Outbreakiomics

Credit: Sharon Isern

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Viruses and diseases we study

Lassa
Ebola
Zika
West Nile
‘Classical’ Epidemiology
Dissecting the Zika epidemic
Spread of Zika virus across the world

Oct 1997
Zika virus outbreak in Florida

(a) Number of ZIKV cases by month in 2016 for different categories: Travel (U.S.), Travel (Florida), and Local (Florida). The graph shows a significant increase in cases from April to July.

(b) Map of Florida showing the distribution of ZIKV cases and mosquito trap sites.

(c) Transmission zones: Little River, Miami Beach, Wynwood. The map highlights areas with high ZIKV+ mosquito activity, with Miami-Dade County having the most cases (35 sequences).
Zika virus outbreak in Florida

Driven by mosquitoes?
When did it arrive?
How many introductions?
Where did it come from? And how?
Why Miami? Why southern Florida?

Grubaugh et al., Nature 2017
Mosquito-driven outbreak

(a) Number of ZIKV cases over the month of 2016. The graph shows the number of ZIKV cases reported in Florida, with different colors indicating different transmission zones. The x-axis represents the months of the year, and the y-axis represents the number of cases.

(b) Map of Florida with transmission zones labeled. The map highlights areas where ZIKV cases were reported, with specific regions such as Miami-Dade, Broward, and Pinellas highlighted. The map also indicates the abundance of Ae. aegypti mosquitoes in these areas.

(c) Transmission zones in Florida, with specific locations such as Wynwood and Miami Beach highlighted. The map shows the distribution of ZIKV+ mosquitoes and mosquito trap sites.

The mosquito abundance and ZIKV cases are visualized with graphs showing the abundance of Ae. aegypti and ZIKV cases over time, with peaks observed in certain months.

The text also mentions the number of ZIKV cases and the abundance of Ae. aegypti mosquitoes in specific regions, such as Wynwood and Miami Beach, with data from different months and years.
Florida transmission started in Spring, 2016
Surveillance gaps across the Americas

From Worobey, Nature 2017

Grubaugh et al., Cell 2018
Surveillance gaps across the Americas

Diagram showing the spread from Pacific islands outbreak to Brazil, Honduras, Colombia, Puerto Rico, Caribbean, and Florida from 2013 to 2016.
The virus moved around Miami.
The virus moved around Miami
Zika virus established itself repeatedly in Florida
Zika virus established itself repeatedly in Florida
Zika virus established itself repeatedly in Florida
The Caribbean is the main source of Zika virus in Florida.
The Caribbean is the main source of Zika virus in Florida.
Hmm…

Estimated proportion of infected travelers by region and month of 2016.

- **Caribbean**
- **South America**
- **Central America**

Legend:
- ZIKV incidence rate (per 100,000 population)
- Log scale
- No data
Ahh - cruise ships

Estimated proportion of infected travelers

- Caribbean (cruises)
- Caribbean (flights)
- South America (combined travel)
- Central America (combined travel)
Miami is unique
... and so is Florida
Is it over?
Zika is gone?
Using travelers as a proxy for local transmissions

- **Dominican Republic**
  - \( r = 0.66, p = 0.003, 135 \) travel cases

- **Haiti**
  - \( r = 0.84, p < 0.0001, 25 \) travel cases

- **Jamaica**
  - \( r = 0.52, p = 0.03, 106 \) travel cases

- **Puerto Rico**
  - \( r = 0.91, p < 0.0001, 216 \) travel cases

- **US Virgin Islands**
  - \( r = 0.84, p = 0.005, 10 \) travel cases

- **Guatemala**
  - \( r = 0.45, p = 0.04, 14 \) travel cases

- **Nicaragua**
  - \( r = 0.80, p < 0.0001, 117 \) travel cases

- **Mexico**
  - \( r = 0.58, p = 0.006, 36 \) travel cases

- **Colombia**
  - \( r = 0.80, p < 0.0001, 35 \) travel cases

- **Venezuela**
  - \( r = 0.88, p < 0.0001, 45 \) travel cases

- **Honduras**
  - \( r = 0.77, p < 0.0001, 25 \) travel cases

- **Cuba**
  - \( r = -0.33, p = 0.14, 97 \) travel cases
Multiple introductions and persistence in Cuba
Collaborators

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Open Science & Open Data

Open Science

Data
We make our data publicly available as soon as possible after data generation. You can find it all here.

Protocols
Here you'll find the various protocols that we have developed or use in our lab.

Talks
We give talks. Listen, don't take notes, then come download all of our slides here.

Beer-O-Meter

Overview

We make mistakes. That's one of the main reasons we make our data publicly available - as others can point it out, and we can correct. For every mistake found, we're offering a beer - check back here for the tally and leaderboard.

Tally

9
Beers Owed

Leaderboard

Yozwiak Duels
Richard Neher
Trevor Bedford

Yozwiak et al., Cell 2016

www.nextstrain.org

www.andersen-lab.com/secrets