



What's Next ?



Other versions of this question

- What do I have to worry about next?
- First it was West Nile, then it was Chikungunya and Ebola, and now it is Zika what will be next?
- Can you predict or what virus do you see coming to the U.S. next?



How the conversation proceeds

- Me: The flu
- Them: No
- Me: Measles, Mumps. I don't know your vaccination history.
- Them: No, in relationship to mosquitoes.
- Me: Oh, that's what you mean. I have no idea. Mosquitoes can transmit a lot of things.

The real question is: What will be transmitted by mosquitoes next?



One way to approach the question.

What is happening now?



What happened in 2016

- Zika
- Yellow fever
- Chikungunya
- Rift Valley
- Dengue
- Malaria
- Mayaro

Zika

- 532,000+ suspected cases world wide
- Pay attention during the Zika talks

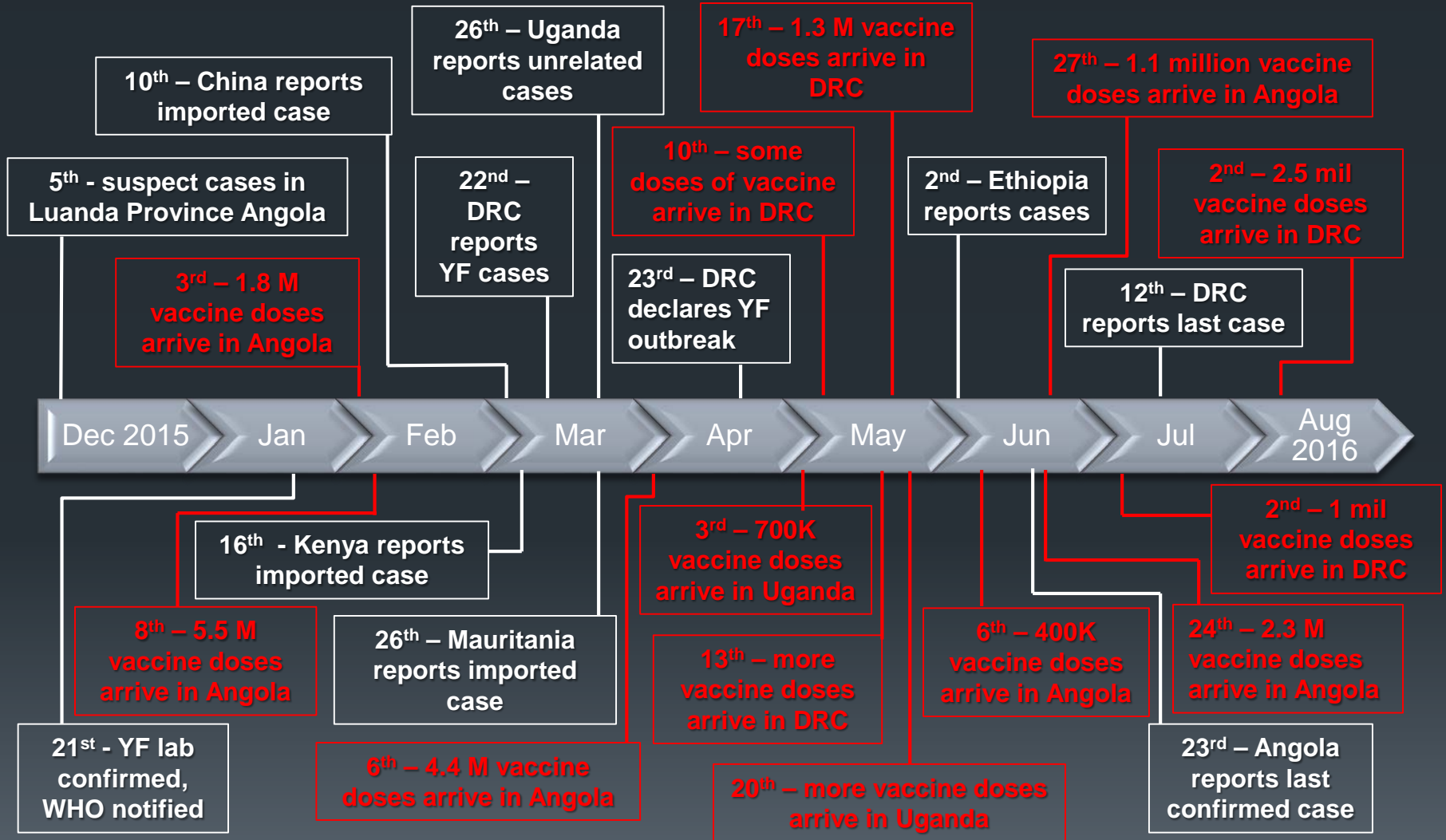


Yellow Fever

- YF started in Angola
- Spread to Democratic Republic of the Congo
- Human cases exported to China, Kenya, Mauritania, and Ethiopia.
- Uganda has unrelated YF transmission



Yellow Fever



Yellow Fever

■ YF Vaccine

- Shortage of vaccine
- WHO Goal to vaccinate 88% of population
- In February, 1 million doses went missing on way to DRC
- Global Supply of 6 million doses was depleted twice
- Dose-sparing strategy implemented, 1/5 of normal dose given. Shown to give temporary protection.
- 16 million vaccinated in Angola
- 10.5 million vaccinated in DRC
- 627,706 vaccinated in Uganda
- Fake YF Card reports spike



Yellow Fever

- **YF cases Angola related**
 - Angola about 6000 suspected, 884 confirmed, 400+ deaths
 - DRC 2987 suspected, 78 confirmed, 71 deaths
 - Ethiopia 22 suspected, 19 confirmed, 5 deaths
 - China 11 confirmed cases
 - Kenya 1 confirmed death
 - Mauritanian 1 confirmed death
 - Brazil 1 confirmed
 - Republic of Congo 2 suspected cases

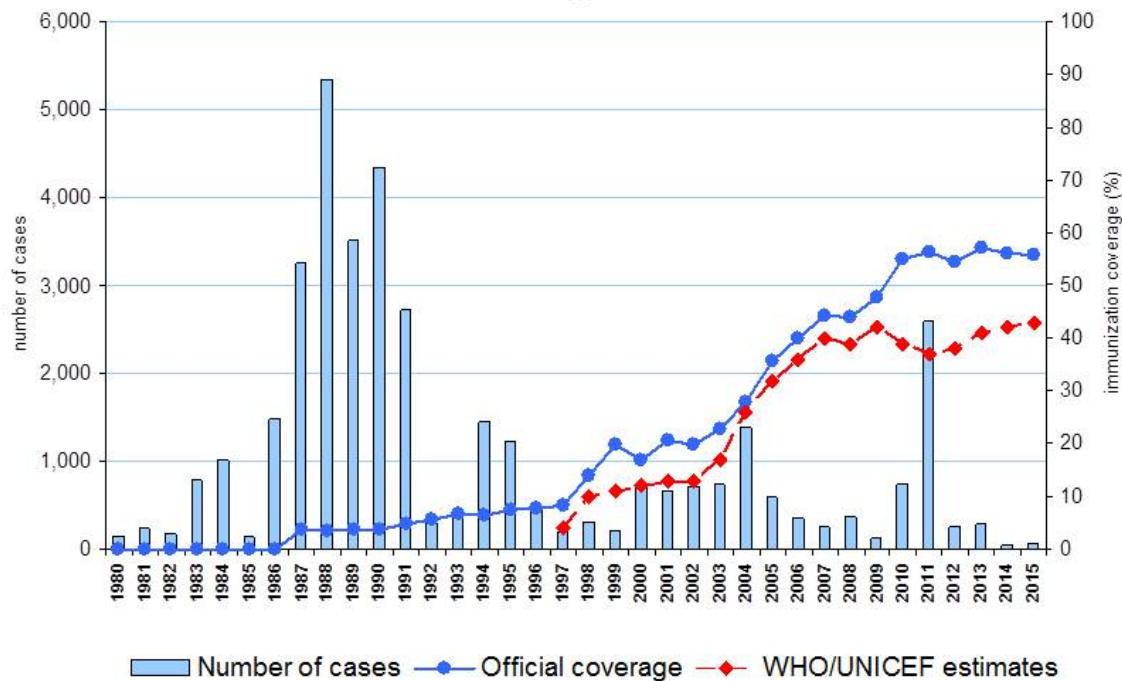
Yellow Fever

- **YF cases not Angola related**
 - **Uganda 68 suspected**
 - **Ghana 12 suspected cases, sylvatic transmission**
 - **Chad 1 suspected sylvatic case**
 - **Peru 80 suspected, 62 confirmed, 26 deaths**
 - **Brazil 5 confirmed sylvatic cases**
 - **Colombia 12 suspected, 7 confirmed all sylvatic cases**

Yellow Fever

Date of chart: 09 July 2016

Yellow fever global annual reported cases and YFV coverage, 1980-2015



Source: WHO/IVB database, 2016
194 WHO Member States.
Data as of 15 July 2016



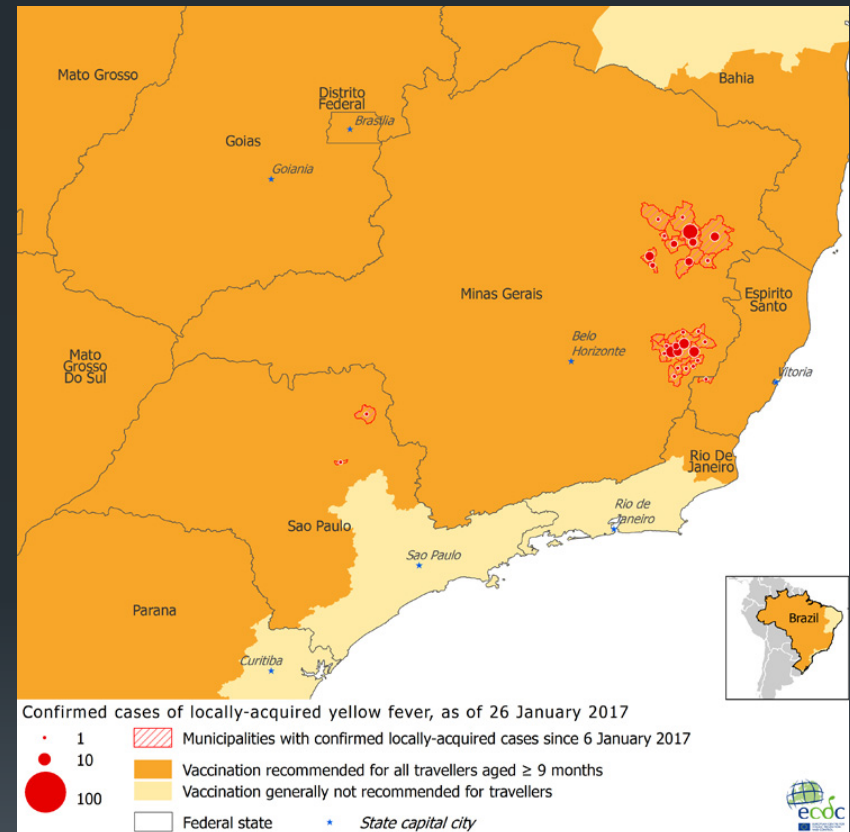
Yellow Fever

- **YF cases in Minas Gerais State, Brazil 2017**
 - **First case symptom onset 12/18/16**
 - **As of 1/27/17**
 - **467 suspected cases**
 - 97 confirmed
 - 40 confirmed deaths
 - **2 million vaccine doses sent to the area**



Yellow Fever

- **YF Brazil 2017**
 - **Espirito Santo State**
 - 33 suspected cases
 - **Sao Paulo State**
 - 3 suspected cases
 - **Bahia State**
 - 6 suspected cases
 - **Brazil has ordered 11.5 million vaccine doses**
 - **Currently largest outbreak since 2000**



Chikungunya

- **CHIKV did not disappear when Zika arrived**
- **North & Central America 2016**
 - U.S. 157 imported confirmed
 - Mexico 642 confirmed
 - Guatemala 4,859 suspected, 177 confirmed
 - Honduras 13,524 suspected
 - Costa Rica 3,215 suspected
 - El Salvador 5,950 suspected
 - Nicaragua 4,675 suspected, 453 confirmed
 - Costa Rica 1,816 suspected
 - Panama 6 confirmed, 5 imported confirmed

Chikungunya

- **South America 2016**
 - Brazil 251,000 suspected, 134,910 confirmed
 - Colombia 19,092 suspected, 186 confirmed
 - Argentina 3,394 suspected, 322 confirmed
 - Bolivia 7,577 suspected
 - Paraguay 873 suspected, 38 confirmed
 - Peru 116 suspected, 120 confirmed
 - French Guiana 805 suspected
 - Ecuador 280 suspected, 1,071 confirmed



Chikungunya

- **Pakistan 2017**
 - Alert issued in October about India outbreak
 - Suspected human cases started in November
 - Investigation started Dec. 17th
 - 3 confirmed cases Dec 19th
 - 638 suspected cases Jan 19th. Unofficial source says 5000 cases



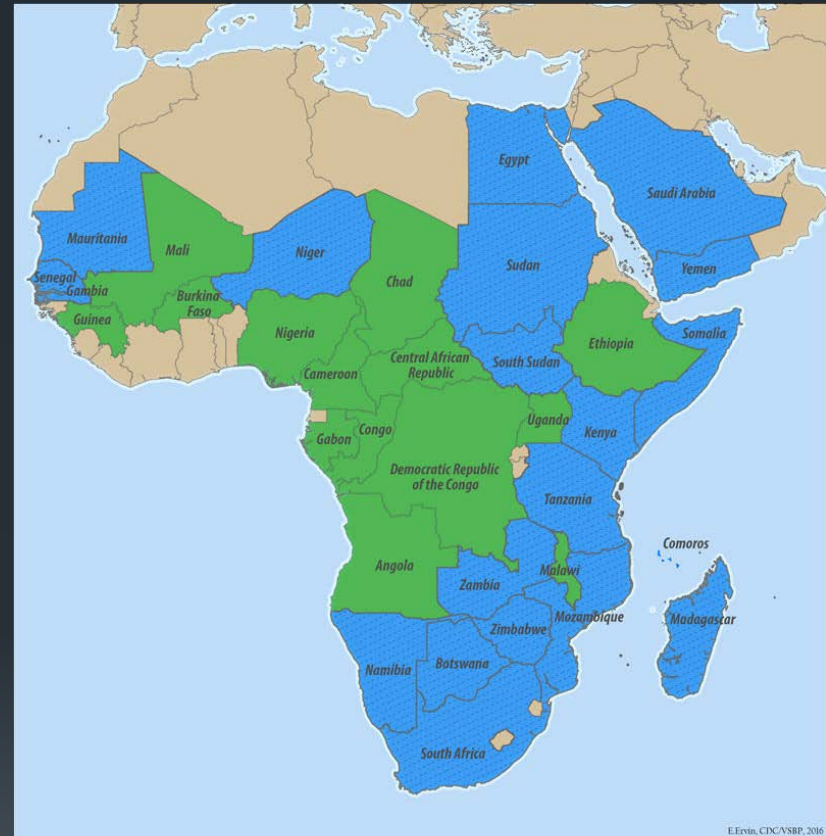
Chikungunya

- **India 2016**
 - Heavy rains in June
 - Regular fumigation in Delhi had been suspended
 - Delhi reporting 3,251 suspected cases
 - Biggest outbreak since 06
 - India reporting 12,250+ suspected cases



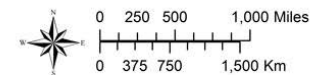
Rift Valley

- **Niger**
 - 266 suspected cases with 32 deaths
- **Uganda**
 - 6 cases
- **China**
 - Imported case from Angola
- **France imported case from Mali in 2015**
 - Virus found in urine 3 months and semen 4 months after onset



Rift Valley Fever Distribution Map

- Countries reporting endemic disease and substantial outbreaks of RVF
- Countries reporting few cases, periodic isolation of virus, or serologic evidence of RVF infection
- RVF status unknown



Dengue

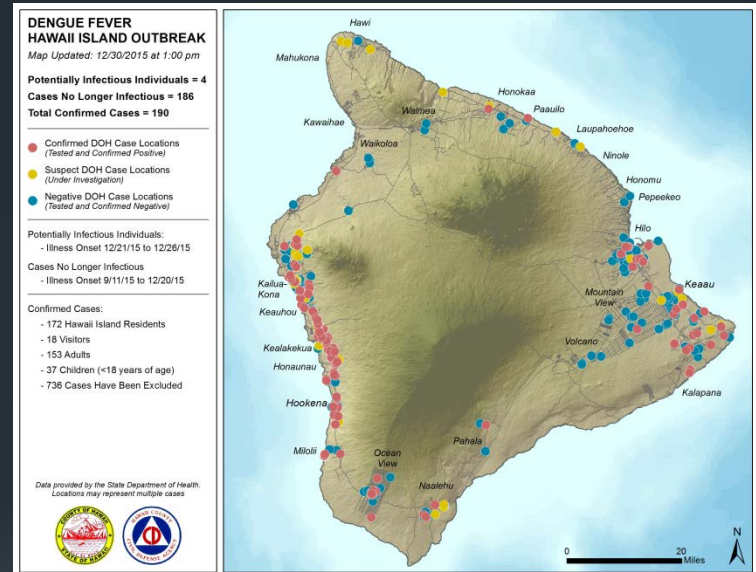
■ Hawaii

- 238 Hawaii island residents
- 26 visitors
- Last onset of illness 3/17/16

■ Americas 2,249,842 (2,430,278)

- North America 412 (751)
- Central America 267,026 (407,408)
- South America 1,901,263 (1,992,837)
- Caribbean 81,141 (29,282)

As of 12/12/16 (all of 2015)



Dengue

- **Globally**

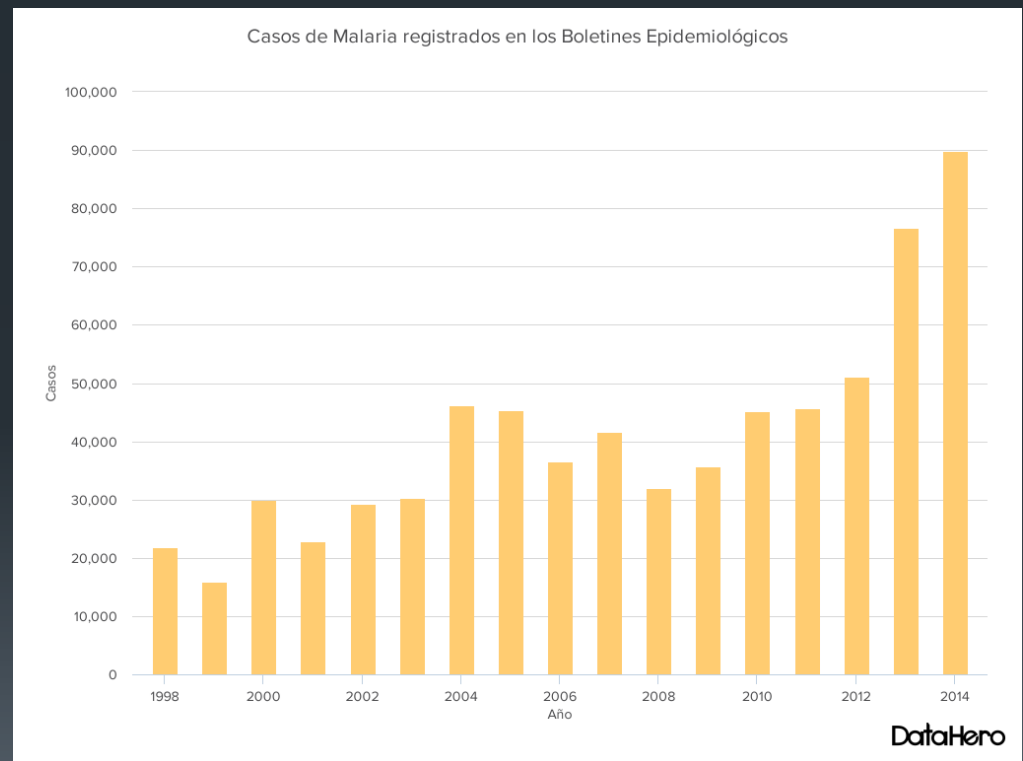
- **WHO estimates 390 million dengue infections annually**
 - **284-528 million per year**
- **3.9 billion in 120 countries at risk**
- **Before 1970 only 9 countries experienced dengue epidemics**
 - **Now endemic in 100+ countries**
- **Dengvaxia licensed in Mexico, Brazil, El Salvador, and Philippines**



Malaria

■ Venezuela

- Political chaos
- Numbers are questionable
- 199,902 new local cases in 2016
- Record high in 75 years of reliable records
- 115,313 new local cases in 2015



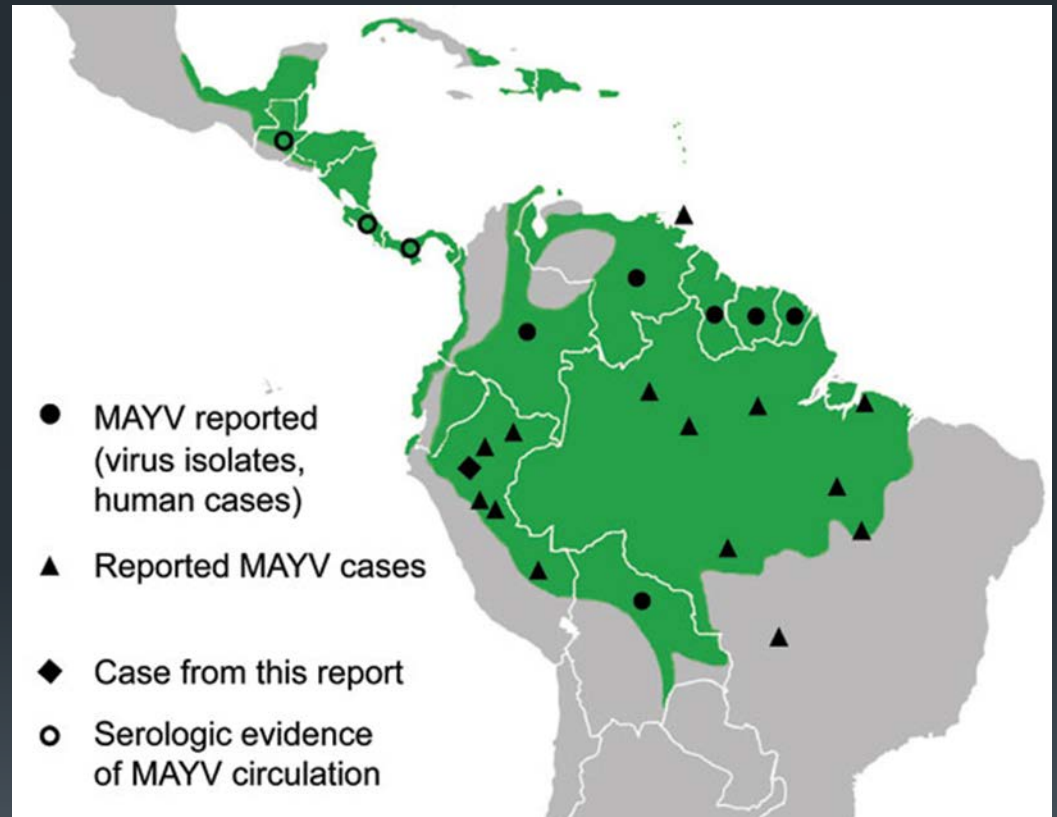
Malaria

- **Rodas, Cuba**
 - As of 1/10/17
 - 10 confirmed cases



Mayaro

- Alphavirus
- Isolated in Trinidad in 1954
- Dengue like illness
- Transmission cycles appear to be the same as YF, CHIKV, etc...
- Natural reservoirs are NHPs, birds and reptiles



Ramos, A. Mayaro Fever, a new viral disease, on the radar. Amandala, 08 Oct. 2016.

Mayaro

- 1996 U.S. imported case from Peru
 - Case became symptomatic on flight home to Ohio
- 2010 77 cases in La Estacion, Venezuela
- 2010 France imported case from Brazil
- 2011 33 cases in Manaus, Brazil
 - First outbreak in an urban setting
- 2016 MAYV found in blood sample taken from a child in Haiti. Sample collected in 2015



Estofolete, C.F., et al. Mayaro fever in an HIV-infected patient suspected of having Chikungunya fever. Rev. Soc. Bras. Med. Trop. Vol49 no.5 Uberaba Sept./Oct. 2016



Another way to approach the question.

Pick several obscure neglected tropical MBDs with odd names.

What is Next ??????

- Rift Valley
- Usutu
- Mayaro
- O'nyong-nyong
- Venezuelan Equine Encephalitis
- Bwamba
- Sindbis
- Barmah Forest
- Semliki Forest
- Ross River
- Rocio
- Spondweni
- Ilheus

Mosquitoes also on the move

- University of Florida researchers find 2 species for the first time in Florida
 - Collected in October in Homestead and Florida City. Hundreds from a single trap.
 - *Aedeomyia squamipennis* (Gamboa virus)
 - *Culex panocossa* (Venezuelan Equine Encephalitis)
- *Aedes aegypti* larvae in Windsor, Ontario
 - *Aedes albopictus* adults trapped 3 time in 4 weeks
- *Aedes albopictus* eggs collected in traps in Kent, United Kingdom
- *Aedes aegypti* adults trapped in Netherlands
- *Aedes aegypti* larvae in traps in New Zealand