MULTI-HOST MODELLING OF BRUCELLOSIS AT THE WILDLIFE-LIVESTOCK INTERFACE IN THE FRENCH ALPS

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INTRODUCTION

Background

• Brucella melitensis in the Bargy massif, French Alps^[1-3]



METHODS

Build on the modelling method of ^[4]

anses

Step 1

- Estimate λ , the force of infection, from prevalence data^[2], assuming equilibrium
- **Multi-host system** at the wildlife-livestock interface^[2,3] Infection: cattle, ibex, chamois/Exposure: sheep, goats

Scientific question

• Previous studies focused mainly on ibex \rightarrow which hosts maintain and transmit infection?

Methodological aspect

Contact patterns are usually assumed by lack of data^[4] \rightarrow integrate contact data from direct observations

Step 2

Calculate relative contact rates k_{ij} from observations Data: 2131 observations in June-July 2013, every 30 minutes from 6am to 9pm, following ^[5]



Step 3

• Calculate the basic reproduction number *R* with the infectious period D and results from steps 1 and 2 $R_{ij} = \beta_{ij} \cdot D_j = \frac{k_{ij} \cdot \lambda_i^*}{\sum_i k_{ij} \cdot i_i^*} \cdot D_j \ (i_j^* \text{ and } \lambda_i^*: \text{ step } 1 - k_{ij}: \text{ step } 2 - D_j: \text{ literature})$



DISCUSSION



Scientific question

- Maintenance of *Brucella* within the system
 - \rightarrow lbex are the only maintenance hosts ($R_{ii} \geq 1$)
 - \rightarrow They are also essential hosts: without ibex, Brucella could not persist (overall $R_0 < 1$)
- Transmission of *Brucella* to domestic cattle \rightarrow lbex can transmit to cattle without any other hosts → Chamois could transmit to cattle via domestic goats

Methodological aspect

Non-exhaustive direct observations were used to calculate relative contact rates, assuming betweenspecies β_{ij} are proportional to within-species β_{ii}

- Use herds instead of individuals for livestock lacksquare
- Expand to study temporal dynamics after 2013
- Compare results with phylodynamic models?

Ibex are the reservoir^[6] of brucellosis in the multi-host system \rightarrow important in a One Health perspective to protect humans and animals

[1] Mailles *et al.* (2012) *Eurosurveillance* [2] Garin-Bastuji et al. (2014) Emerg. Infect. Dis. [5] Richomme *et al.* (2006) *Epidemiol. Infect.* [6] Haydon *et al.* (2002) *Emerg. Infect. Dis.*

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