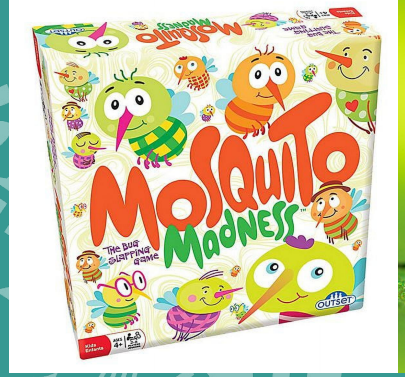
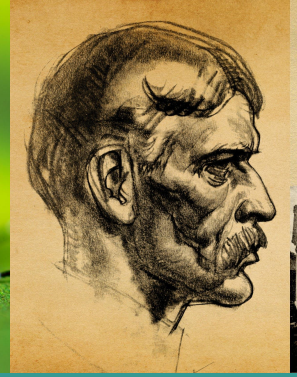
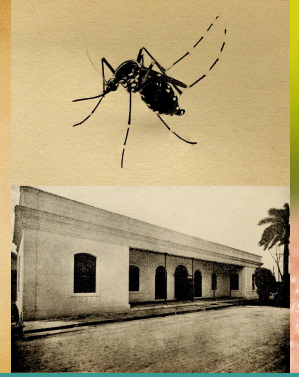



Mosquito Madness:

mosquito-borne infections breaking the rules.

April 15th-16th, 2025

Joel Terriquez, MD, FIDSA, CIC

Medical Director

Bureau of Infectious Diseases Services

Bureau of immunizations Services

ARIZONA DEPARTMENT OF HEALTH SERVICES

Speaker Information

Joel Terriquez, MD

Medical Director
Bureau of infectious Diseases (BIDS)
Bureau of Immunizations (BIZS)

- Dr. Terriquez is the Medical Director for the Bureau of Infectious Diseases with the Arizona Department of Health Services.
- Certified in infection control and hospital epidemiology.
- Adjunct Faculty- Microbiology- Northern Arizona University .
- Medical School graduate from Universidad Autonoma de Baja California, Mexico.
- Completed his Internal Medicine residency and Infectious Disease Fellowship at the University of Arizona in Tucson.
- Additional training at MD Anderson in Houston and National Jewish Healthcare in Denver.
- Safety, Quality, Informatics and Leadership- Harvard Medical School.
- Email: joel.terriquez@azdhs.gov

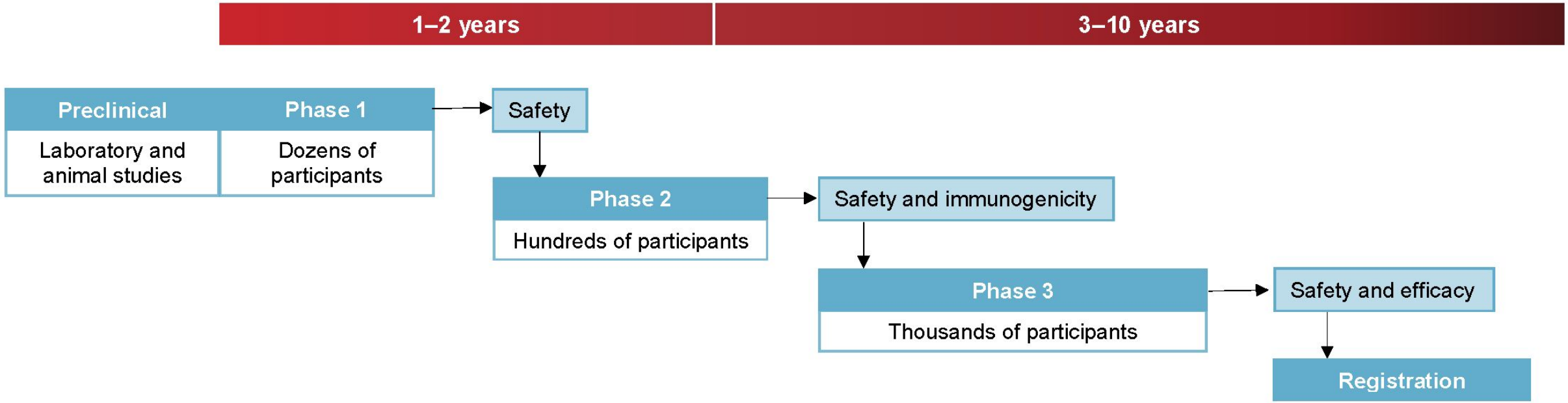
Financial Disclosures

- Dr. Joel Terriquez, faculty for this CE activity, has no relevant financial relationship(s) with ineligible companies to disclose.
- None of the planners for this activity have relevant financial relationships to disclose with ineligible companies.
- The Arizona Alliance for Community Health Centers is accredited by the Arizona Medical Association to provide medical education for physicians.
- The Arizona Alliance for Community Health Centers designated the 2025 Arizona Immunization Conference educational activity for a maximum of 11 hours AMA PRA Category 1 Credits Physicians should only Claim credit commensurate with the extent of their participation in the activity.
- The Arizona Pharmacy Association is accredited by the Accreditation Council for Pharmacy Education (ACPE) as a provider of continuing pharmacy education.

Learning Objectives:

1. Identify vaccine preventable mosquito-borne infections
2. Understand vaccine indications, mechanisms of action and availability of vaccine
3. Understand vaccine side effects associated with Chikungunya, Yellow fever and Dengue vaccines.

Conventional pathway of vaccine development

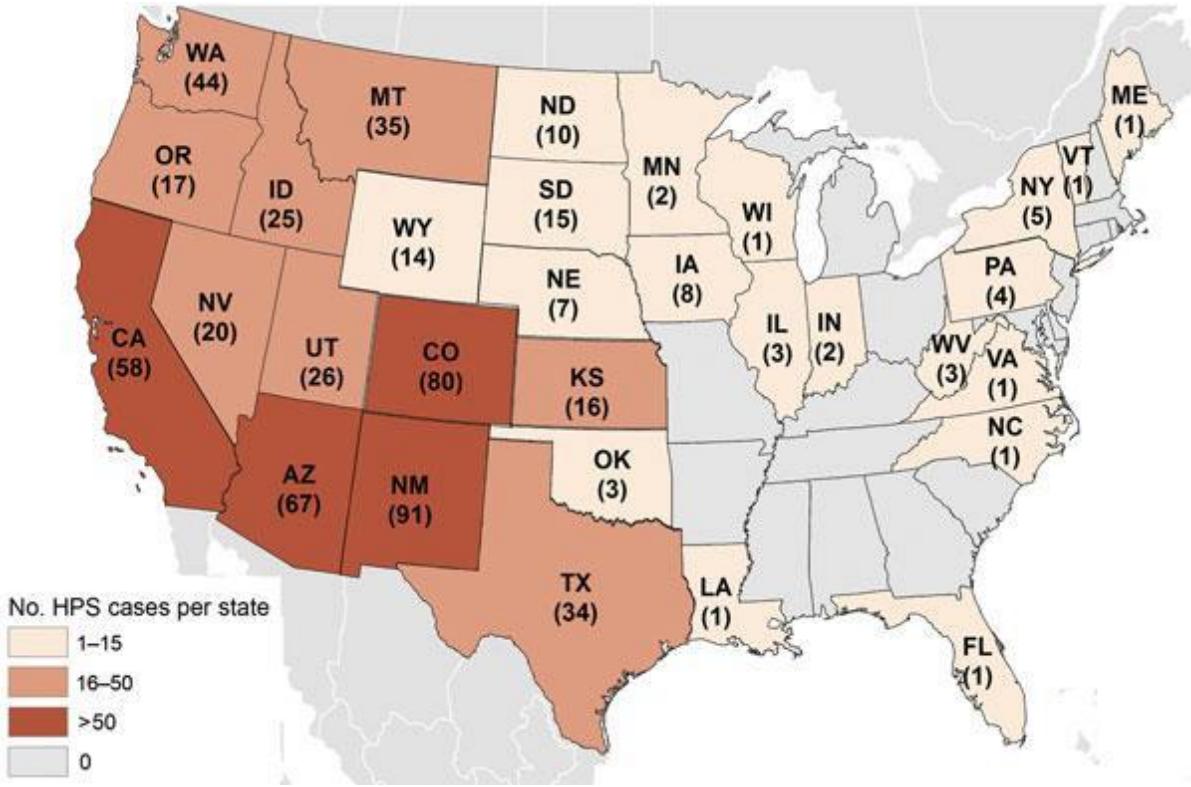


Limited manufacturers

- Over the past 40 years the rate of development of new human viral vaccines, compared with veterinary vaccines, has been disappointingly slow.
- Research on human vaccines is undertaken by smaller commercial enterprises associated with research institutes.
- Commercial manufacture in first world countries is confined to a decreasing number of very large multinational companies (Big pharma) and institutional facilities.

Limited investors

- Geographically limited infections
  - Hantavirus
  - Coccidioidomycosis
- Need to achieve financial goals
- Increase in testing requirements before vaccine release



Ongoing concerns about new vaccine development

- Deficiencies in animal models used to assess protection against human viral illness
- Use of inappropriate viruses to obtain predictive data in animal models
- Legitimate concerns as to the possibility of reversion to virulence- immunity to most human viral diseases is best achieved by live attenuated viruses
- The possibility that some live herpesvirus vaccine viruses will undergo latency during replication, followed by recrudescence and subsequent infection by pathogenic viral progeny (eg, HSV-1 and -2).

Tannock GA, Kim H, Xue L. Why are vaccines against many human viral diseases still unavailable; an historic perspective? J Med Virol. 2020 Feb;92(2):129-138. doi: 10.1002/jmv.25593. Epub 2019 Oct 3. PMID: 31502669; PMCID: PMC7166819.

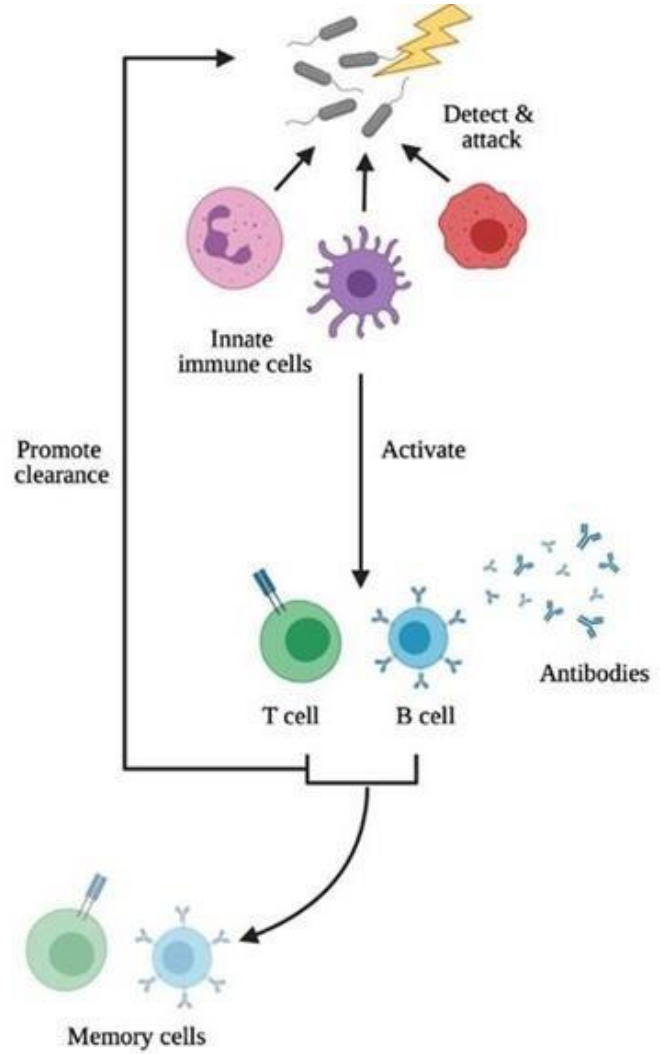
Bugs are antigenically loaded

- A critical step in vaccine development is determining what structure or molecule on, or secreted by, a pathogen the vaccine should target.
- The chosen molecule, or antigen, plays a role in the colonization/pathogenesis of the microbe

"In other words, finding the best vaccine target is like playing a game of darts with a moving board—you might hit something, but it likely won't be the bullseye".

Protective immunity?

- **The purpose of a vaccine is to generate a protective immune response against microbial invaders**.
- During infection, pathogens are detected by innate immune cells, which activate B and T cells (adaptive immune cells).
  - **B cells** produce antibodies that flag a pathogen for elimination by other immune cells, such as neutrophils.
  - **T cells** support antibody production, recruit other cells to the site of infection and, depending on the type, may inactivate or eliminate pathogens directly.
- Antibodies are often the primary focus of vaccine research because of their integral role in pathogen recognition and memory responses.



“One immune mechanism may not be sufficient”

PAHO issues new epidemiological alert amid rising yellow fever cases in the Americas

31 Mar 2025

Washington, D.C., March 31, 2025 (PAHO) – The Pan American Health Organization (PAHO) has issued a new **epidemiological alert** in response to an increase in yellow fever cases

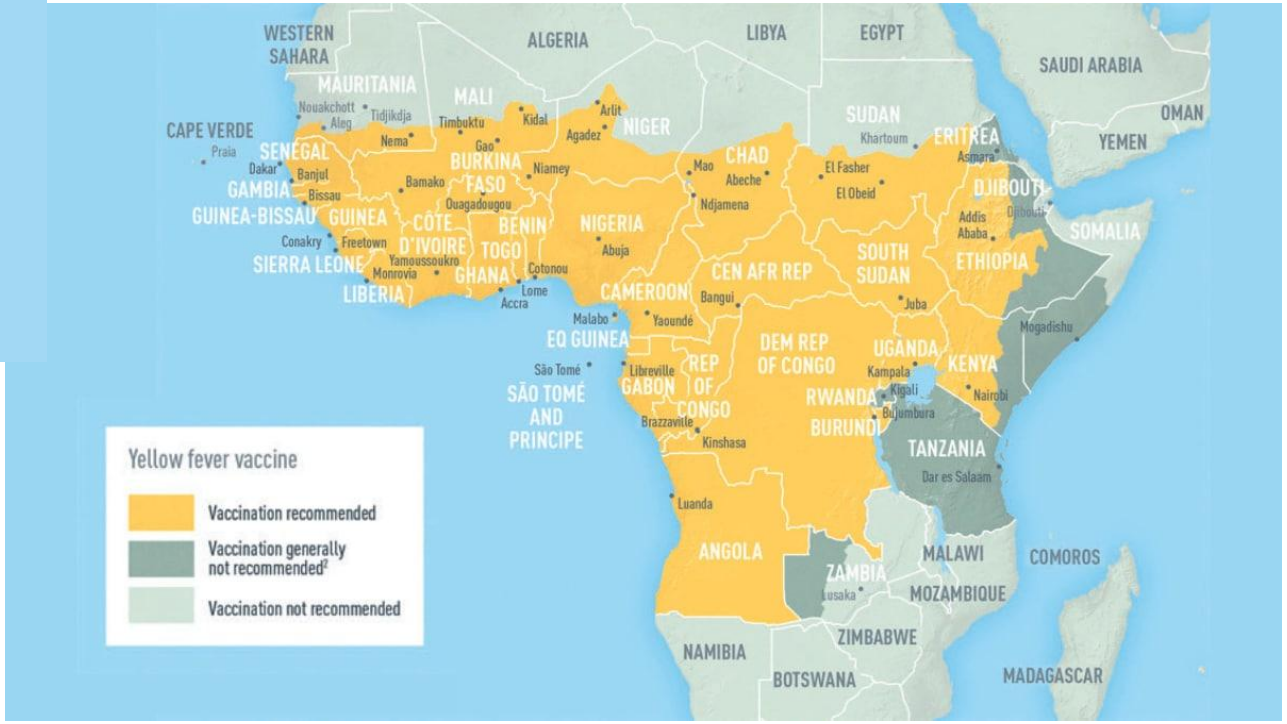
We like to have fun! #girlsjustwannahavefun

Yellow fever

- Yellow fever virus is spread to people by the bite of an infected mosquito (*Aedes sp*).
- It is found in tropical and subtropical areas of Africa and South America.
- Yellow fever is a very rare cause of illness in U.S. travelers.
- No specific treatment but supportive care

Where?


Yellow Fever Vaccine
Vaccination recommended
Vaccination recommended since 2017 due to yellow fever outbreak²
Vaccination generally not recommended³
Vaccination not recommended
CURAÇAO
MARTINIQUE
BARBADOS
NICARAGUA
Santa Marta
Port-of-Spain
TRINIDAD
San Jose
Cartagena
Caracas
Maturin
Panama City
VENEZUELA
Georgetown
GUYANA
Paramaribo
PANAMA
Medellin
Bogotá
SURINAME
Cayenne
FRENCH GUIANA
COLOMBIA
Cali
Quito
ECUADOR
Riobamba
Puyo
Manaus
Iquitos
Fortaleza
PERU
Chachapoyas
BRAZIL
Recife
Huanuco
Aracaju
Salvador
Lima
Cusco
BOLIVIA
Brasilia
La Paz
Sucre
Santa Cruz
Belo Horizonte
Tarija
PARAGUAY
CHILE
Asunción
Rio de Janeiro
Salta
São Paulo
Resistencia
Porto Alegre
ARGENTINA
Santiago
URUGUAY
Montevideo
Buenos Aires

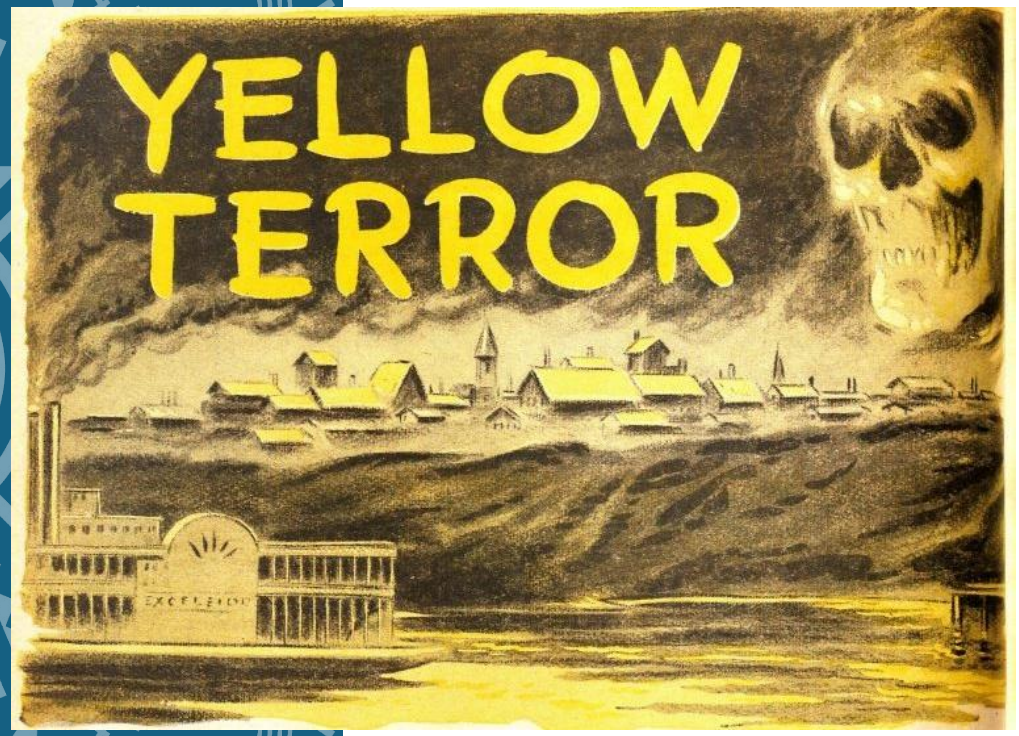

Yellow fever vaccine
Vaccination recommended
Vaccination generally not recommended²
Vaccination not recommended
WESTERN SAHARA
ALGERIA
LIBYA
EGYPT
SAUDI ARABIA
MAURITANIA
MALI
OMAN
Nouakchott
Tidjikdja
Timbuktu
Kidal
Arlit
SUDAN
YEMEN
CAPE VERDE
Aleg
Agadez
NIGER
Khartoum
ERITREA
Praia
Nema
Gao
SENEGAL
BURKINA FASO
Niamey
CHAD
Asmara
Dakar
Banjul
Mao
El Fasher
GAMBIA
Bamako
Abeche
DJIBOUTI
Bissau
El Obeid
Ouagadougou
Ndjamena
GUINEA-BISSAU
GUINEA
CÔTE D'IVOIRE
BENIN
NIGERIA
Addis Ababa
Djibouti
SOMALIA
Conakry
Freetown
TOGO
Abuja
SOUTH SUDAN
Yamoussoukro
SIERRA LEONE
Monrovia
GHANA
Cotonou
ETHIOPIA
CEN AFR REP
LIBERIA
Lome
Accra
CAMEROON
Bangui
Juba
Malabo
Yaoundé
Mogadishu
EQ GUINEA
DEM REP OF CONGO
UGANDA
São Tomé
Libreville
REP OF CONGO
KENYA
Kampala
Kigali
SÃO TOMÉ AND PRINCIPE
GABON
RWANDA
Nairobi
Brazzaville
BURUNDI
Bujumbura
Kinshasa
TANZANIA
Dar es Salaam
Luanda
ANGOLA
MALAWI
COMOROS
ZAMBIA
Lusaka
MOZAMBIQUE
ZIMBABWE
NAMIBIA
BOTSWANA
MADAGASCAR

Yellow fever

- Arbovirus- family Flaviviridae: positive-single-stranded RNA viruses
- Same family as dengue, WNV, St. Louis Encephalitis
- Mosquito-borne, incubation period of 3-6 days
- Occurs in South America and sub-Saharan Africa.
- Most patients with yellow fever are asymptomatic, but among the 15% who develop severe illness, the case fatality rate is 20%–60%.

Paules, C. I., & Fauci, A. S. (2017). Yellow fever—once again on the radar screen in the Americas. *New England Journal of Medicine*, *376*(15), 1397-1399.

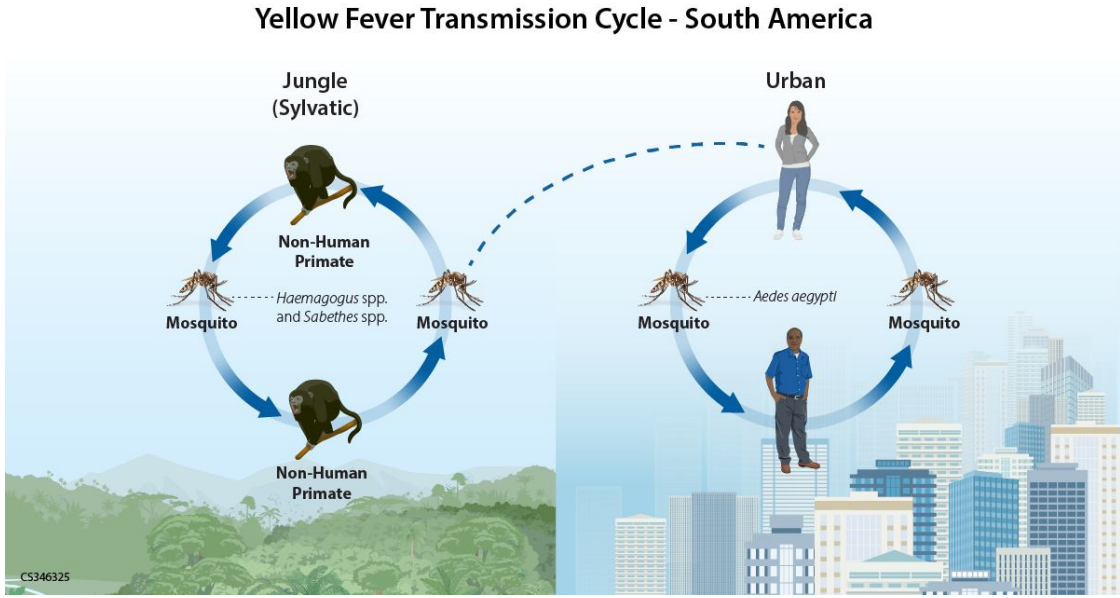
Yellow fever



- 1647- First formally identified YF epidemic in history: occurred in Guadeloupe
- Historic references- YF presence in the New World before the Spanish conquerors arrived (Mayan manuscript 1648)
- Epidemiological and genetic studies sustain the hypothesis that the YF virus originated in Africa and would be introduced in the 16th century by the trading of slaves.
- **Summer of 1793-** deadly epidemic in Philadelphia, (capital of the US). Thousands suffered high fevers, yellow skin, and bloody vomit. Many died within days. Dr. Benjamin Rush, identified it as yellow fever.

Transmission

- People become infected when mosquitoes feed on infected primates and then bite them.
- Yellow fever virus primarily circulates between mosquitoes and non-human primates
- People become infected when visiting or working in forested areas.
- When outbreaks occur in the urban environment, the virus circulates between urban-dwelling mosquitos (*Aedes* species) and people.

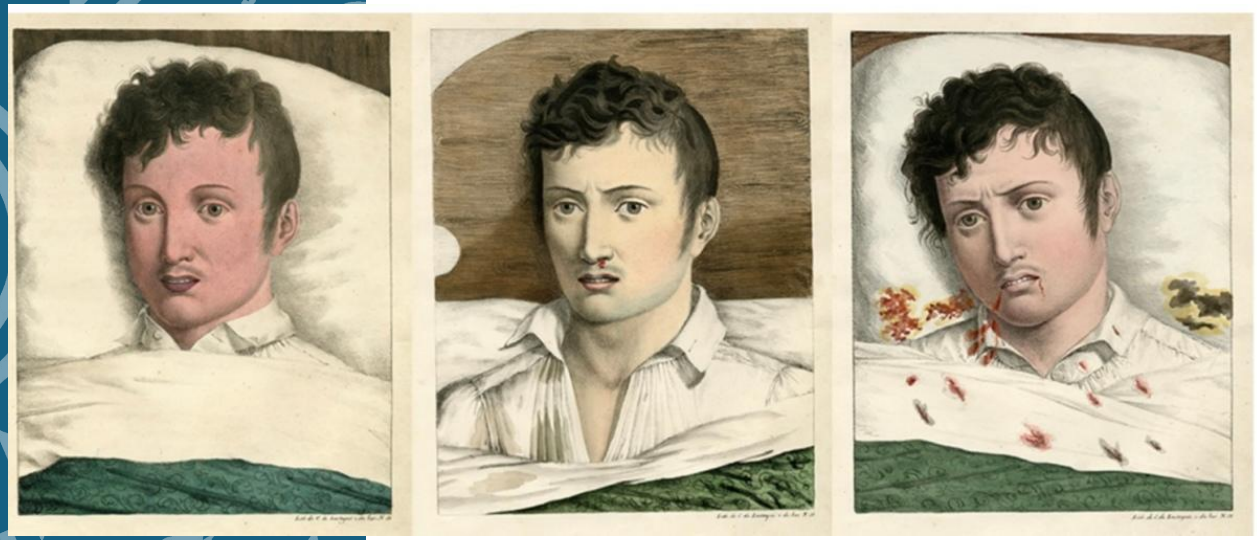


- **People infected with YF virus have high level viremia during the first few days of illness to transmit the virus to mosquitoes**.
  - Spread through blood transfusion and organ transplantation could occur.
  - There is one case of perinatal transmission- the infant died due to yellow fever.

Clinical illness

- The clinical illness manifests in THREE STAGES: infection, remission, and intoxication.
- Most people are asymptomatic
- During the **infection stage**, patients present with a nonspecific symptoms (fever, chills, severe headache, general body aches, nausea, vomiting, fatigue). Low white blood cell count, and liver enzyme elevation (patient is viremic).
- Period of **remission** clinical improvement occurs within 1 week and most patients fully recover.

Clinical illness



- **Intoxication phase** (severe illness)
- 1 out of 7 people who have the initial symptoms, there will be a brief remission (few hours or for a day), followed by symptoms of more severe disease.
- Severe symptoms include high fever, yellow skin or eyes (jaundice), bleeding, shock, and organ failure.
- Mortality can reach 60% or more in persons with underlying diseases (such as diabetes mellitus)
- Likely lifelong immunity

Vaccine

- **9 months old or older and who are traveling to or living in areas at risk**
- **Live attenuated virus vaccine** □ YF-17D (mutated E protein)
- Single dose of yellow fever vaccine provides protection, and a booster dose of the vaccine is not needed (booster might be needed if >10 years from dose)
- Reactions to yellow fever vaccine are generally mild and include headaches, muscle aches, and low-grade fevers.
- Rarely, people develop severe, sometimes life-threatening reactions including:
  - Anaphylaxis
  - Encephalitis or meningitis
  - Guillain-Barré syndrome- causing muscle weakness, and sometimes, paralysis.
  - Internal organ dysfunction or failure

Vaccine contraindications

- Allergic to the vaccine or something in the vaccine (like eggs)
- Aged 6 months or younger
- Organ transplant recipients
- Diagnosed with a malignant tumor
- Diagnosed with thymus disorder associated with abnormal immune function
- Diagnosed with a primary immunodeficiency
- Using immunosuppressive and immunomodulatory therapies
- Showing symptoms of HIV infection or CD4+ T-lymphocytes less than 200/mm^3 (less than 15% of total lymphocytes in children aged 6 years or younger)

Long-term immunity following yellow fever vaccination: a systematic review and meta-analysis

- Systematic review and meta-analysis- 11 databases: included cohort and cross-sectional studies reporting immunogenicity outcomes for children or adults who received a single dose of yellow fever vaccination 10 or more years ago.
- Most primary vaccine recipients maintain neutralizing antibodies above protective thresholds 10 or more years post-vaccination healthy adults in non-endemic settings, who were mostly travelers, we observed high rates of seroprotection 10–60 years post-vaccination (seroprotection 94%).
- Long-term protection in endemic settings was lower than in non-endemic settings (seroprotection rate 76% *vs* 94%).
- Long-term immunogenicity in immunocompromised populations and children was lower.
- For people living with HIV, seroprotection rates 61%.
- Two studies evaluated immunogenicity 10 years post-vaccination in young Brazilian children, aged 9–23 months- lower seroprotection rates than in studies on Brazilian adults (47% *vs* 76%).
- Immunity decreases 2-6 years post-vaccination

Schnyder, J. L., de Jong, H. K., Bache, B. E., Schaumburg, F., & Grobusch, M. P. (2024). Long-term immunity following yellow fever vaccination: a systematic review and meta-analysis. *The Lancet Global Health*, *12*(3), e445-e456.

Duration of Protection After Vaccination Against Yellow Fever: A Systematic Review and Meta-Analysis

- Systematic review: randomized controlled trials (RCT), nonrandomized (observational) studies with control groups, and prospective single-armed observational studies with ≥50 participants.
- Data was stratified according to the follow-up time period after vaccination: ≤ 3 months; >3 months to ≤ 5 years; >5 to ≤ 10 years; > 10 to ≤ 20 years; and > 20 years.
- Outcome of interest was the proportion of people who were seropositive at a given time point post-vaccination. The presence of neutralizing antibody titers ≥ 1:10
- YF vaccine confers high rates of seroprotection within 3 months after primary vaccination. After a single vaccine dose, reduced seroprotection rates were observed 5 and 10 years after vaccination of healthy adults and 3 months to 5 years after vaccination of children.

Kling, K., Domingo, C., Bogdan, C., Duffy, S., Harder, T., Howick, J., ... & Wolff, R. (2022). Duration of protection after vaccination against yellow fever: a systematic review and meta-analysis. *Clinical Infectious Diseases*, *75*(12), 2266-2274.

Yellow fever vaccine safety in immunocompromised individuals: a systematic review and meta-analysis

- The study was guided by **two research questions**:
  - **'What is the frequency of adverse events in immunocompromised patients due to YF vaccine?'**
  - **'What is the risk of adverse events in immunocompromised individuals due to YF vaccine, compared with non-immunocompromised individuals?'**
- The search identified a total of 850 records (mostly cross-sectional studies).
- 149 immunocompromised and 85 non-immunocompromised participants had non-serious adverse events, with higher frequency of events in non-immunocompromised individuals (37.8%) compared with immunosuppressed individuals (20.4%).
- Fever and pain or hyperemia at the inoculation site were the most described local adverse events, followed by headache and arthralgia/myalgia, as systemic reactions.
- Four studies described serious adverse events, included three participants (Crohn's disease, polymyalgia rheumatica and thymoma)□ viscerotropic disease associated with the YF vaccine, followed by death
- A case of a man with HIV who developed myelomeningoencephalitis followed by death after YF vaccination
- **The risk of adverse events after YF vaccination in immunocompromised patients was 8.5%.**

Wigg de Araújo Lagos, L., de Jesus Lopes de Abreu, A., Caetano, R., & Braga, J. U. (2023). Yellow fever vaccine safety in immunocompromised individuals: a systematic review and meta-analysis. *Journal of Travel Medicine*, *30*(2), taac095.

INFECTIOUS DISEASE

Dengue fever cases rising in popular spring break locations, CDC alerts

Amid spring break, transmission 'remains high' among U.S. travelers

By Angelica Stabile · Fox News

Published March 24, 2025 1:33pm EDT

CDC issues alert about ongoing dengue threat

News brief | March 18, 2025

Lisa Schnirring

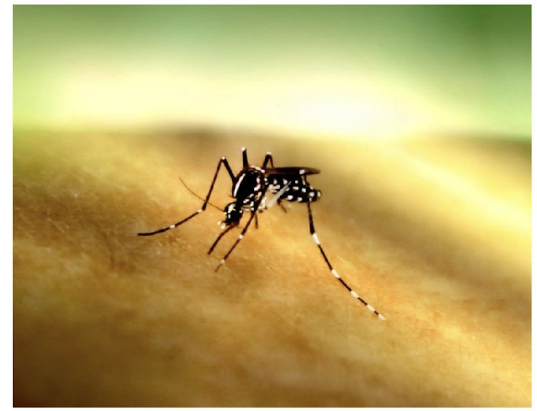
Topics: Dengue

SHARE

The US Centers for Disease Control and Prevention (CDC) today issued a Health Alert Network **notice** to healthcare providers and the public about the ongoing risk of dengue virus infections, with levels remaining high in some US territories and surges still under way in other countries, especially in the Americas region.

In Puerto Rico, a dengue emergency declared in March 2024 remains in effect, and cases this year are up 113% compared to this time a year ago. The US Virgin Islands declared an outbreak in August 2024, and cases continue, with 30 local cases already reported this year.

A substantial rise in global dengue cases over the past 5 years, plus record levels in the Americas, led to a record number of travel-related cases in the United States in 2024, up 84% from the previous year.



PAHO warns of increased risk of dengue outbreaks due to circulation of DENV-3 in the Americas

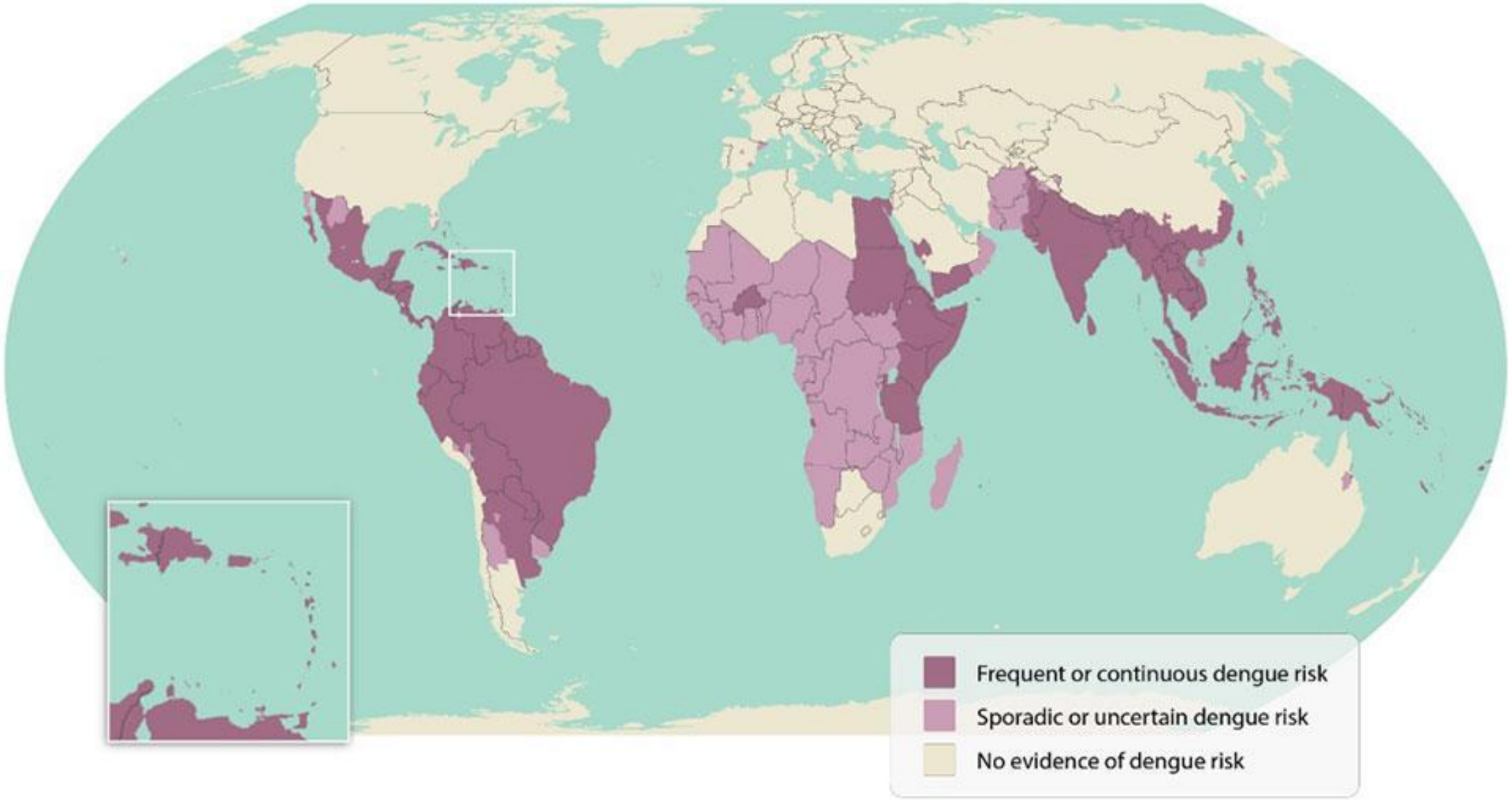
10 Feb 2025

n, D.C., February 10, 2025 (PAHO) – The Pan American Health Organization

Dengue

- Enveloped, single-stranded RNA virus
- Most Important and most frequent mosquito transmitted virus infection in humans
- The causative agent is the DEN virus- 4 serotypes (DEN 1, DEN 2, DEN 3, DEN 4)
- Exists in all continents except Europe and Antartica
- Transmitted by *Aedes aegypti*, *Stegomyia albopicta*, *S. scutellaris*
- Each year there are an estimated 50-100 million dengue infections
- 500,000 cases of DHF that must be hospitalized
- 20,000-25,000 deaths, mainly in children.

Where?

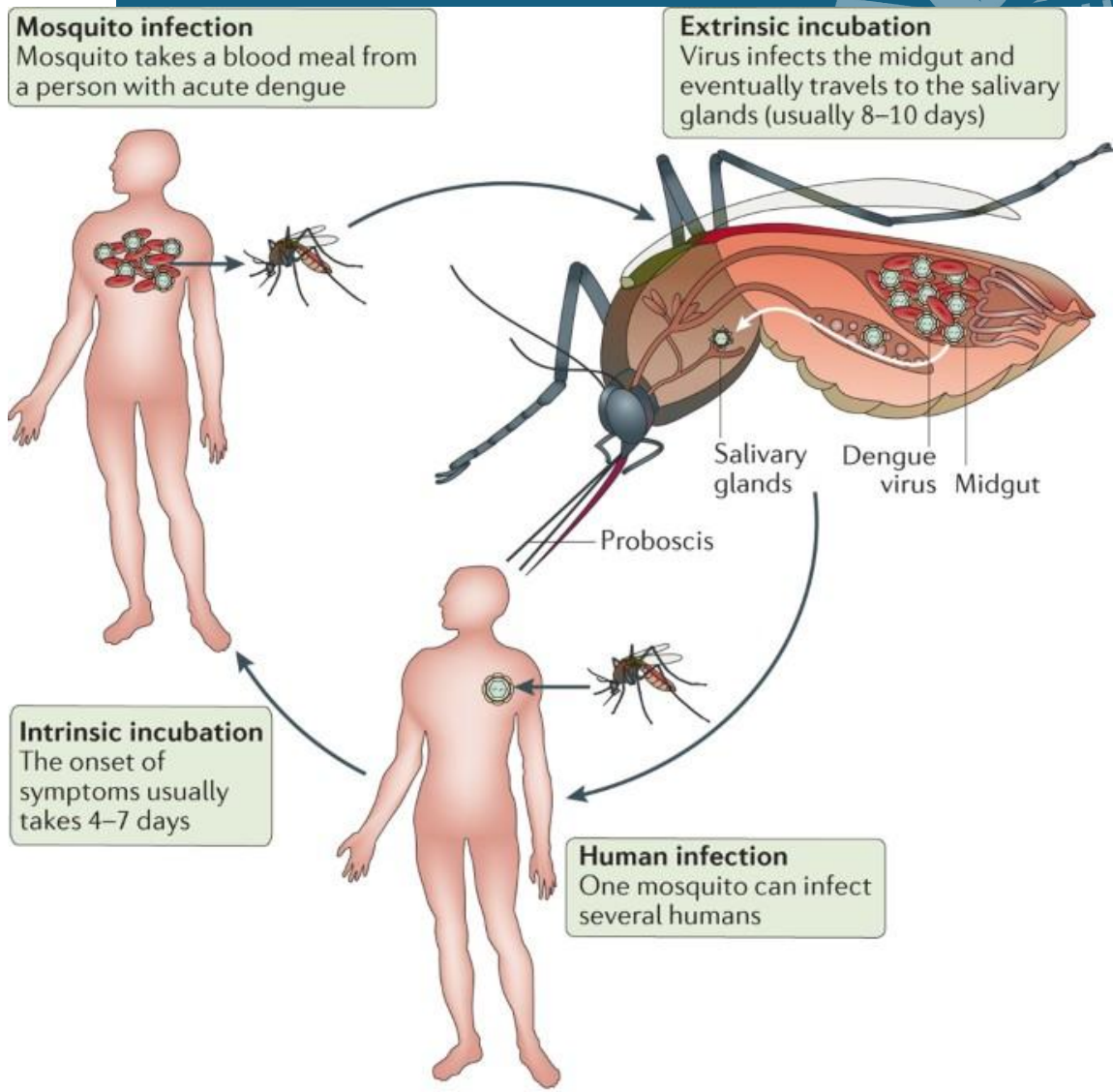

Frequent or continuous dengue risk
Sporadic or uncertain dengue risk
No evidence of dengue risk

Dengue

- First record of a clinically compatible disease-Chinese medical encyclopedia in 992.
- Global shipping industry (18th-19th centuries)- port cities became more urbanized- ideal conditions for the mosquito vector.
- Sailing ships long intervals (10-40 years) between epidemics.
- World War II- rapid urbanization in SE Asia led to increased transmission (first major epidemic of dengue hemorrhagic fever)
- 20th century- unplanned urbanization in tropical developing countries, modern transportation, lack of effective mosquito control and globalization- larger epidemics.

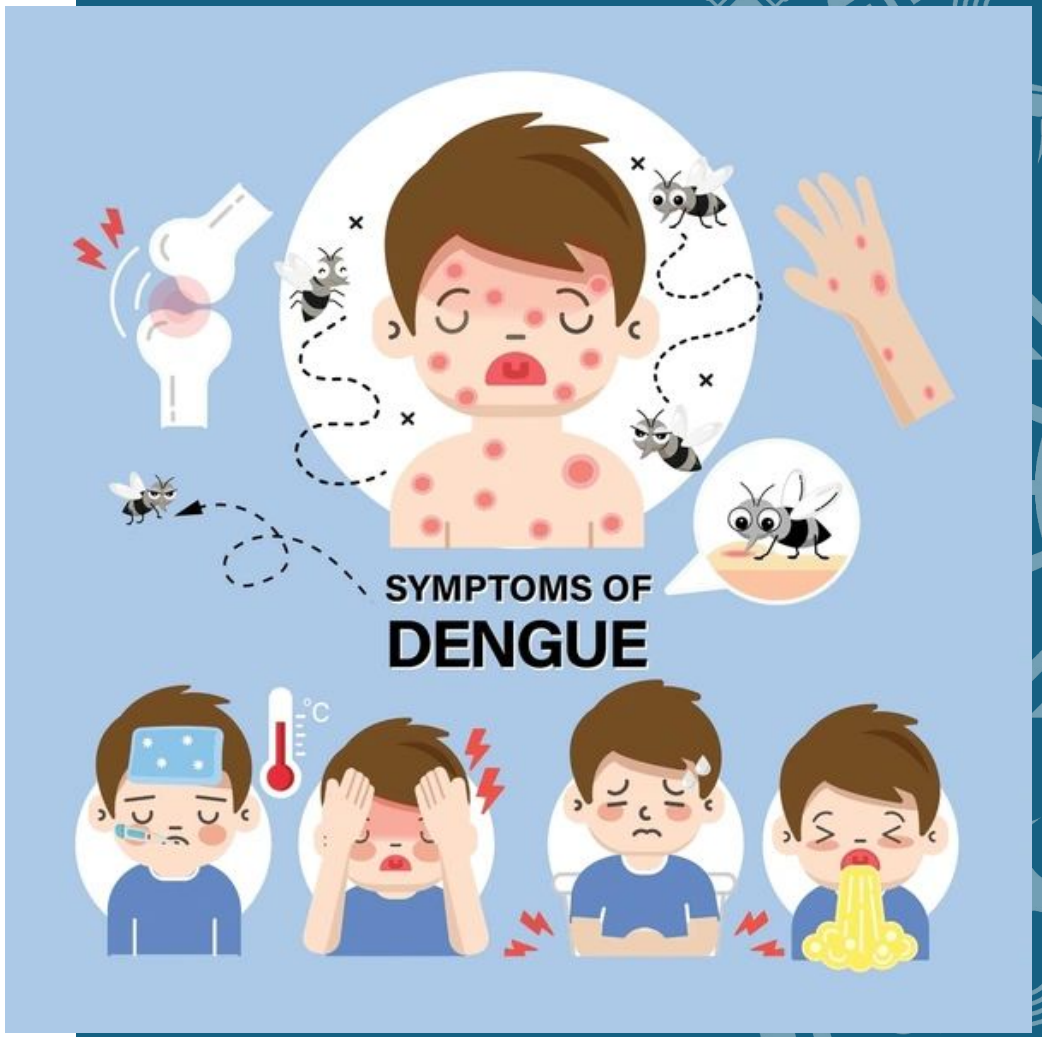
Dengue

- Incubation period 4-7 days
- **25% attack rate– 1:4 will develop symptoms**.
- Since there are 4 distinct dengue viruses, a person can be infected up to 4 times.
- Infection with each dengue virus type confers lifetime immunity for that specific virus type
- Diagnosis by Dengue antibodies or PCR



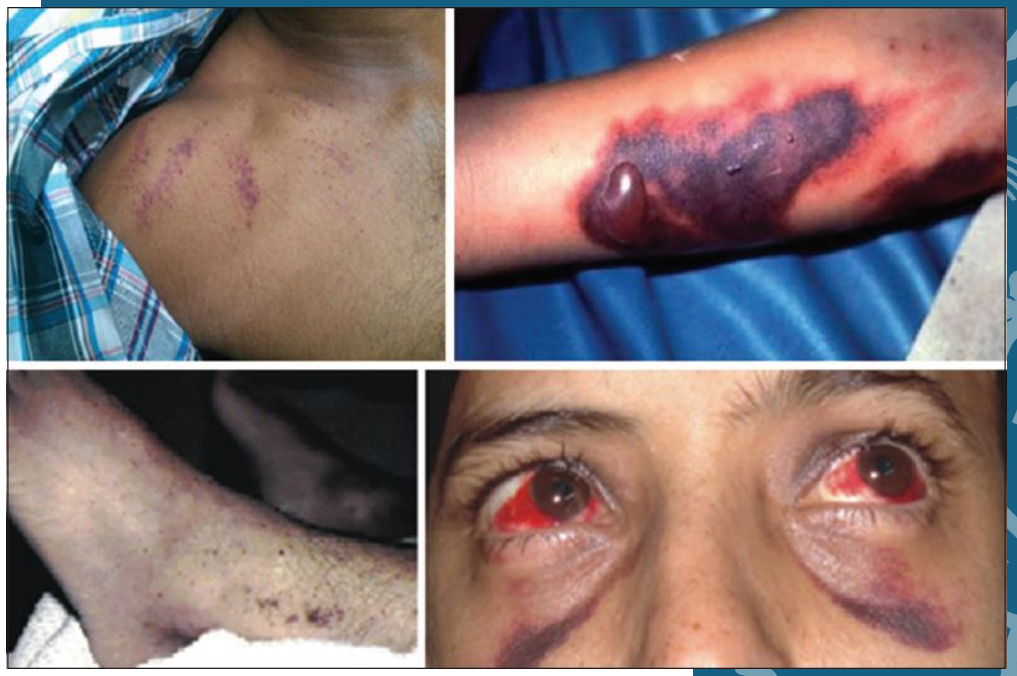
Clinical illness

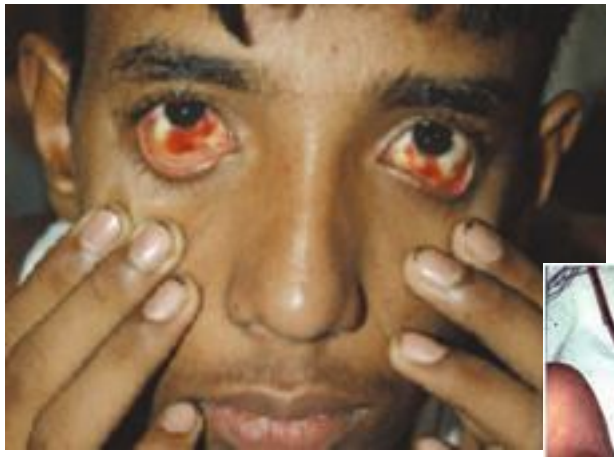
- Febrile phase: Last for 2-7 days. Fever with **2 more of the following**: Headache, retro-orbital pain, joint pain, muscle or bone pain, rash, mild bleeding or easy bruising, neutropenia.
- Critical phase: Starts at defervescence, last 24-48 hours. Most patients improve, but severe disease requiring hospitalization can occur
- Recovery phase: Gradual reabsorption of extravasated fluid from plasma leakage over 48-72 hours, diuresis, hemodynamic stability, temporary bradycardia

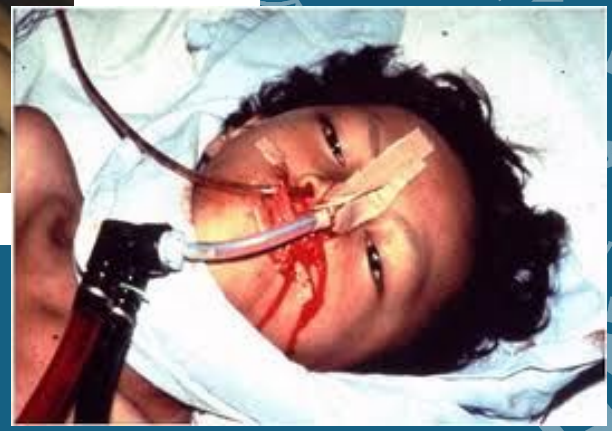


Dengue hemorrhagic fever

Non neutralizing circulating immune complexes are responsible for Dengue hemorrhagic fever– In response to a previous recent infection, which blocks macrophage response to the second infection.



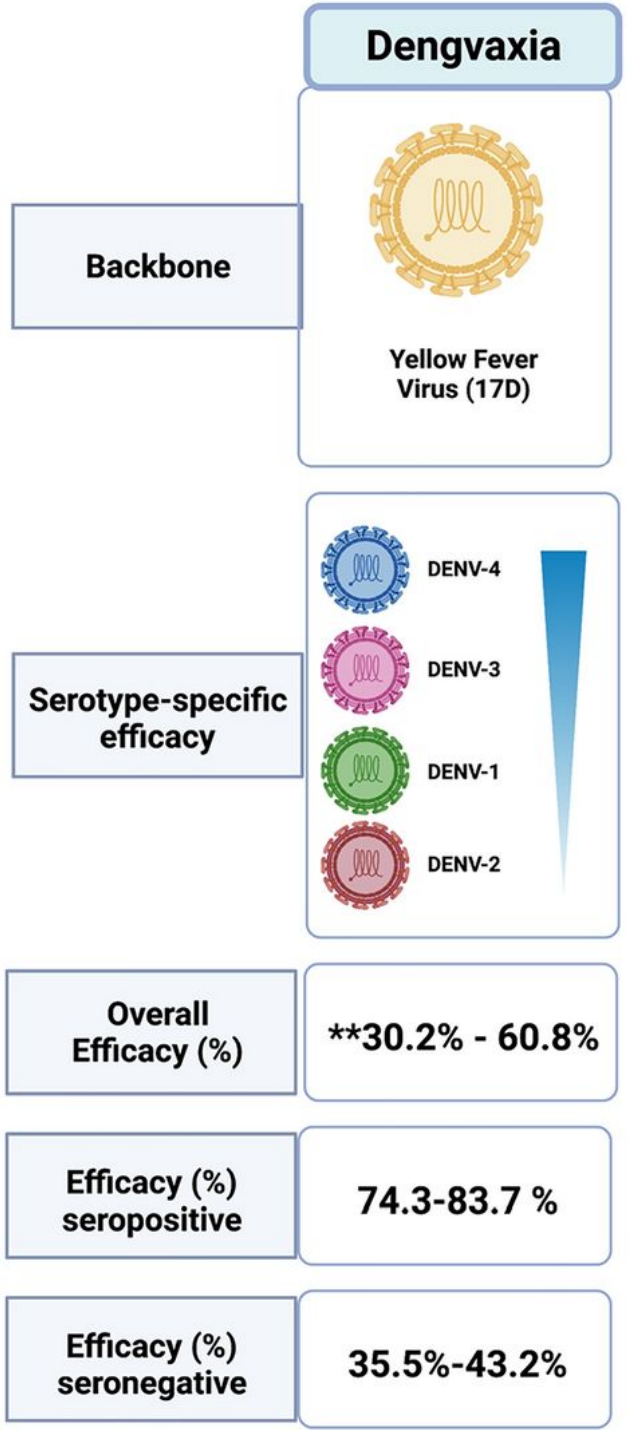




Dengue vaccine

- **Live vaccine- recombinant DNA vaccine that contains the structural proteins for DENV-1, DENV-2, DENV-3, and DENV-4, embedded in a yellow fever RNA polymerase backbone.**

- At least 7 DENV vaccines (live attenuated viruses, inactivated viruses, chimeric live attenuated viruses, DNA, and recombinant proteins) have been developed and undergoing different phases of clinical trials.



Long-term efficacy and safety of a tetravalent dengue vaccine (TAK-003): 4·5-year results from a phase 3, randomized, double-blind, placebo-controlled trial

- Phase 3, double-blind, placebo-controlled, randomized trial.
- Healthy children and adolescents aged 4–16 years - 8 countries (Brazil, Colombia, Dominican Republic, Nicaragua, Panama, Philippines, Sri Lanka, and Thailand)
- 20,099 participants were randomly assigned to receive either TAK-003 (n=13,401) or placebo (n=6698)
- Cumulative vaccine efficacy was 61·2% against virologically confirmed dengue and 84·1% against hospitalized virologically confirmed dengue
- Efficacy was 53·5% and 79·3% in baseline seronegative participants
- Vaccine efficacy was shown against all four serotypes in baseline seropositive participants.
  - In baseline seronegative participants, vaccine efficacy was shown against DENV-1 and DENV-2 but was not observed against DENV-3 and unable to evaluate against DENV-4.
- Serious adverse events were reported 5% of TAK-003 recipients and 5·9% of placebo recipients; 17 deaths (6 in the placebo vs 11 in the TAK-003 group) were reported, none were considered study-vaccine related.
- **TAK-003 demonstrated long-term efficacy and safety against all four DENV serotypes in previously exposed individuals and against DENV-1 and DENV-2 in dengue-naive individuals.**

Tricou, V., Yu, D., Reynales, H., Biswal, S., Saez-Llorens, X., Sirivichayakul, C., ... & Wallace, D. (2024). Long-term efficacy and safety of a tetravalent dengue vaccine (TAK-003): 4·5-year results from a phase 3, randomised, double-blind, placebo-controlled trial. *The Lancet Global Health*, *12*(2), e257-e270.

Dengue vaccine

- **Children aged 9–16 years with laboratory-confirmed previous dengue virus infection and living in areas where dengue is endemic**.
- The vaccine is **NOT** approved for use in U.S. travelers who are visiting but not living in an area where dengue is common.
  - Dengvaxia will be discontinued due to low demand.
  - This decision is not due to any concerns regarding quality, safety or efficacy.
  - Will continue to be distributed through public and private markets globally last doses will expire at the end of August 2026.
    - Given the 3-dose, 1-year series needed for full immunization, individuals should start the Dengvaxia® immunization series no later than August 31, 2025.

Chikungunya contracted during travel: likely places of infection reported by travellers to the EU/EEA

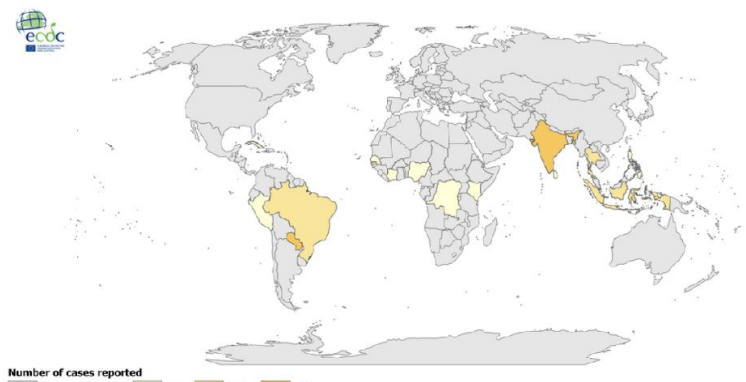
Translate this page

The maps and table below depict the locations where people with travel-associated chikungunya cases contracted the infection, as reported to ECDC. These are presented as number of cases and infection rates per 100 000 travellers. The aim is to inform public health authorities and EU/EEA citizens about the risks associated with chikungunya.

Information about chikungunya outbreaks in mainland EU/EEA

Annual epidemiological reports.

Travel-associated chikungunya cases reported to ECDC, by place of infection, 2023

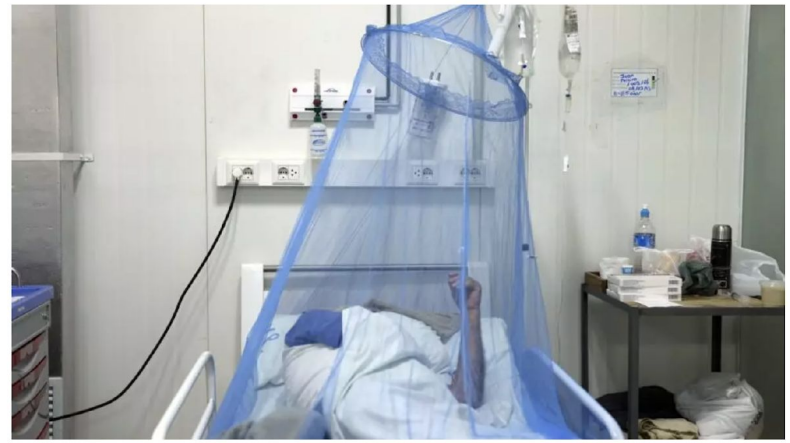


HEALTH

Reunion Island launches emergency health plan amid chikungunya epidemic

Health authorities in France's Reunion Island on Friday launched an emergency plan to boost staff in hospitals to deal with the spread of the chikungunya virus. This comes as the Indian Ocean territory reported over 6,000 new cases of the mosquito-borne disease last month.

Issued on: 05/04/2025 - 12:24 2 min



A patient infected with chikungunya. AP - Jorge Saenz

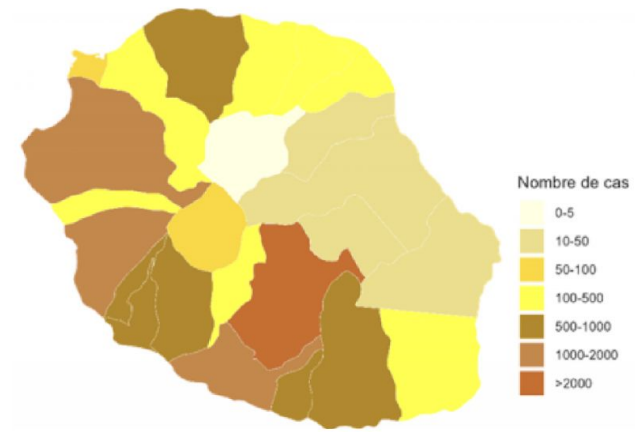
By: RFI Follow

The University Hospital of Reunion Island announced that it had

BREAKING NEWS

Chikungunya Outbreak in France's Réunion Becomes Critical

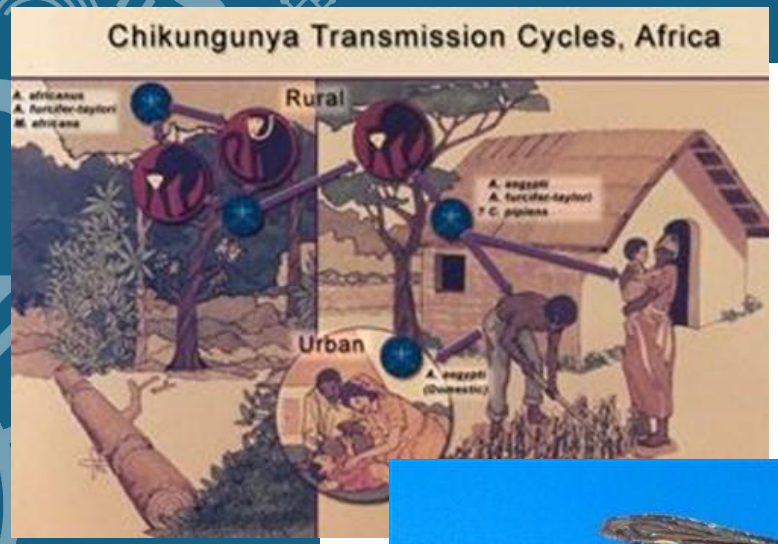
March 27, 2025 • 5:13 am CDT

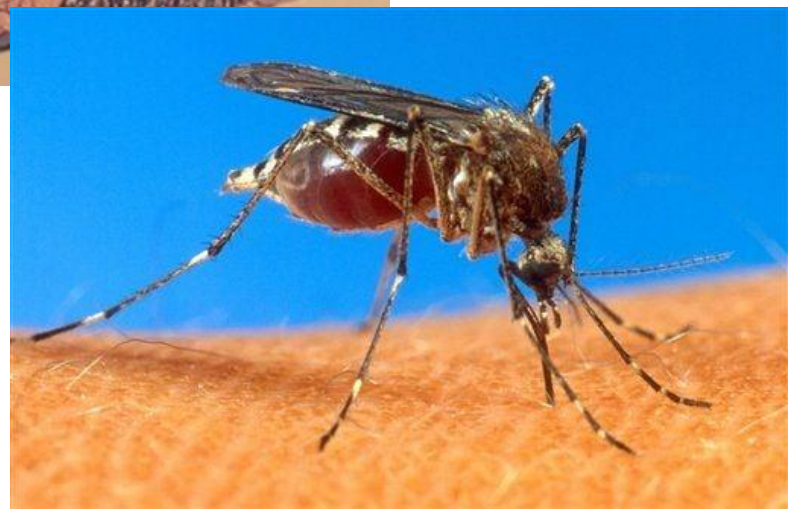


Agence Régionale de Santé La Réunion March 26, 2025

(Vax-Before-Travel News) – The French Republic's overseas department and region of Réunion today reported a serious spike in Chikungunya cases. Over the last week, 4,156 new cases were reported.

This data indicates a 16% increase in Chikungunya cases compared to the previous week.

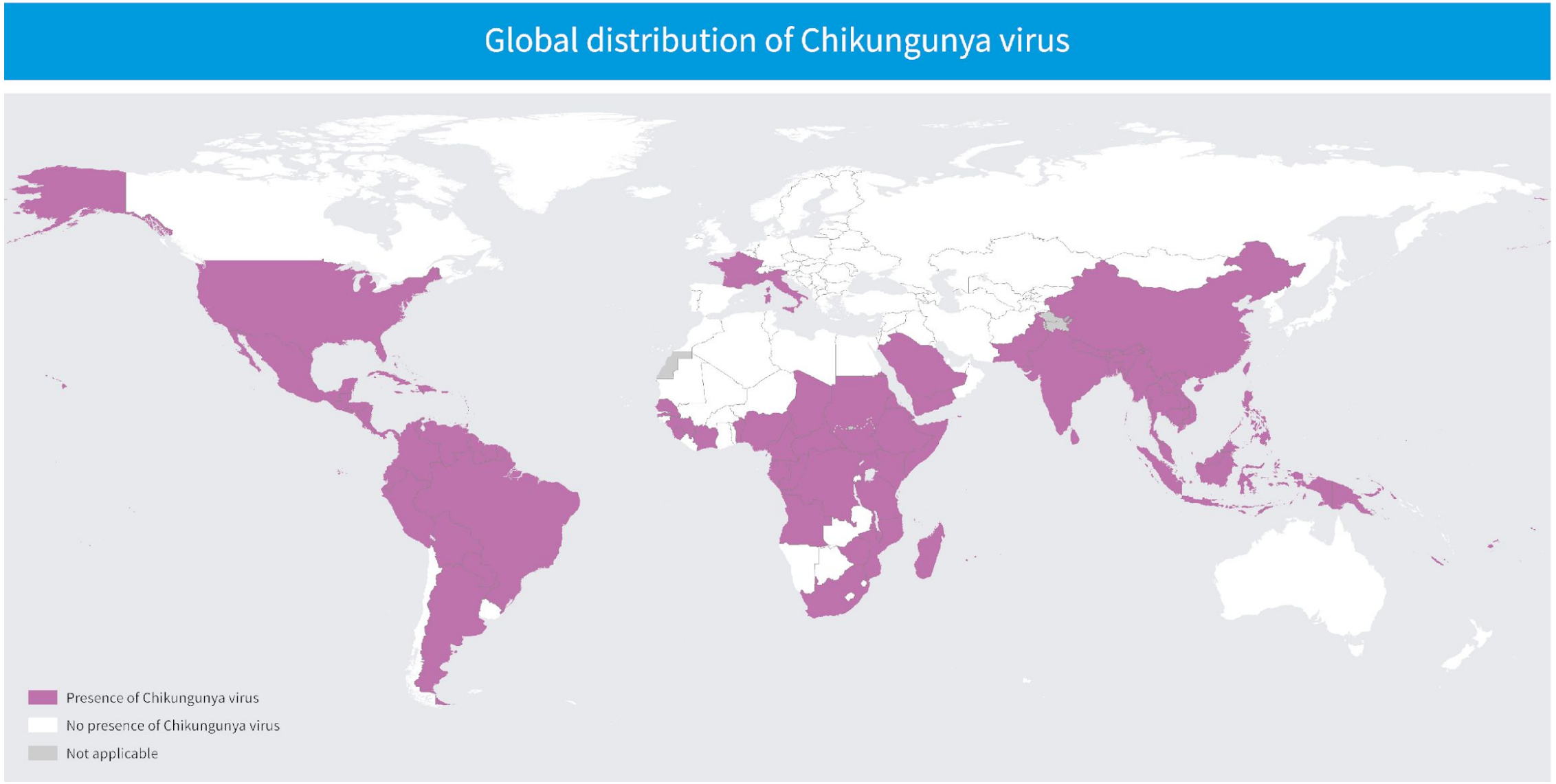




Chikungunya

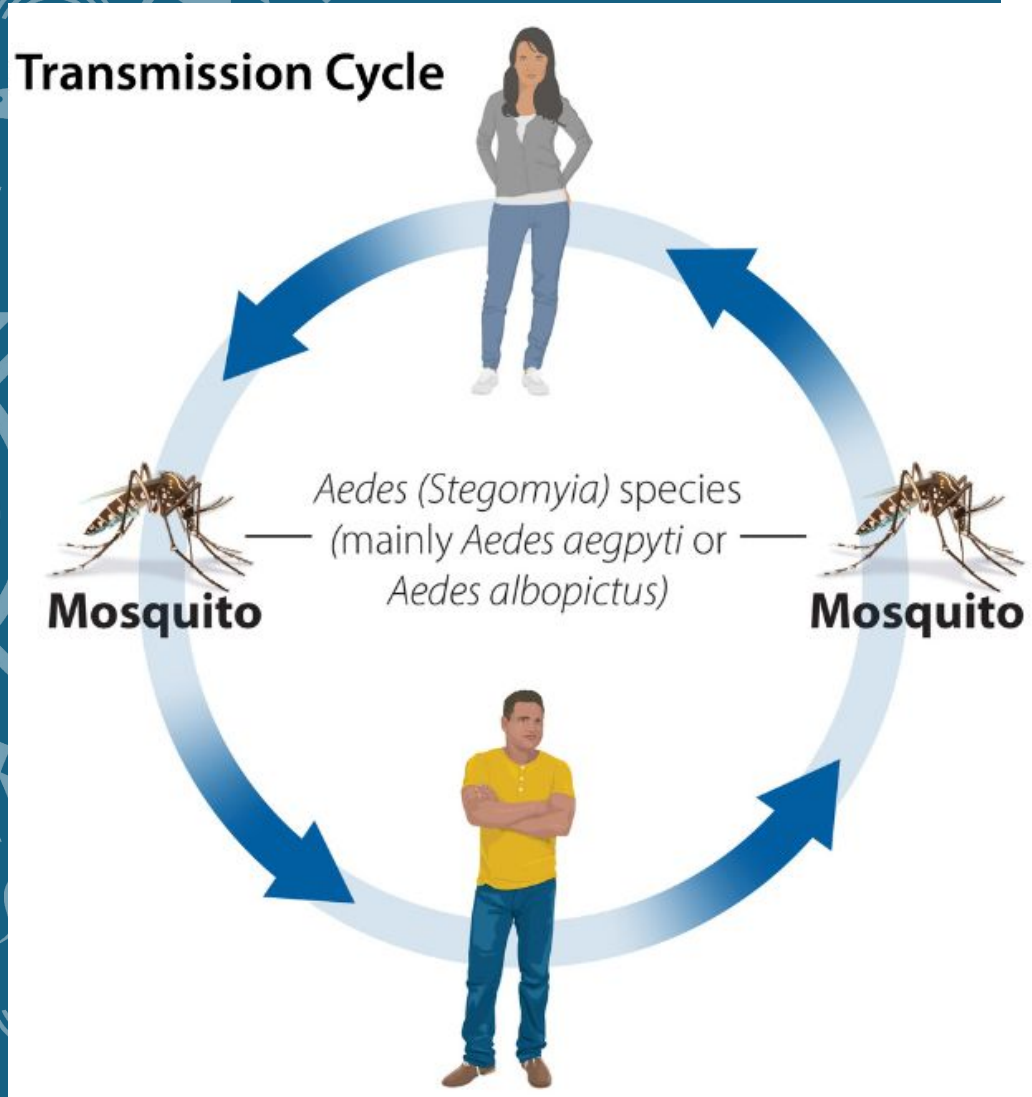
- Chikungunya is a mosquito-borne viral disease caused by the chikungunya virus (CHIKV)
- Alphavirus genus of the family Togaviridae.
- The name chikungunya derives from a word in the Kimakonde language, meaning **“to become contorted”**.
- Chikungunya virus that can be found in many areas of the world including Africa, the Americas, Asia, Europe, and islands in the Indian and Pacific Oceans.

Where?


Global distribution of Chikungunya virus
Presence of Chikungunya virus
No presence of Chikungunya virus
Not applicable

Chikungunya

- First identified in the United Republic of Tanzania in 1952
- Urban outbreaks were first recorded in Thailand in 1967 and in India in the 1970s.
- Since 2004, outbreaks have become more frequent and widespread due to viral adaptation (spread more easily by *Aedes albopictus* mosquitoes).
- Transmission has been interrupted on islands where a high proportion of the population is infected and then immune.



Transmission

- Transmitted by mosquitoes, *Aedes (Stegomyia) aegypti* and *Aedes (Stegomyia) albopictus* (can also transmit dengue and Zika viruses).
- Mosquitoes bite primarily during daylight hours.
- After mosquitoes feed from an infected person, the virus replicates over several days, gets to its salivary glands, and can be transmitted into a new human host

Transmission

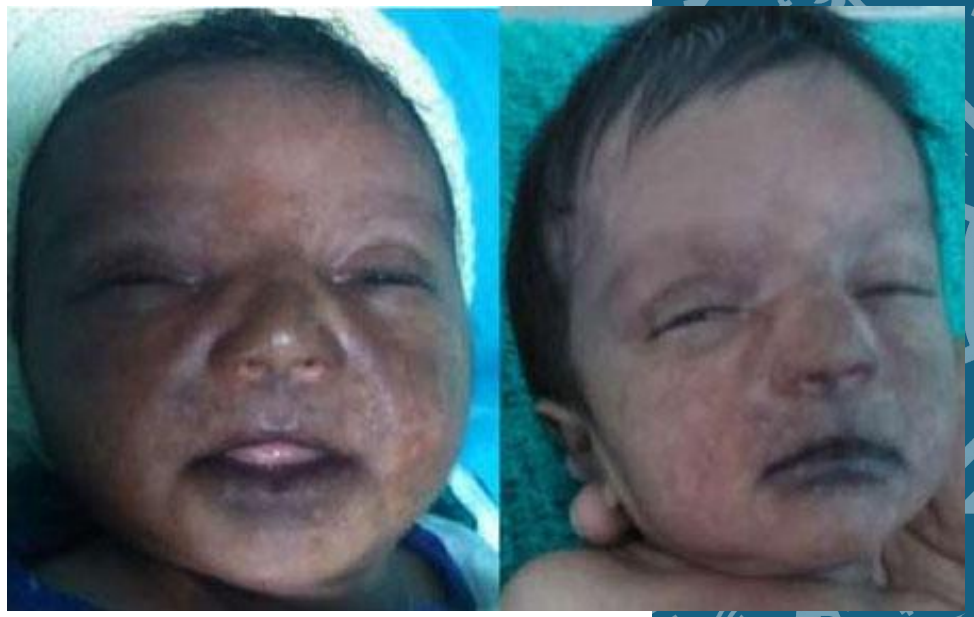
High level of viremia can cause transmission by:

- Blood transfusion
- Handling infected blood in the laboratory
- Drawing blood from an infected patient

Pregnancy and breastfeeding

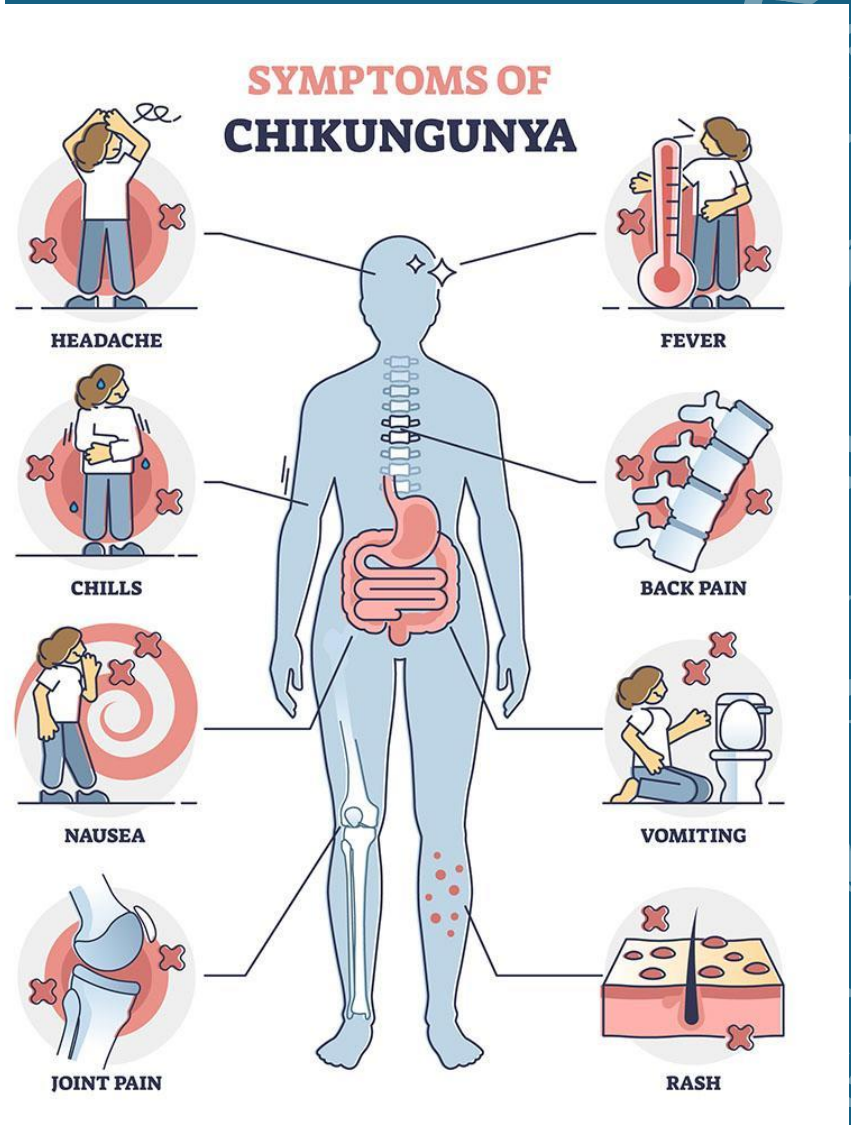
- Infection can be spread from a pregnant woman to her fetus during the second trimester (rare).
- If the pregnant woman is infected around the time of delivery intrapartum transmission (severe disease in the baby).

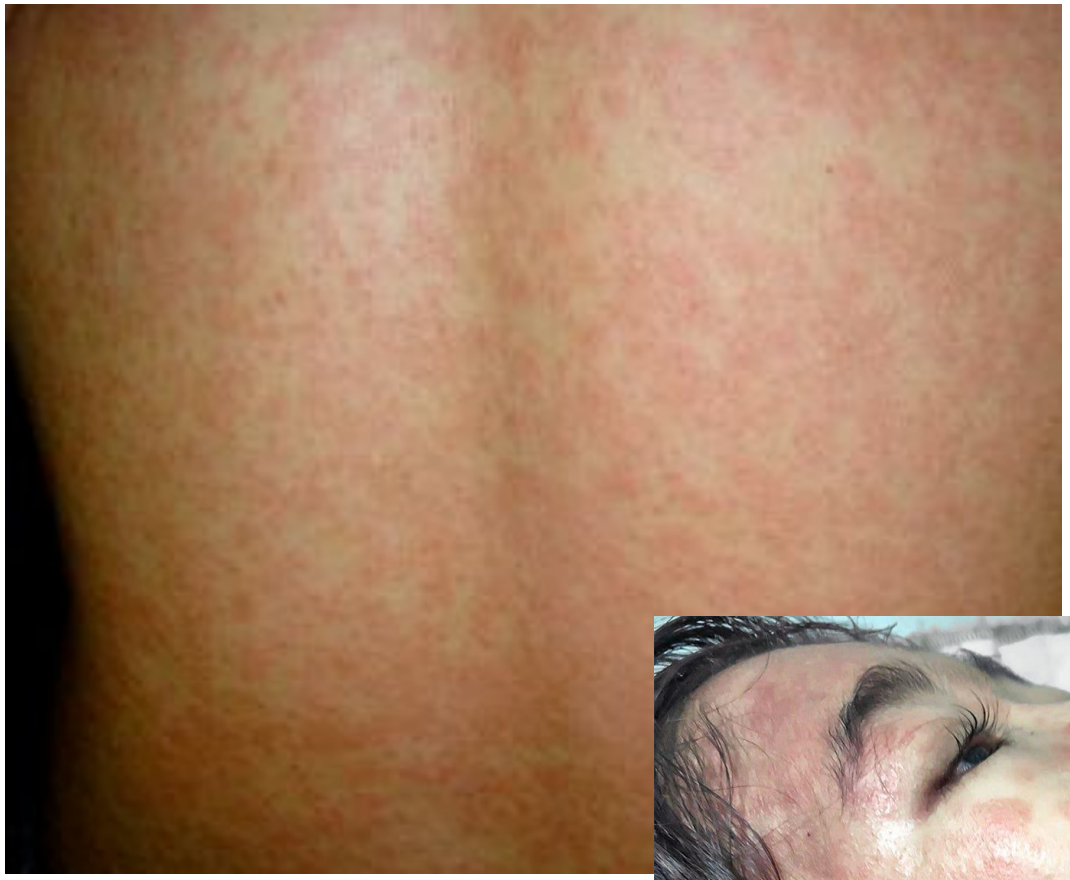
- The virus is **not** spread from person-to-person

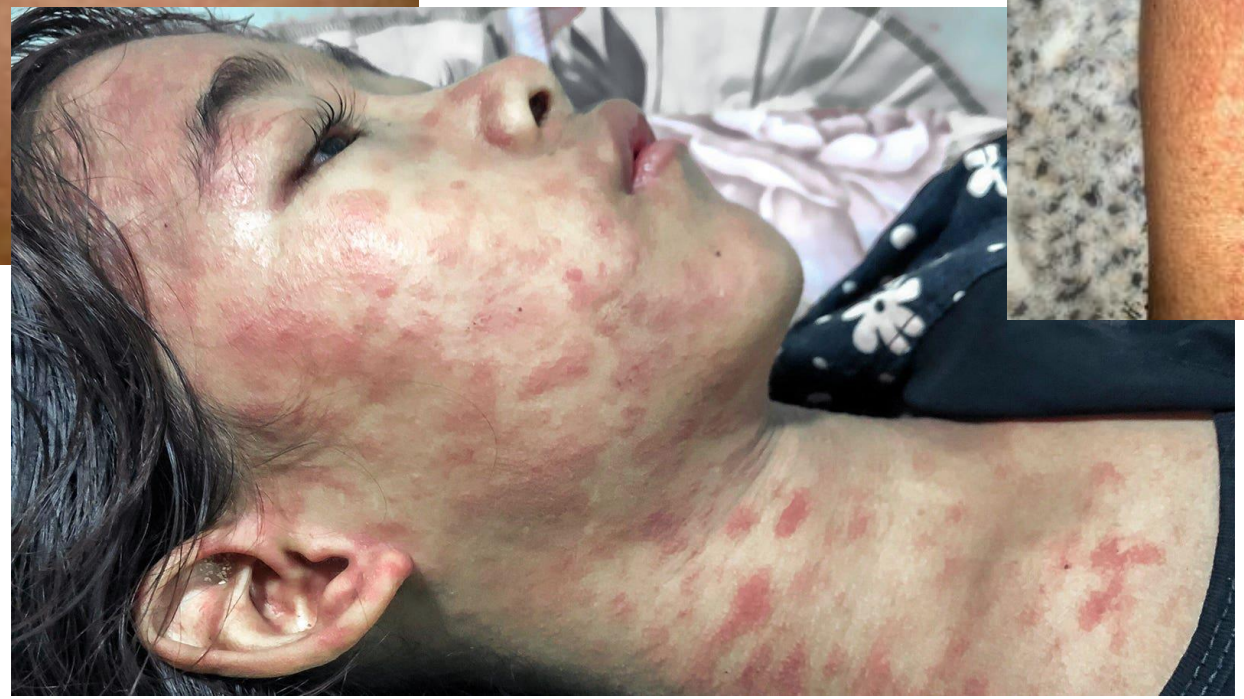


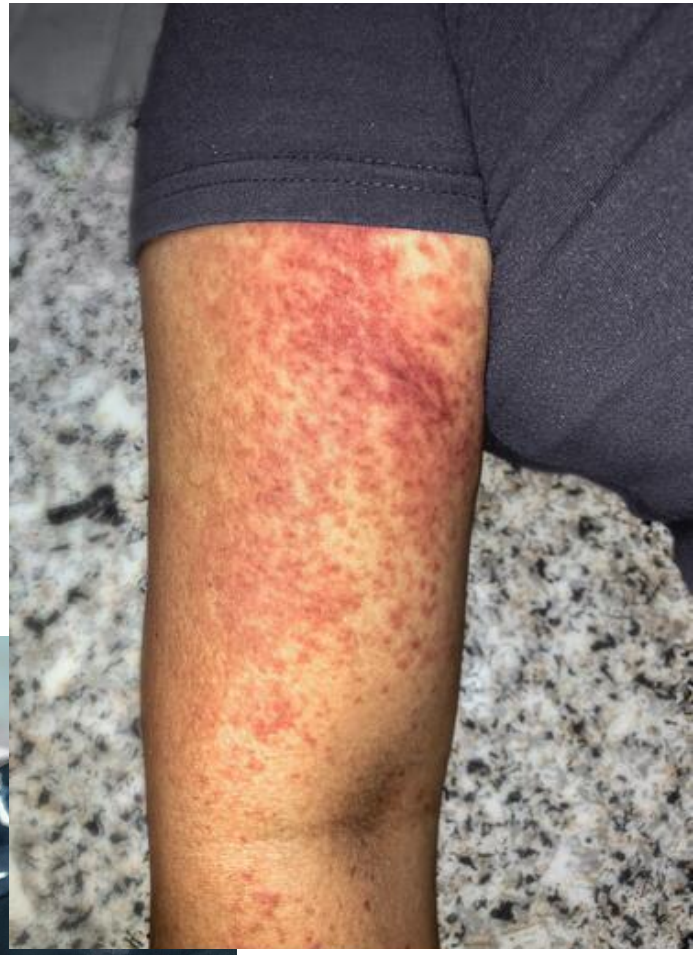
Clinical illness

- Incubation 4–8 days (range 2–12 days) after mosquito bite.
- Sudden onset of fever and severe joint pain.
- The joint pain is often debilitating (lasts for a few days but can last weeks-years)
- Joint swelling, muscle pain, headache, nausea, fatigue and rash.
- Coinfection with dengue and Zika viruses can happen
- Most patients recover fully from the infection, but can cause eye, heart, and neurological complications
- Patients at extremes of the age are at higher risk for severe disease with risk of death
- Evidence suggests immunity after infection.

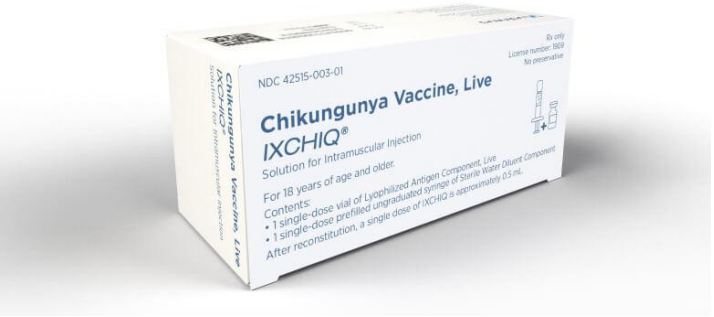








Chikungunya vaccine



- **Adults aged 18 years and older (IXCHIQ). Virus like vaccine (Bavarian Nordic)- >12 y.o**
- **Laboratory workers with potential for exposure to chikungunya virus.**
- It is administered intramuscularly as a single 0.5mL dose. There are currently no recommendations for a booster dose of vaccine.

Contraindications

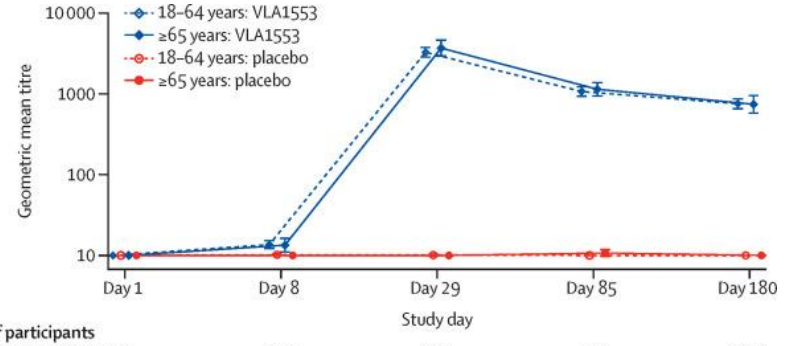
- Immunocompromising condition (due to immunodeficiencies or immunosuppressive and immunomodulatory therapies)
- History of a severe allergic reaction (e.g., anaphylaxis) to any component of the vaccine.

Precautions

- Pregnancy
  - Vaccination should be deferred until after delivery if possible.
  - If a pregnant woman chooses to be vaccinated. Avoid during the 1st trimester (until 14 weeks gestation) and after the 36th week of gestation.

Safety and immunogenicity of a single-shot live-attenuated chikungunya vaccine: a double-blind, multicenter, randomized, placebo-controlled, phase 3 trial

- Double-blind, multicenter, randomized, phase 3 trial
- Healthy volunteers aged >18 years
- Exclusions: Prior chikungunya virus infection or immune-mediated or chronic arthritis or arthralgia, defect of the immune system, any inactivated vaccine within 2 weeks or any live vaccine received within 4 weeks
- Chikungunya virus neutralizing antibody titers above the protective threshold were induced in 98·9% of participants 28 days after receiving vaccine.
- No significant difference in the seroprotection rate was observed between patients aged 18–64 years and 65 years or older
- At day 180, 96·3% of participants remained with titers above the seroprotective level
- Almost all adverse events occurred within 4 weeks after vaccination SAEs were reported in 1·5% of participants exposed to vaccine and 0·8% in the placebo arm
- 0·1% of participants reported adverse events related to vaccine- mild (myalgias)



Number of participants					
18–64 years: VLA1553	207	198	207	194	184
18–64 years: placebo	73	70	73	69	68
≥65 years: VLA1553	59	53	59	52	58
≥65 years: placebo	23	23	23	22	23

Schneider, M., Narciso-Abraham, M., Hadl, S., McMahon, R., Toepfer, S., Fuchs, U., ... & Wressnigg, N. (2023). Safety and immunogenicity of a single-shot live-attenuated chikungunya vaccine: a double-blind, multicentre, randomised, placebo-controlled, phase 3 trial. *The Lancet*, *401*(10394), 2138-2147.

Chikungunya virus virus-like particle vaccine safety and immunogenicity in adolescents and adults in the USA: a phase 3, randomized, double-blind, placebo-controlled trial

- Randomized, double-blind, placebo-controlled trial- healthy adolescents and adults aged 12–64 years
- Chikungunya virus virus-like particle vaccine- single-dose IM injection.
- Three age strata (12–17 years, 18–45 years, and 46–64 years)
- 3258 were enrolled- 2983 participants- 2559 (vaccine) and 424 (placebo).
- By day 22, 97·8% of participants in the vaccine group had a seroresponse, compared to 1·2% of the placebo group
- The vaccine had a favorable safety profile; most adverse events were self-limiting
- The most common adverse events were injection site pain 23·7%, fatigue19·9%, headache18·0%, and myalgia 17·6%.

Richardson, J. S., Anderson, D. M., Mendy, J., Tindale, L. C., Muhammad, S., Loreth, T., ... & Bedell, L. (2025). Chikungunya virus virus-like particle vaccine safety and immunogenicity in adolescents and adults in the USA: a phase 3, randomised, double-blind, placebo-controlled trial. *The Lancet*.

Take home points

- Some viral infections transmitted by mosquitoes are vaccine-preventable
- Vaccines are very well tolerated with small risk of adverse events
- Yellow fever live attenuated vaccine is indicated in anyone 9 months old and older traveling to risk areas
- Dengue vaccine prevents dengue hemorrhagic fever on individuals with previous seropositivity; unfortunately vaccine will be discontinued.
- Chikungunya vaccine is available, well tolerated and indicated for adults >18 y.o; a second virus-like particle vaccine will be available for younger.

ARIZONA

Thank you

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