Humans, Dogs, and Rats: Does *Leptospira* vaccination in one species influence infection in other species?

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Background

Leptospira

- Zoonotic bacteria shed in the urine of infected hosts (Figure 1).
- ~2.9m DALYs globally[1]

Risk factors for human exposure to *Leptospira* include handling infected animals and water-based activities such as flooded rice farming which make the skin barrier permeable.[2]

Rodents are the primary reservoir of *Leptospira*, however, dogs may play a key role in human infections.[3]

Leptospira dog vaccination is a common public health measure.[3]

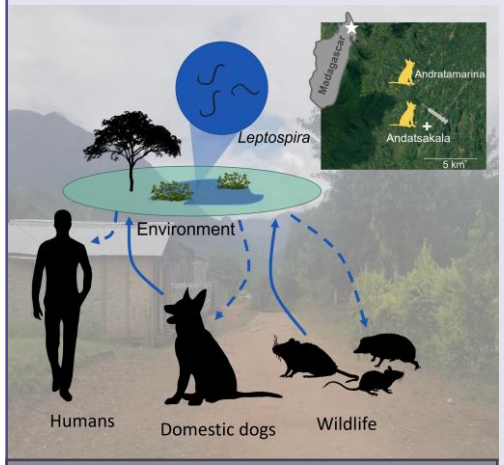


Figure 1: The transmission cycle of *Leptospira*. Inset contains the location of the study locations.

Study sites in northeast Madagascar

- Two villages across seasons:
  - Andatsakala (vaccination)
  - Andratamarina (control)
- Flooded rice farming is the primary activity in both villages.
- 39.2% *Leptospira* prevalence in *Rattus rattus* in a nearby village.[4]

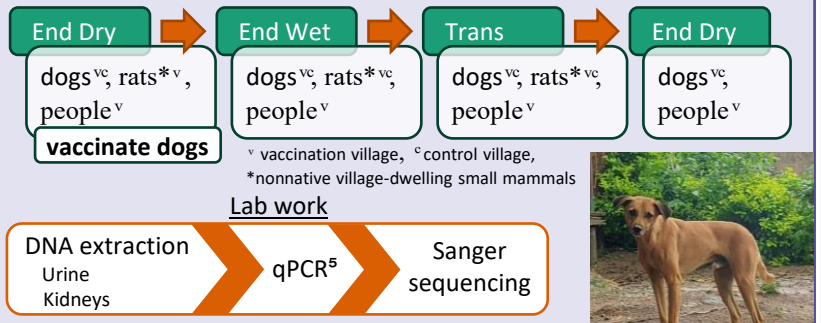
Study aims:

Investigate whether vaccinating dogs against *Leptospira* lowers prevalence in humans and rats.

Elucidate the role dogs play in the northeastern Madagascar multi-reservoir host *Leptospira* system.

Methods

Sampling Schema in Villages



v vaccination village, c control village,
*nonnative village-dwelling small mammals

Lab work

Results – Dogs

>75% of dogs were vaccinated (87 of estimated 115).
The vaccine offered individual-level protection to dogs with only one dog that was negative at the time of vaccination becoming positive in the subsequent 8 months.
Village level prevalence of *Leptospira* shedding in dogs between the vaccine and control villages was not significantly different (χ^2 test, p>0.05) until 1-year post-vaccination; counter to predictions, it was higher in the village with vaccinated dogs (Figure 2). *Leptospira* prevalence in dogs was highest during the End of Dry season. This was earlier than expected, given that *Leptospira* generally cycles with the rainy season.

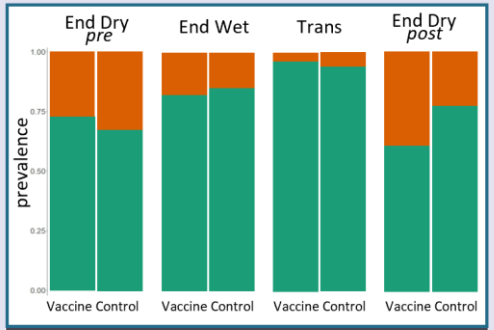


Figure 2: The proportion of dogs in which *Leptospira* was detect of those tested each sampling season in the two villages.

Results – Humans & Small mammals

Human prevalence was highest at the End of Wet season (Figure 3). The spike in human cases lagged the spike in dog prevalence by one season. No significant difference was found in human cases at the End of Dry season pre- and post-dog vaccination. We therefore found no knock-on protective effects in humans from vaccinating dogs against *Leptospira*. In both villages, we found low prevalence in *Rattus rattus* (0.02; 3/145), *Mus musculus* (0.2; 2/9) and *Suncus murinus* (0; 0/33).

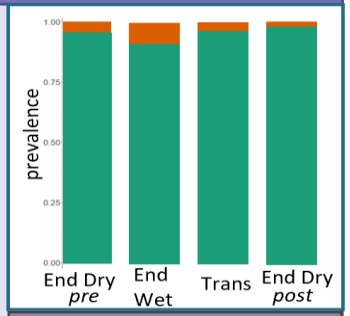
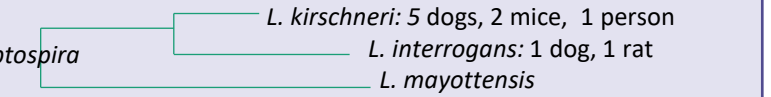


Figure 3: The proportion of humans in which *Leptospira* was detect of those tested during each sampling period

Results – Sequencing



Conclusions

Our study implicated dogs as an important *Leptospira* reservoir in northeastern Madagascar. However, we did not find evidence that our one-off vaccination effort in dogs against *Leptospira* had protective effects for humans or rats. Our findings highlights the need to identify both the reservoir host within a system and to evaluate the efficacy of public health control measures for zoonotic diseases.

Thank you!

This work would not have been possible without the cooperation of people living in Andatsakala and Andratamarina. The sampling effort was led and carried out by locals who also graciously hosted our team.

NIH R01-TW011493-01 UC SANTA BARBARA Duke PIMIT

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