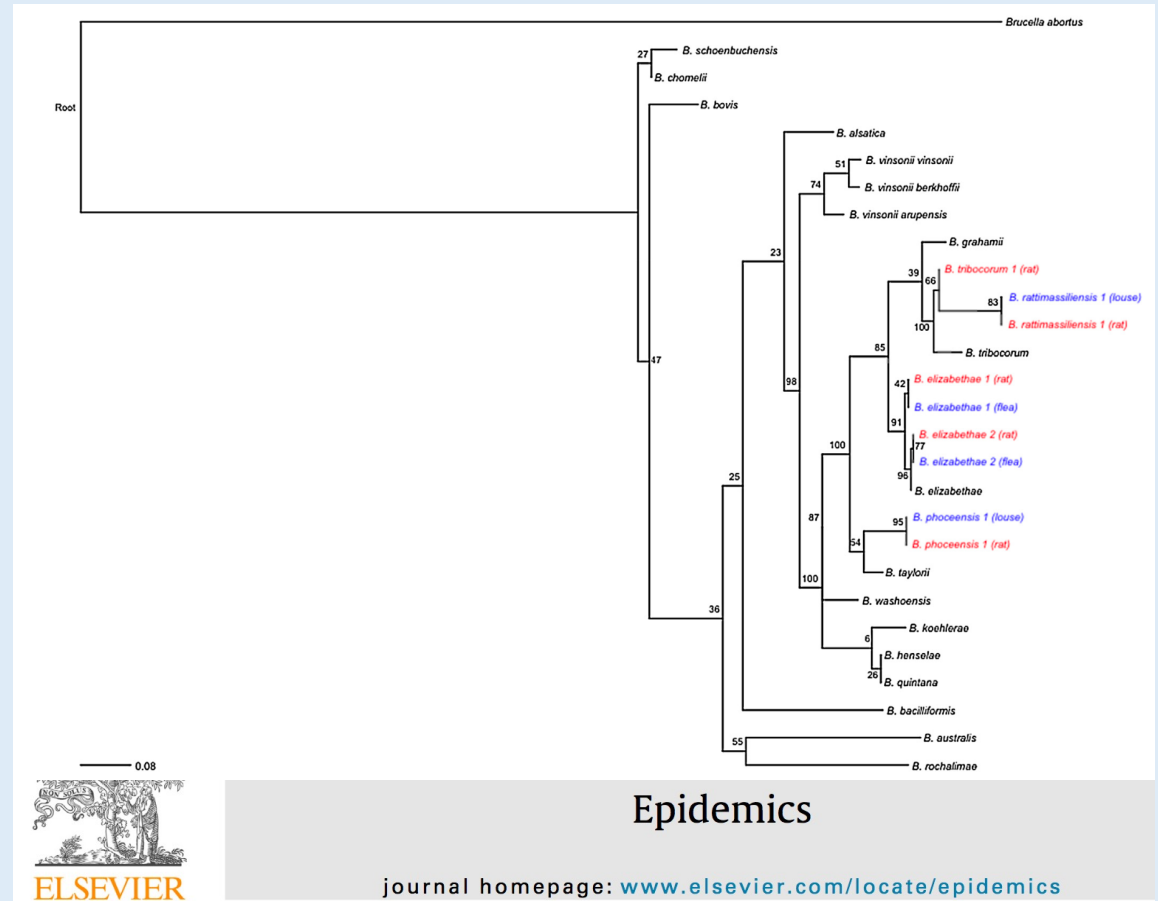


Transmission dynamics and host-parasite-vector relationships in rodent-borne *Bartonella* spp.

- **Background:** *Bartonella* spp. is an erythrocytic bacterial pathogen of Malagasy rodents with different genotypes which could demonstrate unique transmission mechanisms.
- **Statistical Question:** Is the occurrence of *S. fonquerniei* on Malagasy *R. rattus* related to (a) the indoor/outdoor locality in which the rat is trapped, (b) abundance of *E. gallinacea*, and (c) the abundance of *X. cheopsis* on the same rat?
- **Mechanistic Question:** How can we explain the prevalence of different genotypes of *Bartonella* spp. by age class in Malagasy *Rattus rattus*?
- **Acknowledgements:** Christian and Sophia (readers); Gwen (presentation)

Cara Brook, University of Chicago



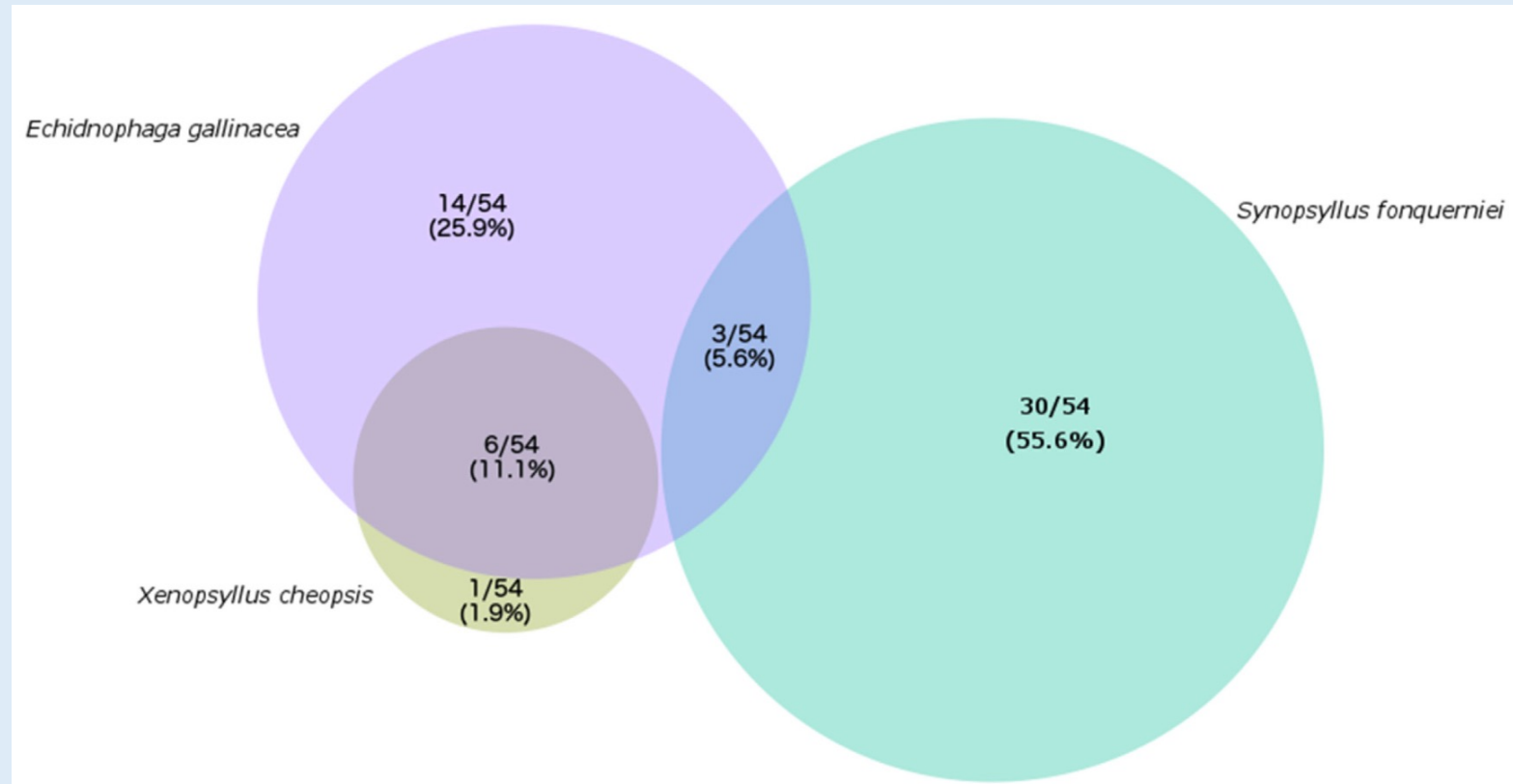
Elucidating transmission dynamics and host-parasite-vector relationships for rodent-borne *Bartonella* spp. in Madagascar

Cara E. Brook^{a,*}, Ying Bai^b, Emily O. Yu^a, Hafaliana C. Ranaivoson^{c,d}, Haewon Shin^e, Andrew P. Dobson^a, C. Jessica E. Metcalf^{a,1}, Michael Y. Kosoy^{b,1}, Katharina Dittmar^{e,1}

Statistical Question:

Is the occurrence of *S. fonquerniei* on Malagasy *R. rattus* related to (a) the indoor/outdoor locality in which the rat is trapped, (b) abundance of *E. gallinacea*, and (c) the abundance of *X. cheopsis* on the same rat?

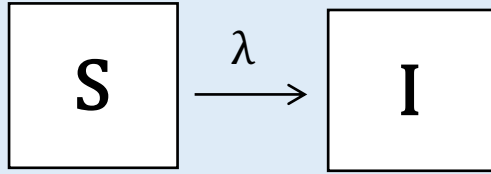
- **Response Variable:** pres/abs *S. fonquerniei*
- **Predictor Variables:** abundance of *E. gallinacea* (numeric); abundance of *X. cheopsis* (numeric); indoor/outdoor locality (factor)
- **Family:** “binomial”
- **Link:** logit
- **Hypothesis:** *S. fonquerniei* occurrence is related to low abundance of *X. cheopsis* & outdoor status locality
- **R code:**



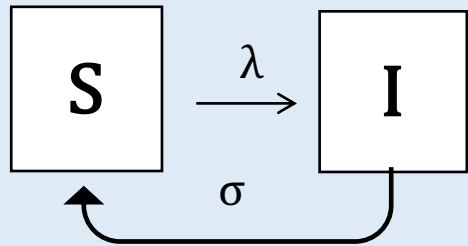
```
glm(pres/abs S. fonquerniei ~ abundance X. cheopsis + abundance E. gallinacea + indoor_outdoor, family="binomial", data = madarat)
```

Mechanistic Question:

How can we explain the prevalence of different serotypes of *Bartonella* spp. by age class in Malagasy *Rattus rattus*?



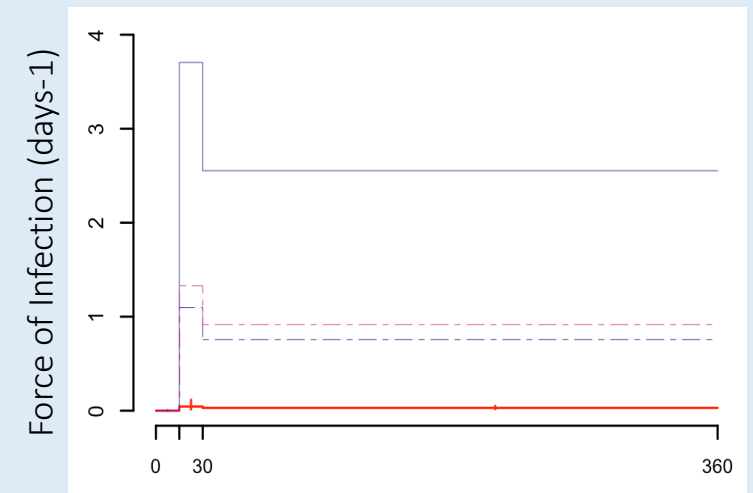
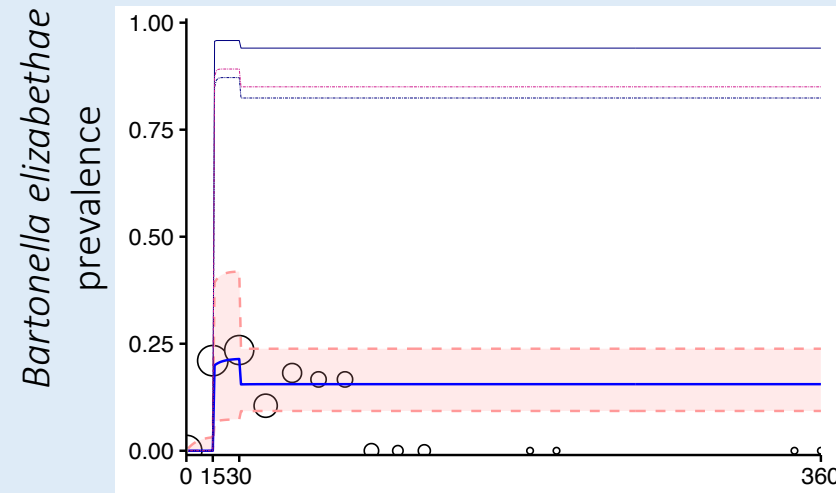
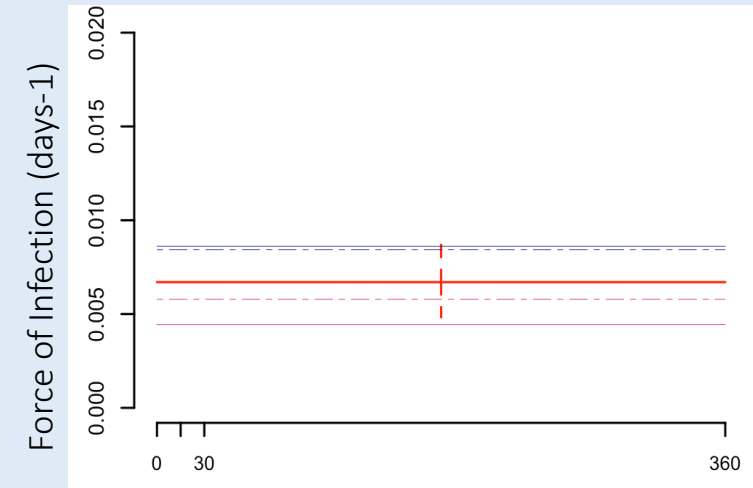
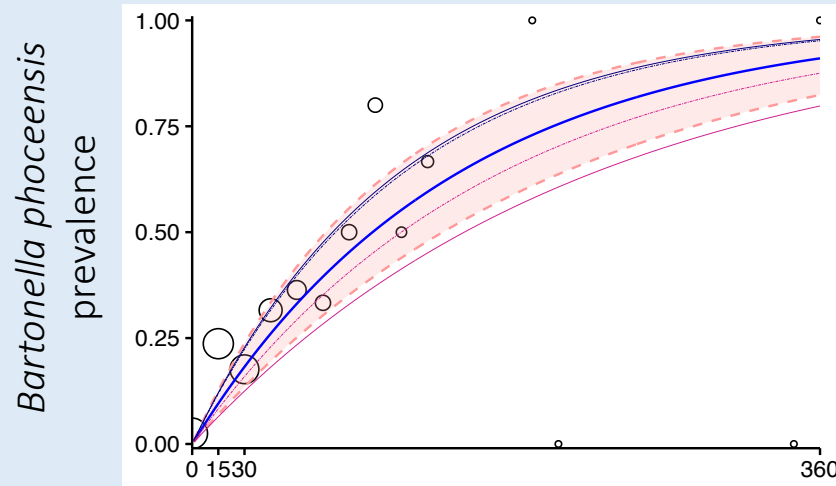
$$\frac{dI(a)}{da} = \lambda(a)(1 - I(a))$$



$$\frac{dI(a)}{da} = \lambda(a)(1 - I(a)) - \sigma I(a)$$

S = susceptible rats
I = infectious rats

λ = force of infection;
σ = rate of waning immunity



Age (days)

Age (days)

Next Steps:

1. Conduct further field studies in lowland regions of Madagascar to determine whether the distribution of *B. elizabethae* is limited to the highland range of *S. fonquerniei*
2. Conduct serological tests on *R. rattus* blood to attempt to identify a whether *Bartonella* spp. negative rats are recovered or susceptible.
3. Fit relevant mechanistic transmission models to age-seroprevalence data.

