municipality of Monteagudo)	Epizootic activity.
2017	5	Villa Tunari, Department of Cochabamba, and Caranavi, Department of La Paz.	The areas in which the infection was acquired were known yellow fever risk areas. One case was a male tourist. The case fatality rate was 60%.
2018	1	Municipality of San Ramón, Department of Beni	15-year-old male with no history of vaccination.
2019	1	Municipality of Mapiri, Department of La Paz	15-year-old male with no history of vaccination.
2021	1	Municipalities of Teoponte, Maya, Department of La Paz	Occasional migrant, with no vaccination history.

5 Castillo-Quino R, et al. Adaptación del mosquito *Aedes aegypti* a 2 550 m snm Cochabamba, Bolivia. Febrero 2016. Gaceta Médica Boliviana. 2018;41(1):24-30.

6 Mutebi J-P, et al. Yellow fever virus infectivity for Bolivian *Aedes aegypti* mosquitoes. Emerg Infect Dis. 2004 Sep; 10(9): 1657-1660.

7 Pan American Health Organization. Epidemiological alerts and updates: Yellow fever. Washington, DC: PAHO; n.d. <https://www.paho.org/en/epidemiological-alerts-and-updates>.

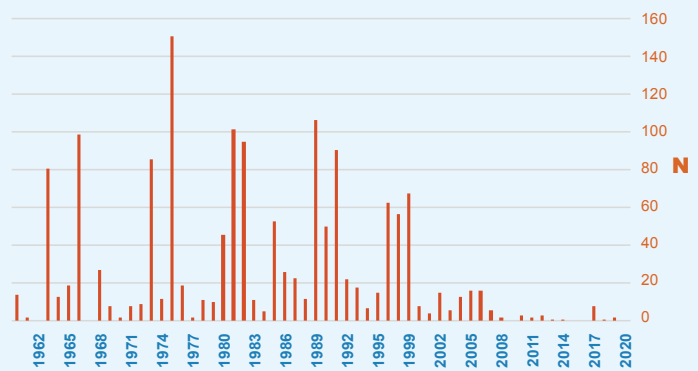
Trends of past outbreaks⁷

Yellow fever is endemic in the Plurinational State of Bolivia, with cyclical outbreaks.

Between 1960-1980, 1981-2000, and 2001-2021, the country reported 619, 833, and 99 cases of yellow fever to PAHO, respectively.

Prior to 2012, there were outbreaks of varying magnitudes but since then, only sporadic cases have been reported, in the departments of Santa Cruz, Beni, La Paz, and Cochabamba.

Yellow fever cases in Bolivia (Plurinational State of), 1962-2020



ARBOVIRAL ACTIVITY

Dengue The first dengue epidemics occurred in the mid-1980s. Over the years, both the incidence and geographical dispersion have increased across the country. The most affected city is Santa Cruz.⁸

Chikungunya Chikungunya first appeared in the country in 2015, with a total of over 24 000 cases between 2015 and 2017.⁹

Zika Zika emerged in the Plurinational State of Bolivia in 2015. The country reported a total of 2636 suspected cases and 806 confirmed cases between 2015 and 2017, and 14 confirmed Zika-associated birth defects.¹⁰

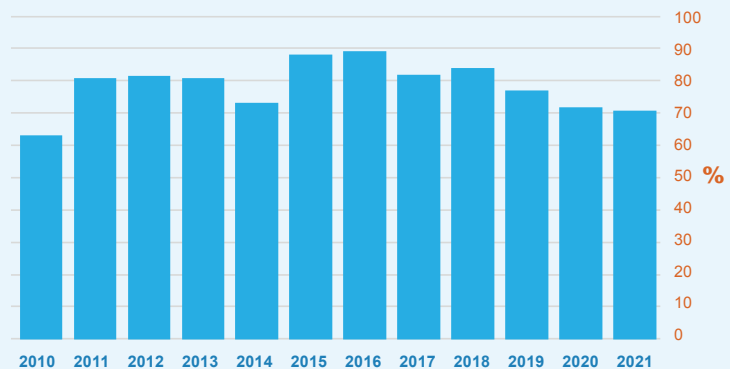
YELLOW FEVER VACCINATION

Routine childhood immunization¹¹

Yellow fever vaccine introduced	Yes
Level	National
Year of introduction	2004
Age vaccine is administered (months)	12
Vaccine schedule	Single dose
Integration with first does of measles, mumps, rubella vaccine (MMR-1)	Yes
Gap MMR-1/ yellow fever vaccine to monitor program	Yes

Vaccine coverage¹¹

Childhood yellow fever vaccination coverage in Bolivia (Plurinational State of), 2010-2021 (%)



The childhood YF vaccine coverage rate oscillates around 70-80%. The gap between MMR-1 and YF vaccination ranges from 2 to 5%. The COVID-19 pandemic was one of the major factors attributed to the drop in coverage since 2019.

8 Pan American Health Organization. Health Information Platform for the Americas (PLISA). Dengue and severe dengue: Cases and deaths for the countries and territories of the Americas. Washington, DC: PAHO; n.d. Available from: <https://www3.paho.org/data/index.php/en/mnu-topics/indicadores-dengue-en/dengue-nacional-en/257-dengue-casos-muertes-pais-ano-en.html>.

9 Pan American Health Organization. Chikungunya. Data and statistics. Cumulative number of confirmed cases of Chikungunya in South America from 2013 to 2017. Washington, DC: PAHO; n.d. <https://www.paho.org/en/topics/chikungunya>.

10 Pan American Health Organization / World Health Organization. Zika: PAHO Regional Epidemiological Update (Americas) 25 August 2017. Washington, DC: PAHO; https://www3.paho.org/hq/index.php?option=com_content&view=article&id=11599:regional-zika-epidemiological-update-americas&Itemid=41691&lang=en#gsc.tab=0

11 World Health Organization. Data compiled from WHO vaccine-preventable diseases: monitoring system reported through the Joint Reporting Form. Washington, DC; Geneva: WHO; 2022. Available from: <https://immunizationdata.who.int/pages/coverage/yfv.html>.

SEROLOGICAL STUDIES

A post-campaign coverage survey in 2007 showed coverage of 84.3% and 86.8% for endemic and non-endemic regions, respectively, reaching a national total of 86%.

A Zika virus seroprevalence study in blood donors revealed that the virus circulated in tropical areas (Beni: 39%; Santa Cruz de la Sierra: 21.5%), but not in the highlands (around 0% in Cochabamba, La Paz, Tarija).¹²

Vaccination campaigns ¹³	
Catch-up campaigns implemented during the last 20 years	Yes
In 2018, a campaign was also carried out in which 1 245 177 people aged 1 to 15 years were vaccinated. With these campaigns, it has been possible to largely reduce the number of accumulated suspect cases.	
Preventive mass campaigns implemented during the last 20 years	Yes
In 2007, a mass campaign was successfully carried out throughout the national territory, vaccinating people aged 2 to 44 years, reaching a total of 5 052 932 persons and 85% post-campaign coverage, according to an external survey.	
Reactive vaccination campaigns implemented during the last 20 years	Yes
The mass campaigns in 2007 and 2018 were carried out in response to outbreaks.	
Is vaccination provided for international travelers? ¹⁴	
The country offers YF vaccination to travelers arriving and departing from and going to at-risk countries.	
Vaccination in internal travelers (when traveling to high-risk areas in the country) ¹⁵	
No	
Registration system to record vaccination data ¹⁶	
Non-individualized immunization registry system	
Vaccine program funding ¹⁷	
Funding sources	Government
Gaps in funding during the past 5 years?	No
Does the country require financial support?	Yes

INTERNATIONAL HEALTH REGULATIONS¹⁵

Does the country request proof of YF vaccination at points of entry?		No	
LABORATORY DIAGNOSTIC CAPACITY ¹⁸		SURVEILLANCE ¹⁹	
Member of the Arbovirus Diagnosis Laboratory Network of the Americas	Yes	National guidelines for surveillance	Yes
National Reference Laboratories	CENETROP (Center for Tropical Diseases)	Type of surveillance for human cases	Syndromic-case based
Report to PAHO	Yes	Type of YF surveillance in non-human primates	None

12 Saba Villarroel PM, et al. Zika virus epidemiology in Bolivia: A seroprevalence study in volunteer blood donors. PLoS Negl Trop Dis. 2018 Mar 7;12(3):e0006239.

13 See Note 14

14 Ibid.

15 Ibid.

16 Ibid.

17 Ibid.

18 Ibid.

19 Ibid.

TESTING CAPACITY FOR YELLOW FEVER		Entomological surveillance	No data available
IgM antibody capture enzyme-linked immunosorbent assay (MAC-ELISA)	Yes	Entomovirological surveillance	No
Plaque reduction neutralization test (PRNT)	Yes	Case investigation (reactive)	Yes
Reverse transcription polymerase chain reaction (RT-PCR) blood specimens	Yes	YELLOW FEVER CONTROL STRATEGIES²⁰	
RT-PCR tissue specimens	Yes	Multi-annual immunization plan	Yes
RT-PCR wild type virus	Yes		
Immunohistochemistry	Yes	Risk assessment methodology	No
Virus isolation	Yes	Vector control activities	Yes
External quality assessment compliance	Yes	Diagnostic capacity	Yes
Shortages of diagnostic supplies in the last 5 years?	No	Surveillance	Yes
		Request for proof of YF vaccination at points of entry?	No

POPULATION MOVEMENTS

Given the internal migratory movement in the Plurinational State of Bolivia, there is a high risk of susceptible population movements to yellow fever risk areas. The country is highly dependent on the exploitation of natural resources (agriculture, mining, hydrocarbons) and the occupations associated with these are considered risky. Population movement from non-endemic highlands to large cities in the departments of Santa Cruz de la Sierra, Cochabamba, Beni, and La Paz means that many susceptible, usually unvaccinated, populations enter endemic areas. In addition, the lack of adequate infrastructure and planning in urban metropolises goes hand in hand with the proliferation of *Aedes aegypti* and the inherent risk of the re-emergence of yellow fever.

²⁰ Ibid.