

Combining data sources to model Zika virus outbreaks

Sebastian Funk, Adam Kucharski, Oliver Brady

Centre for the Mathematical Modelling of Infectious Diseases
London School of Hygiene & Tropical Medicine



**centre for the
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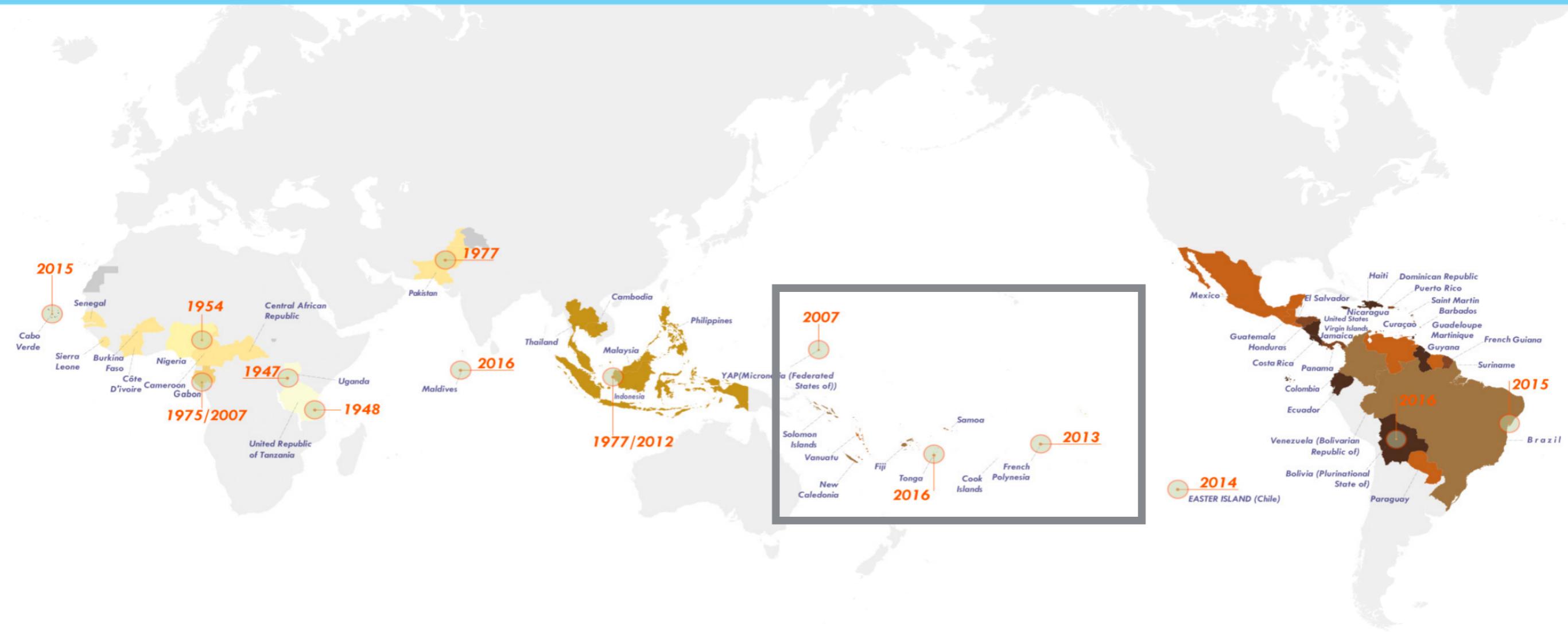
What is the expected epidemiology of Zika

- 1) where there has **not** (yet) been an outbreak?
- 2) **after** an outbreak?

Zika on pacific islands

1947-2016

Countries and territories showing historical time-line of Zika virus spread (1947 - 2016)



ORIGINAL ARTICLE

Zika Virus Outbreak on Yap Island, Federated States of Micronesia

Mark R. Duffy, D.V.M., M.P.H., Tai-Ho Chen, M.D.,
W. Thane Hancock, M.D., M.P.H., Ann M. Powers, Ph.D.,
Jacob L. Kool, M.D., Ph.D., Robert S. Lanciotti, Ph.D., Moses Pretrick, B.S.,
Maria Marfel, B.S., Stacey Holzbauer, D.V.M., M.P.H.,
Christine Dubray, M.D., M.P.H., Laurent Guillaumot, M.S., Anne Griggs, M.P.H.,
Martin Bel, M.D., Amy J. Lambert, M.S., Janeen Laven, B.S., Olga Kosoy, M.S.,
Amanda Panella, M.P.H., Brad J. Biggerstaff, Ph.D., Marc Fischer, M.D., M.P.H.,
and Edward B. Hayes, M.D.

ABSTRACT

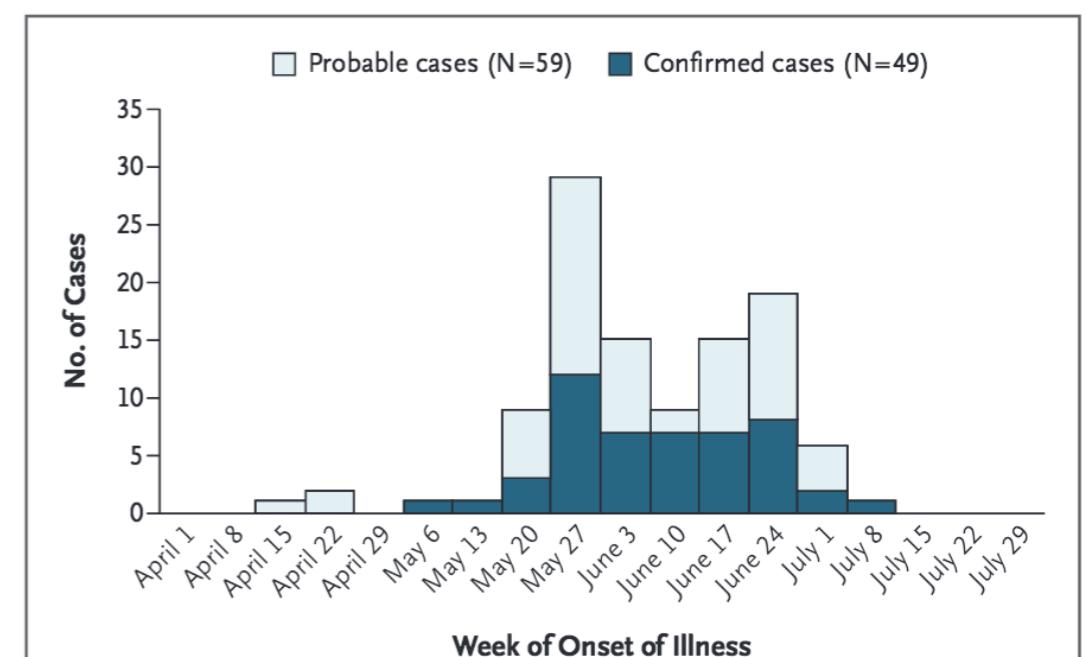
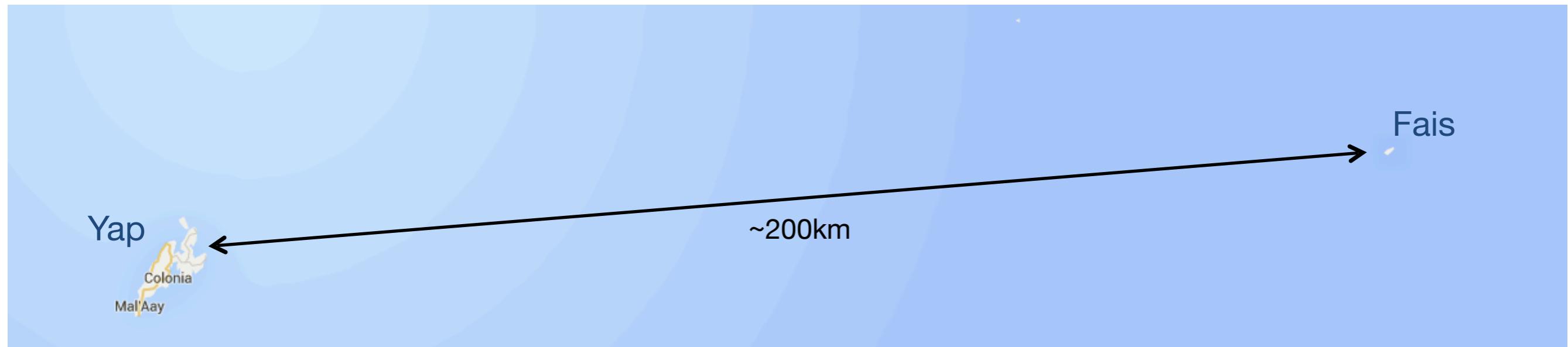
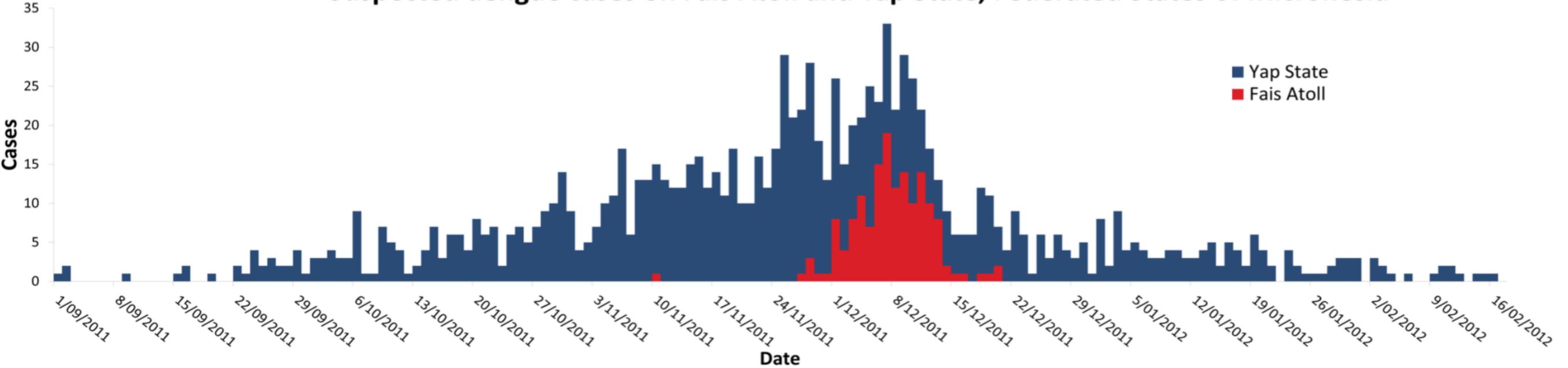
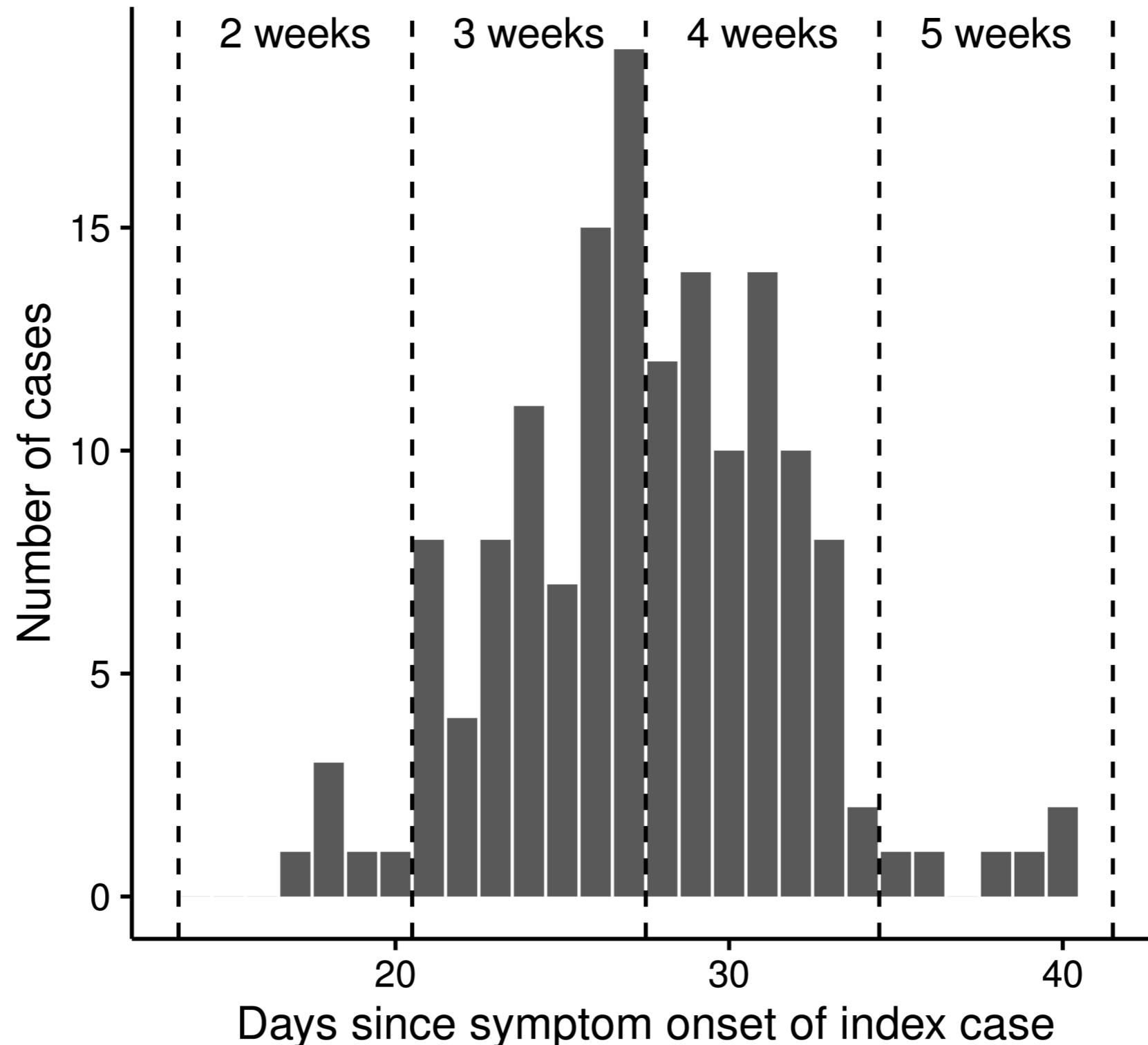


Figure 2. Confirmed and Probable Cases of Zika Virus Disease on Yap among Persons Seeking Health Care, According to Week of Onset of Illness during the Period from April through July 2007.

Suspected dengue cases on Fais Atoll and Yap State, Federated States of Micronesia



Zika on Fais



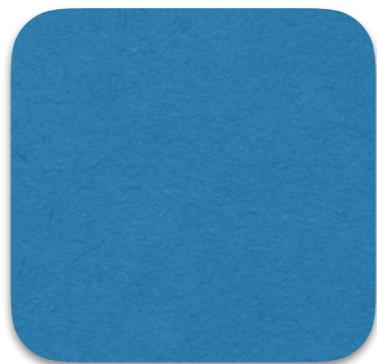


Google

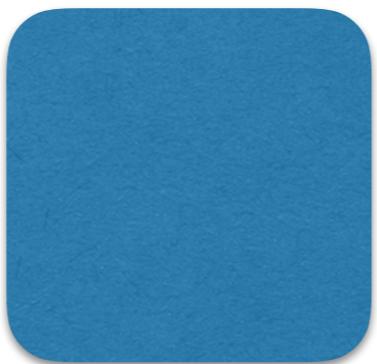
Combining multiple outbreaks

Three outbreaks

Dengue

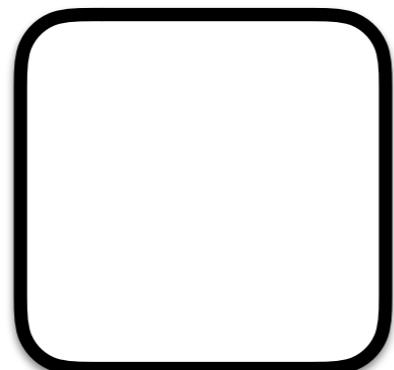


Zika

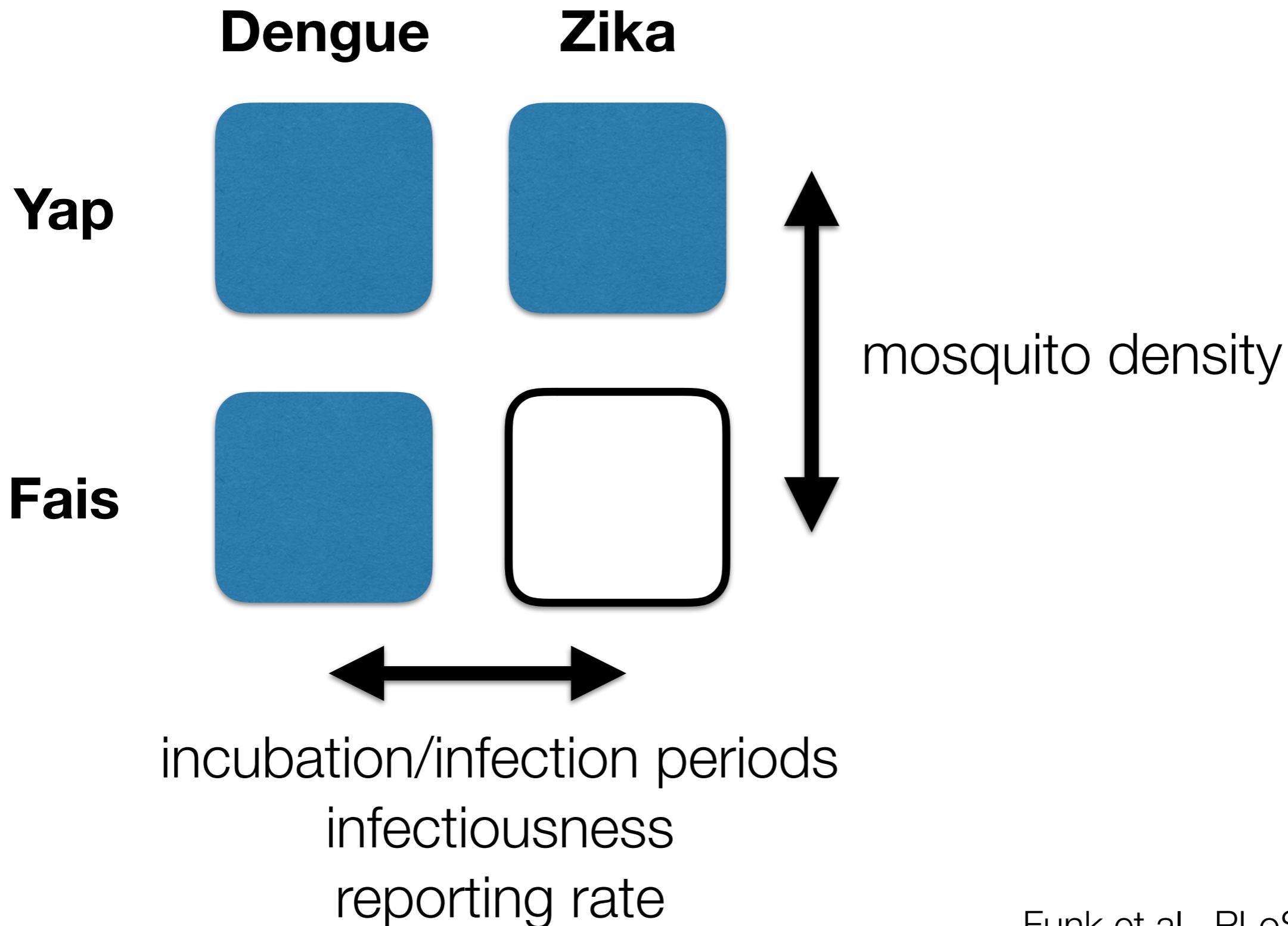


Yap

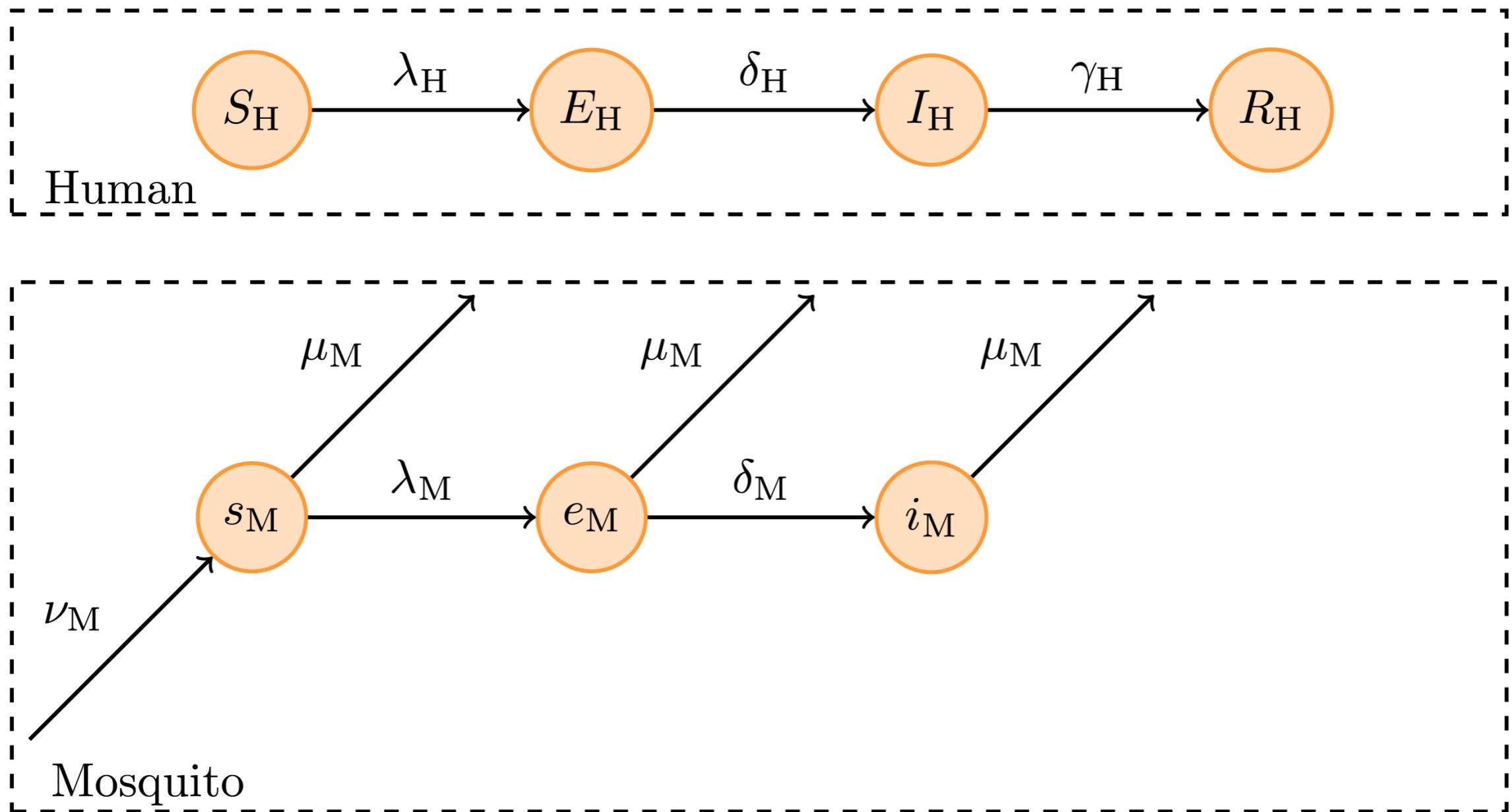
Fais



Common parameters



Mosquito-borne infection model



LibBi

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LibBi has been developed under a [CSIRO](#) project that forms part of the [Computational and Simulation Sciences](#) platform.

Website theme adapted from work by [orderedlist](#).

LibBi is used for state-space modelling and Bayesian inference on high-performance computer hardware, including multi-core CPUs, many-core GPUs (graphics processing units) and distributed-memory clusters.

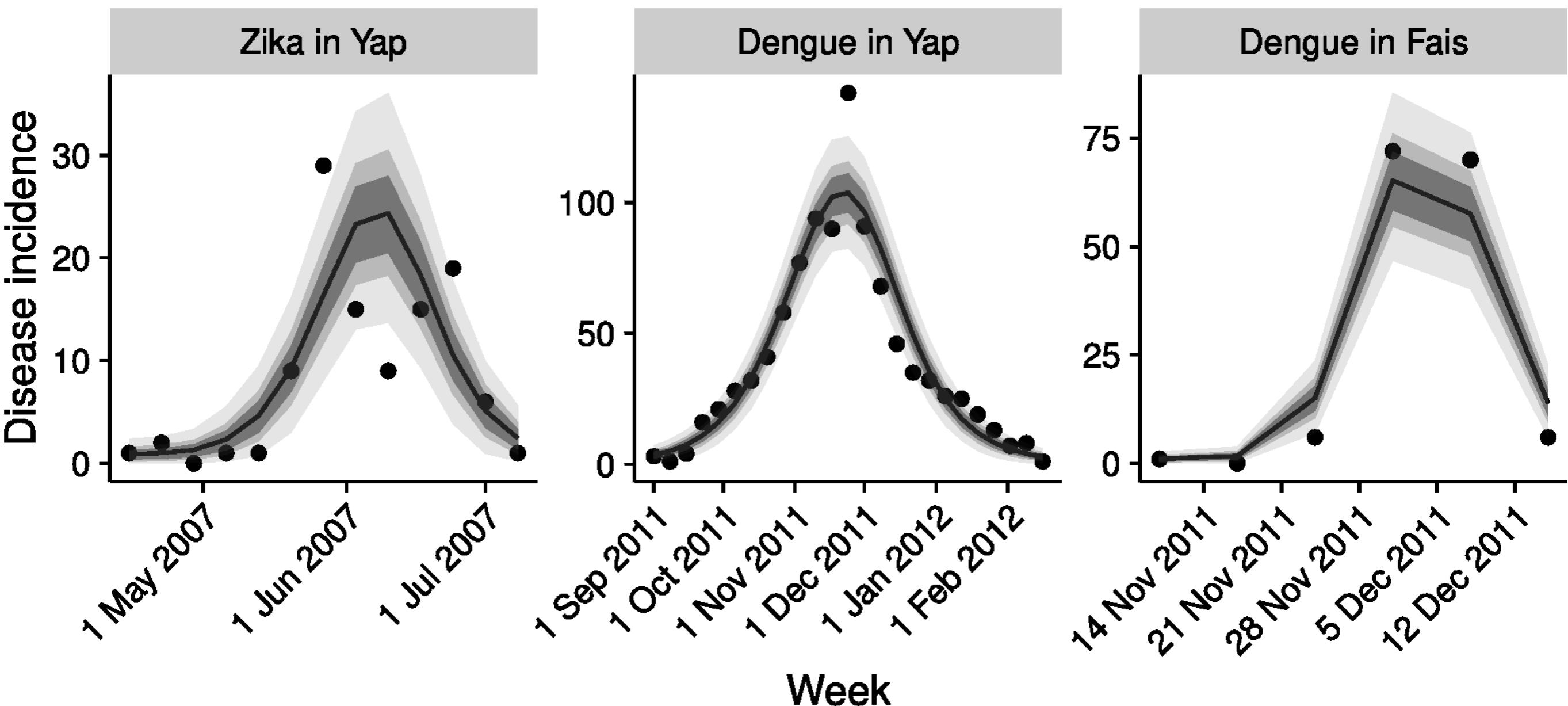
The staple methods of LibBi are based on sequential Monte Carlo (SMC), also known as particle filtering. These methods include particle Markov chain Monte Carlo (PMCMC) and SMC². Other methods include the extended Kalman filter and some parameter optimisation routines.

LibBi consists of a C++ template library, as well as a parser and compiler, written in Perl, for its own modelling language.

News

- [LibBi 1.3.0 released, new anytime features](#)
14 Dec 2016
- [Easily install LibBi from Homebrew](#)
14 Nov 2016
- [RBi package: Use LibBi within R](#)
19 Oct 2016

<http://libbi.org>



Basic reproduction number

	Dengue	Zika
Yap	9.7–13	6.3–9.6
Fais	28–102	26–52

Combining case and serology data

Serology puzzle: Zika in Yap

sults. We estimated that 5005 of the 6892 Yap residents who were 3 years of age or older (95% confidence interval [CI], 4702 to 5308) were infected with Zika virus during the outbreak, an infection rate of 73% (95% CI, 68 to 77). An estimated 919 residents (95% CI, 480 to 1357), or 18%

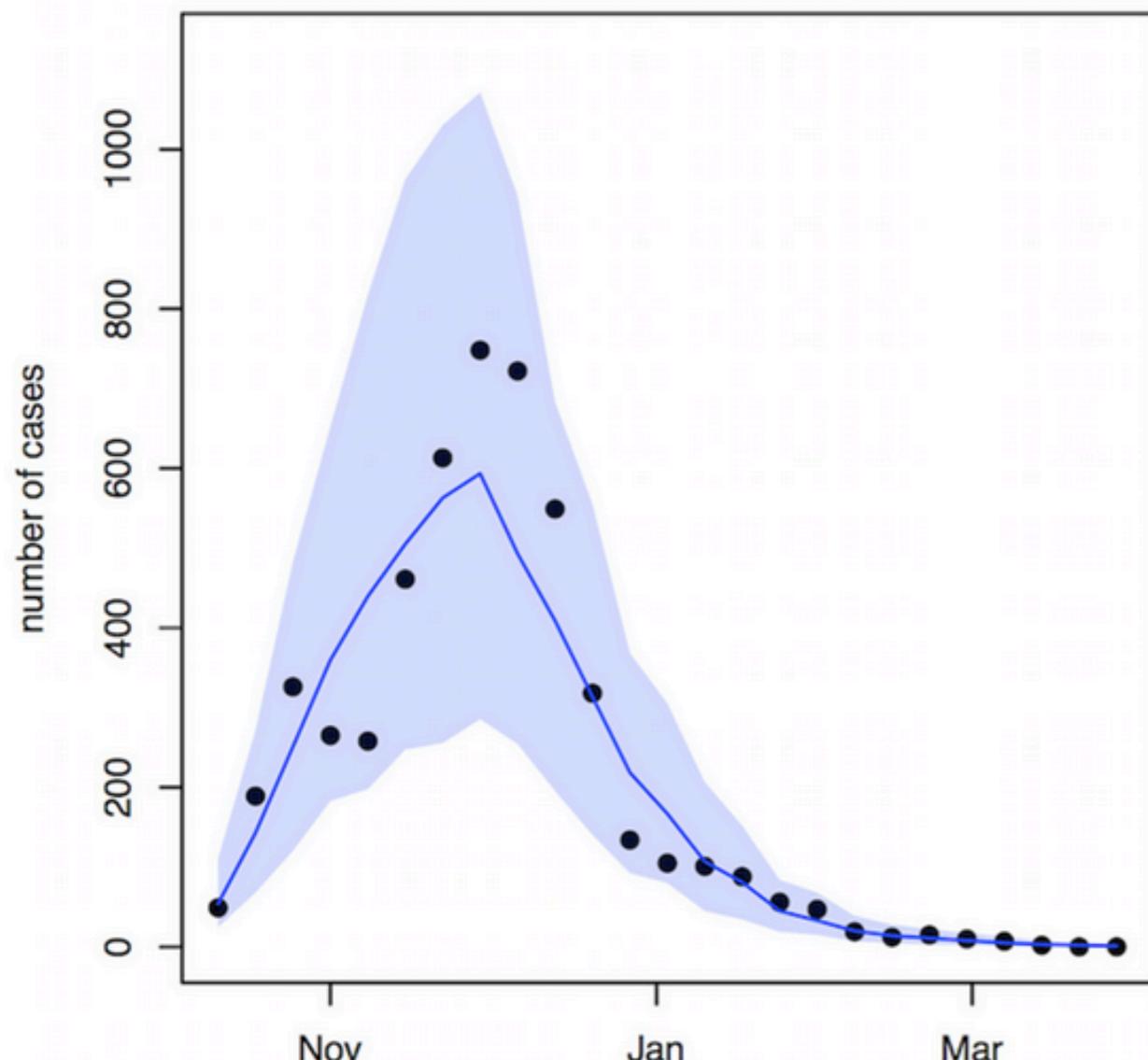
6.3–9.6

Estimated R₀ is 6.3–9.6.
Why was the attack rate not higher?

French Polynesia

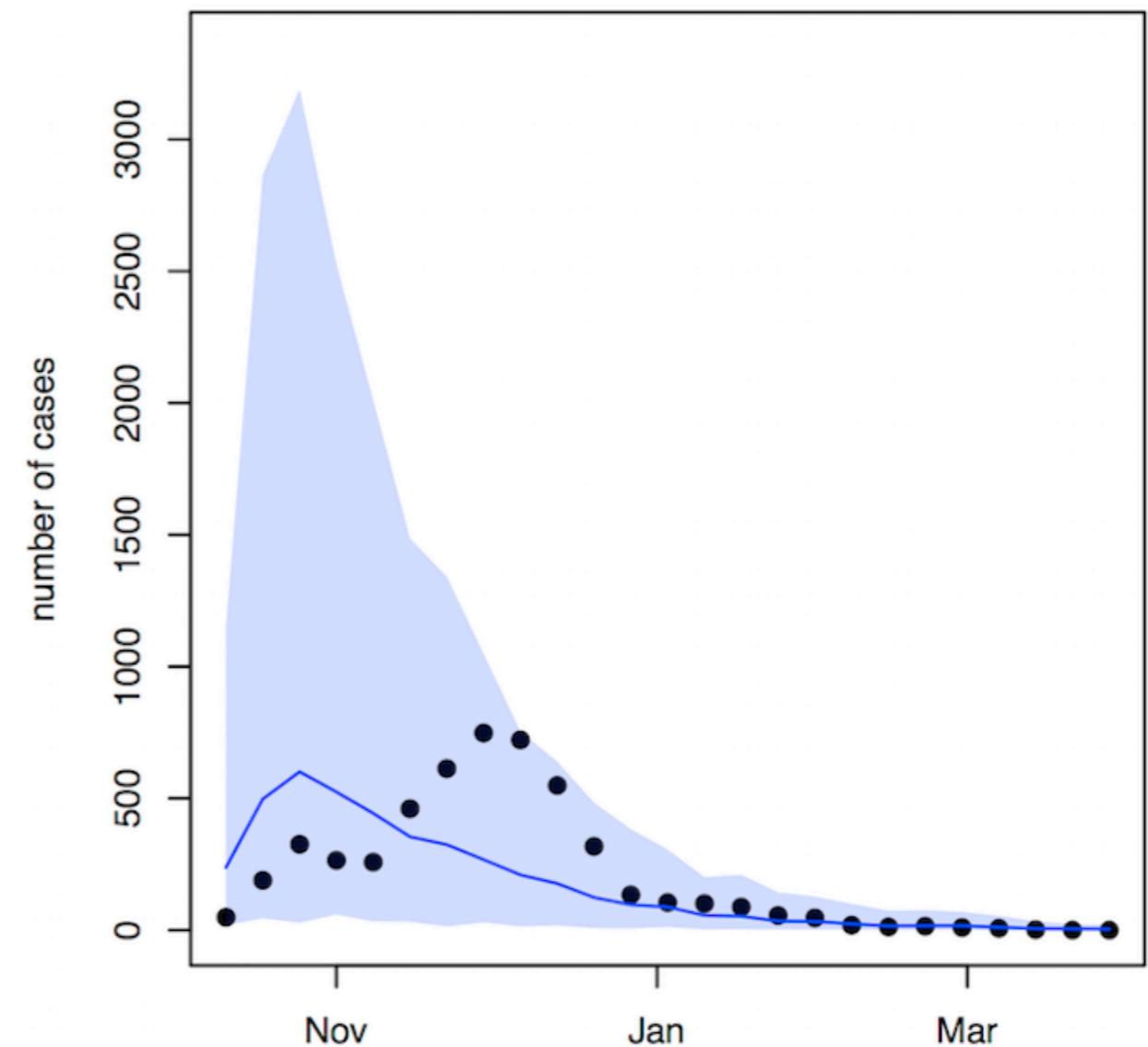
Without serology

Tahiti

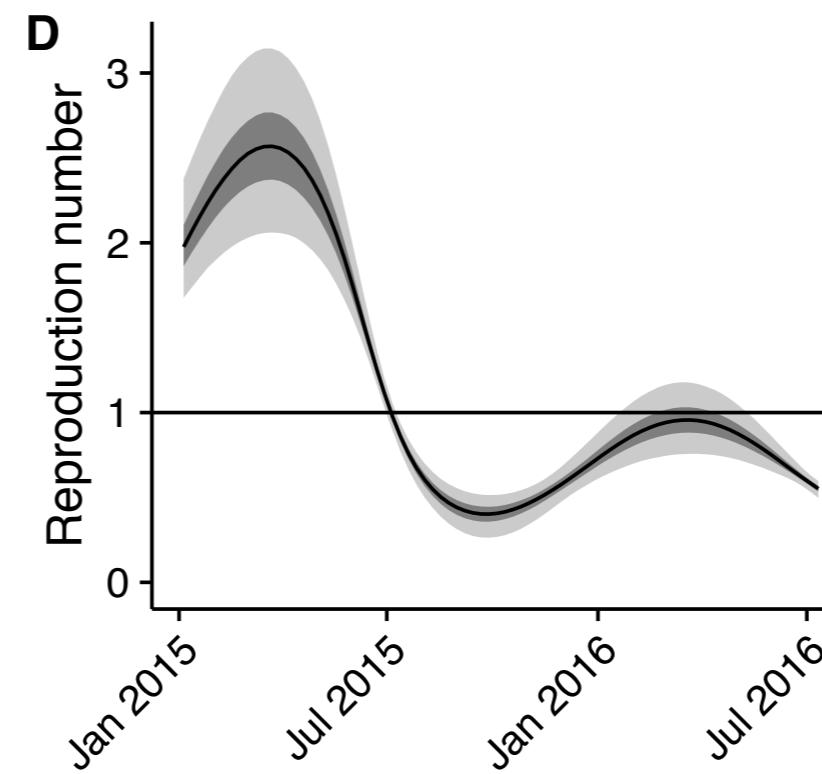
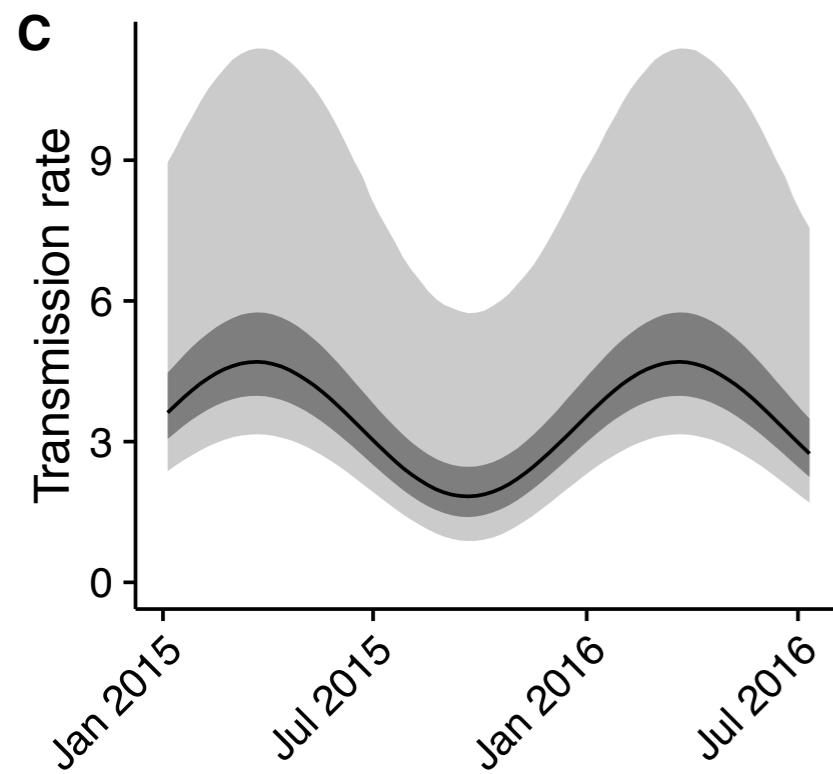
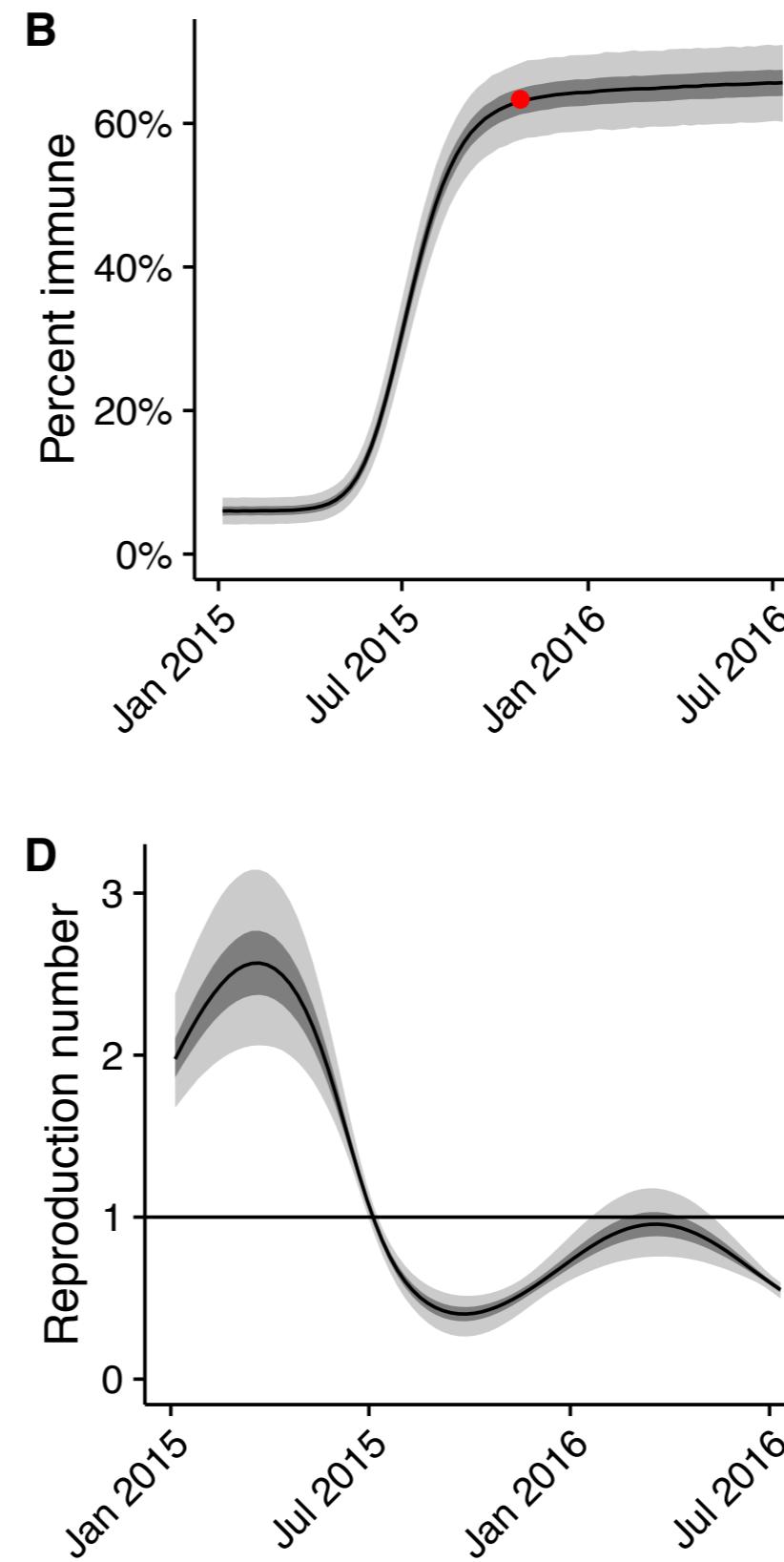
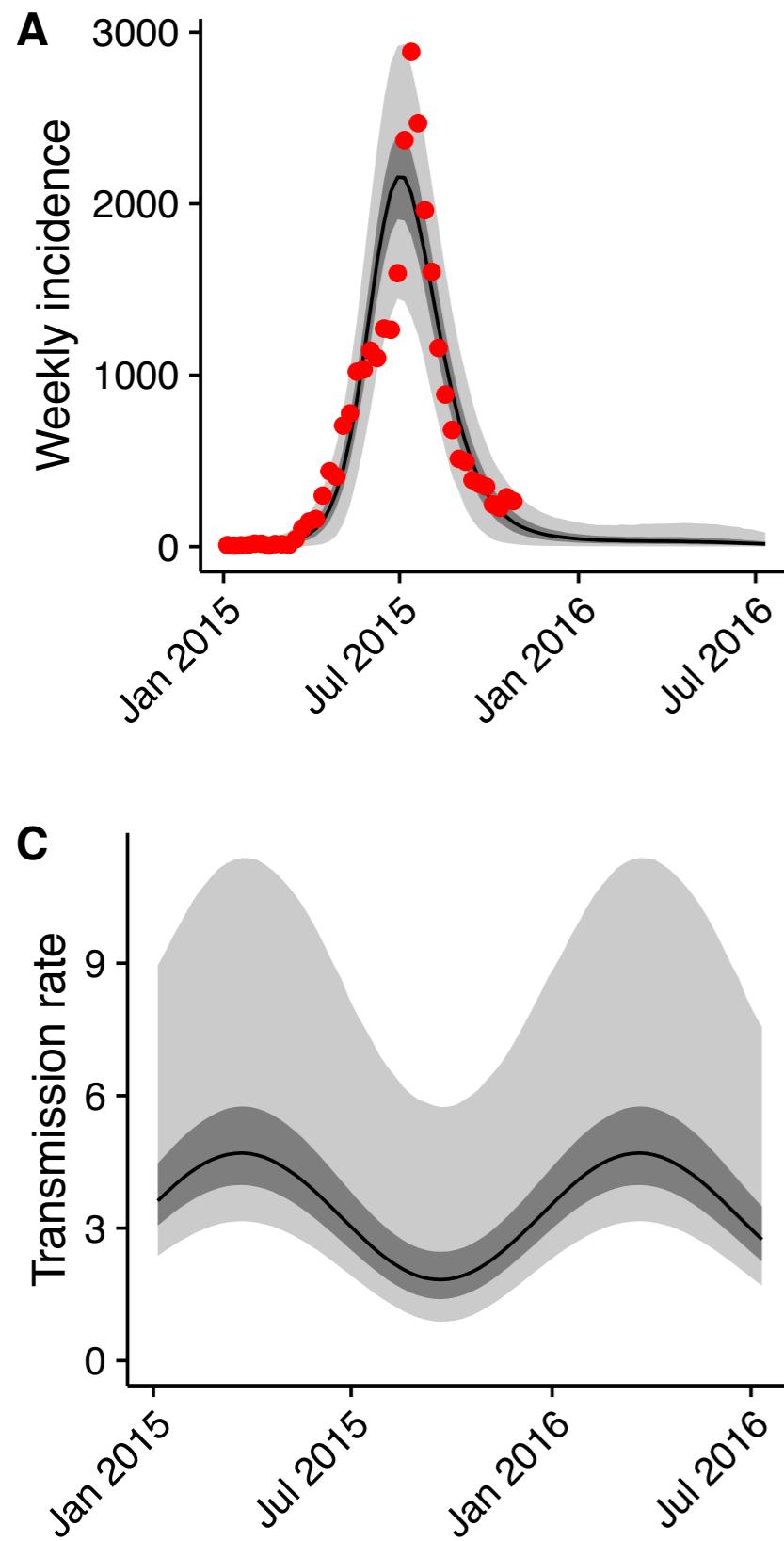


With serology

Tahiti



Zika in Salvador, Brazil



Possible solutions to serology puzzle

- Heterogeneity in risk of **exposure**
- Cross-**immunity**
- Outbreak curtailed because of **other factors**
- Sensitivity of serological **test**

Summary

- Joint inference on multiple outbreaks or multiple data types (case/serology) can help identify parameters and make predictions
- It remains an open question how attack rates and results from serological studies for Zika can be reconciled

Welcome to IDD Jobs

IDDjobs is for posting jobs and PhD opportunities in the fields of transmission modelling, phylogenetics, pathogen ecology, epidemiology, and any topic broadly aligned with infectious disease dynamics.

It's often hard to find these opportunities in one place, and IDDjobs aims to help solve that! [Read more about IDD Jobs.](#)

PhD positions

Description	Institution	Location	Closing date
Postdoc or PhD position: Mathematical Modeling ...	University of Zurich	Zurich, Switzerland	December 26, 2017
PhD position in digital epidemiology of antimic...	ETH Zürich	Zürich, Switzerland	January 01, 2018
Using mathematical modelling to design optimal ...	London School of Hygiene and Tropical Medicine	London, UK	January 14, 2018

<http://iddjobs.org>

Thanks

Pacific Islands

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Christoph Höser
Eduardo Martins Netto
Estela Luz
Gilmara Souza Sampaio
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