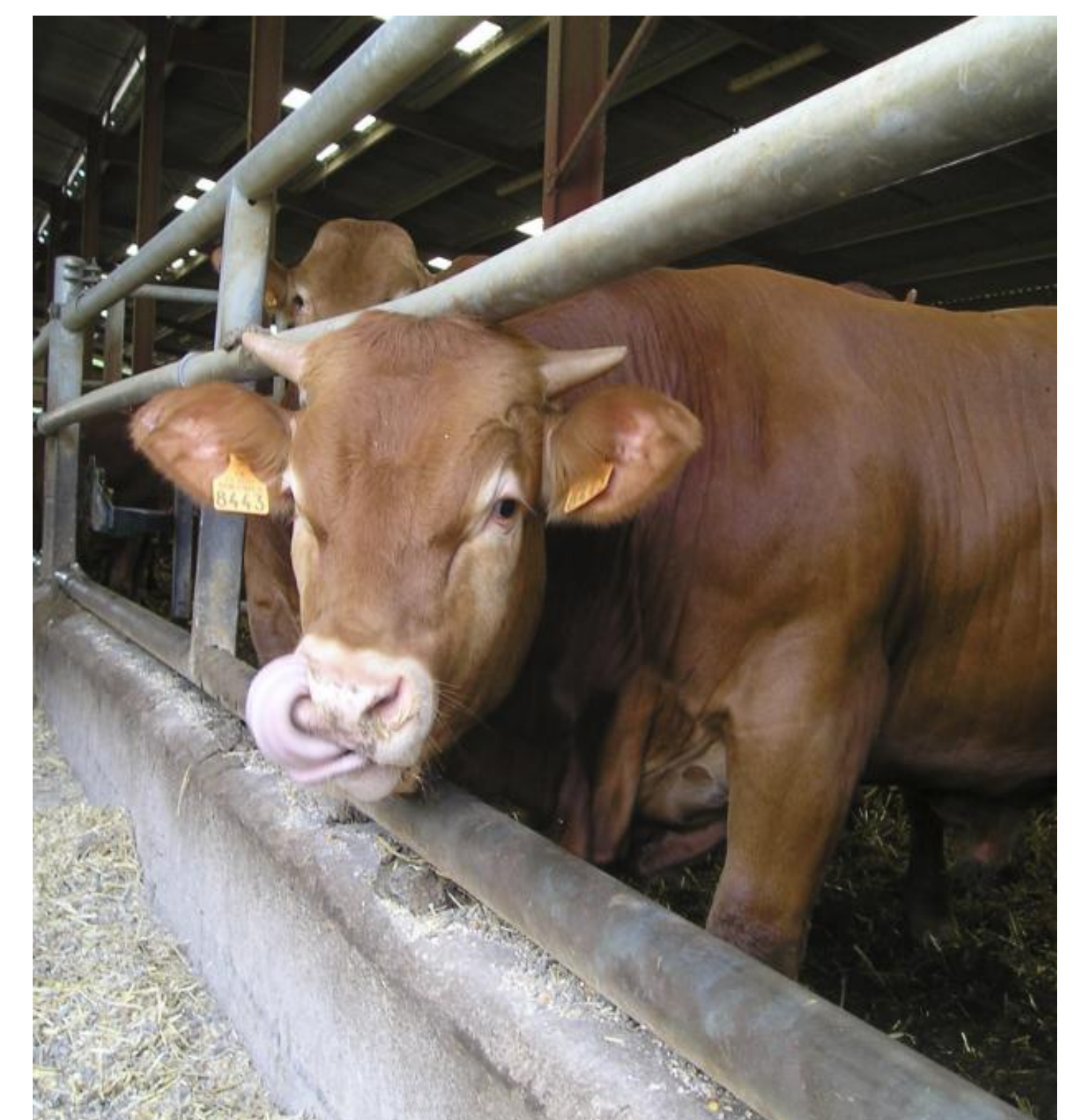
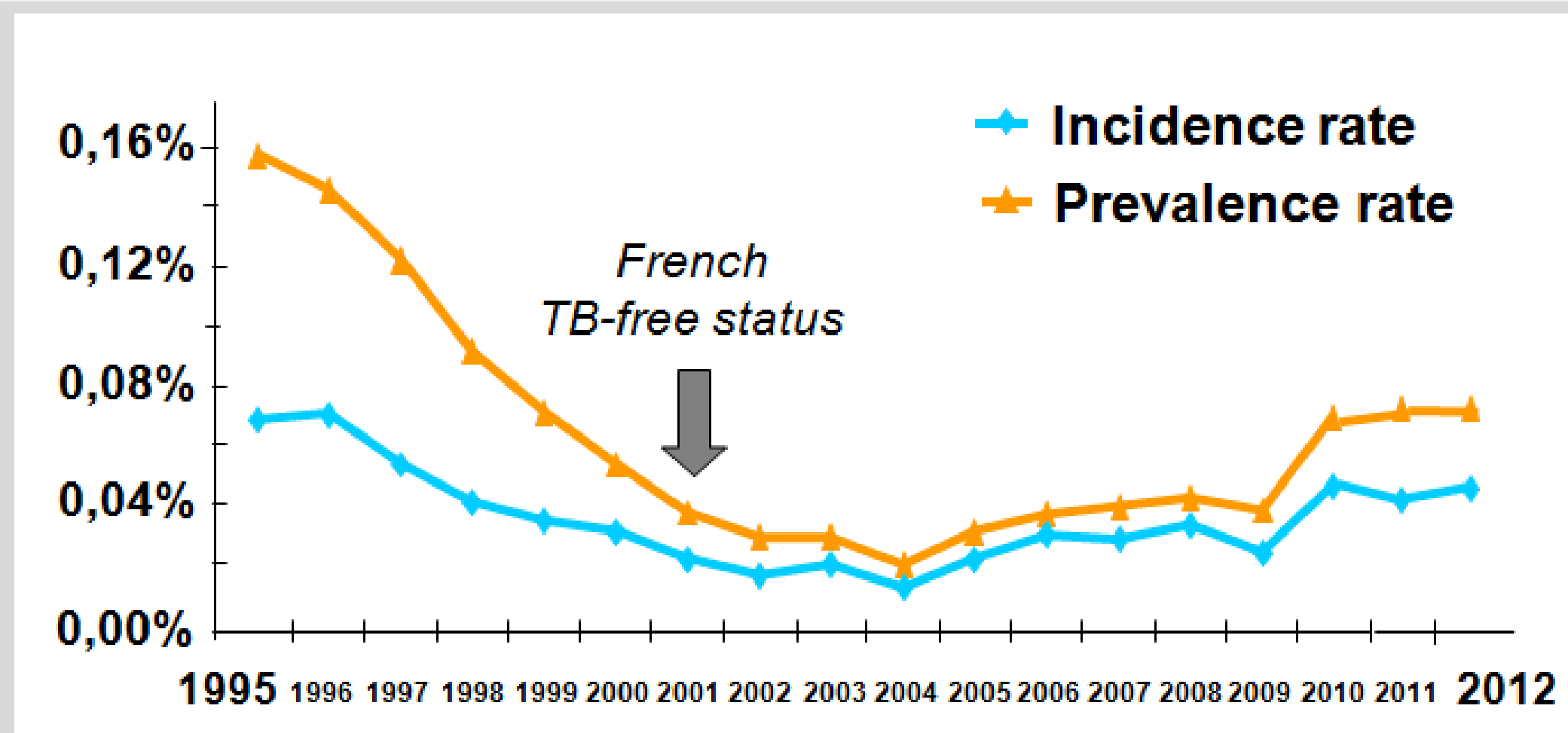


BACKGROUND

France is officially free of bTB since 2001 but the number of cases is currently increasing.



OBJECTIVE

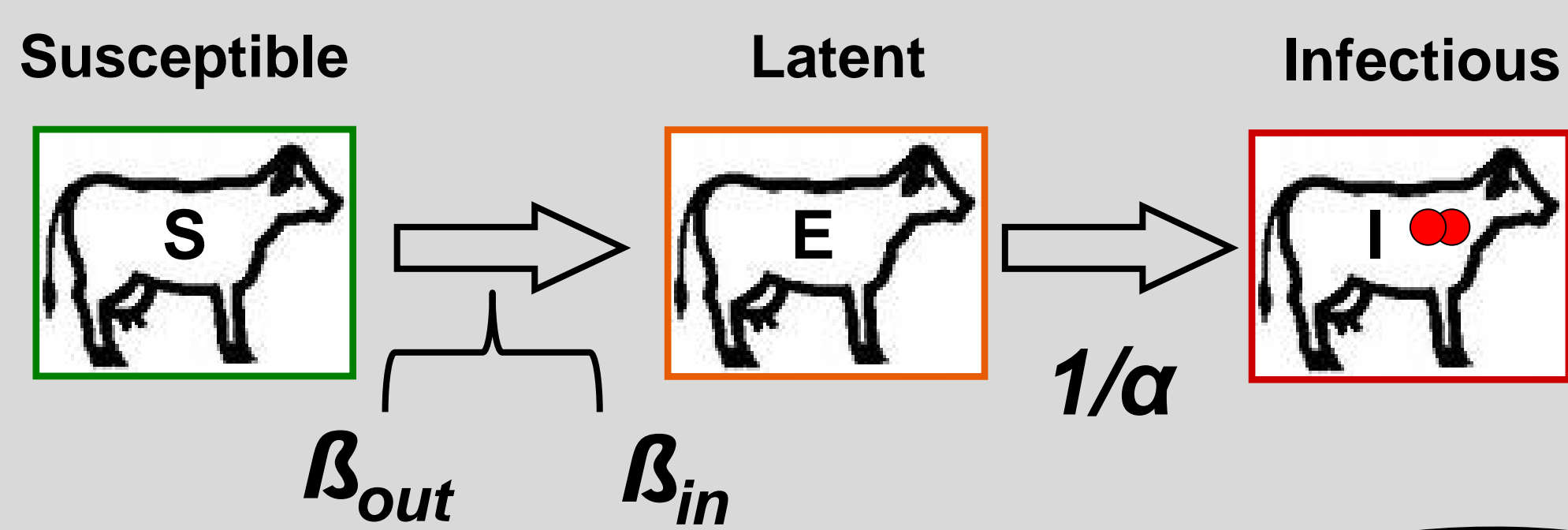
To develop and calibrate a simulation model representing the spread of bTB within a cattle herd

Decision makers want to know the best surveillance strategies to detect an infected herd and the best herd-culling strategies to clean it up.

We need a tool to simulate the within-herd spread of bTB and compare the effectiveness of different surveillance and control strategies.

THE MODEL

We developed a stochastic SEI model. We assumed that only I cows have bTB lesions. Both E and I cows can test positive.



We considered two transmission rates: one at pasture β_{out} and one within farm buildings β_{in} .

We also modeled surveillance schemes and herd dynamics for both dairy and beef herds.

The challenge was to estimate the infection transmission rates β_{out} and β_{in} and the duration of the latent period α (duration in state E).

ESTIMATION OF MODEL PARAMETERS

We had data from 27 infected herds which were wholly culled. We knew for each animal its age, its results to the last skin tests and if it had bTB-like lesions or not.

We used Approximate Bayesian Computation to assess α , β_{in} and β_{out} . The results are in the table below.

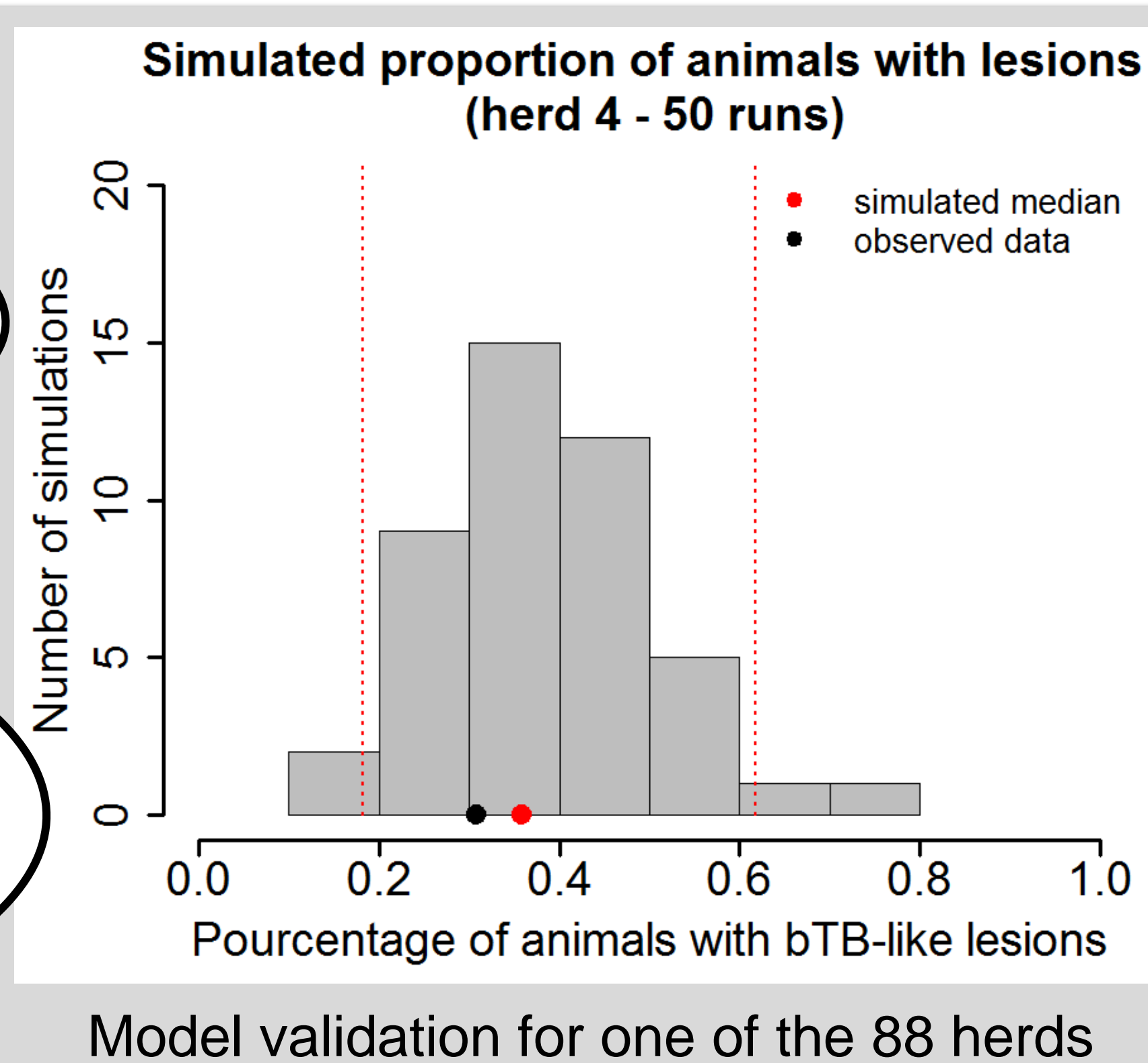
Estimated model parameter	Median	95% credible interval
Latent period duration α	12 months	4-29 months
Transmission rate within farm buildings β_{in}	0.29 month ⁻¹	0.11-0.59 month ⁻¹
Transmission rate at pasture β_{out}	0.14 month ⁻¹	0.01-0.45 month ⁻¹

As a reminder, the ABC concept is to compare observed data with simulated data obtained using randomly chosen parameter values. If observations and simulations data are close enough, parameter values are accepted. Otherwise, they are rejected.

MODEL VALIDATION

We compared the proportion of animals with bTB-like lesions simulated with the model to the ones observed in 88 French infected herds.

In 95.4% of cases, the simulated proportion of animals with lesions was consistent with observations. (observed data point within the simulated 2.5-97.5% percentile interval)



Model validation for one of the 88 herds

CONCLUSION

We have developed a simulation model representing the within-herd spread of bTB.

Simulations are consistent with observed data.

This model will be used to assess the effectiveness of different surveillance and control strategies.

