

# Dairy goat demography and Q fever in the Netherlands

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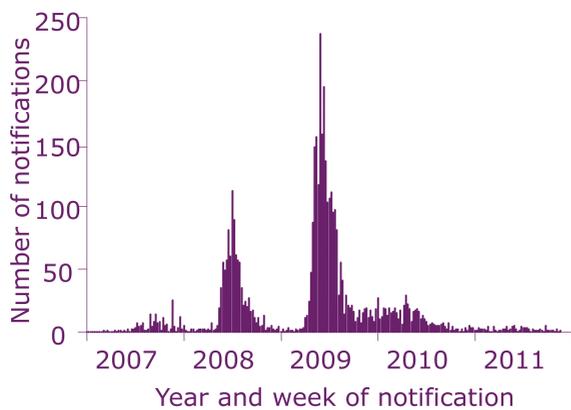
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## Introduction

Between 2007 and 2009, the largest human Q fever epidemic ever described occurred in the Netherlands.



Acute human Q fever notifications, the Netherlands, 1 Jan 2007 – 30 Nov 2011.

One of the putative causes was the intensified goat production system with associated abortion waves on infected farms, which are not seen in cattle herds.

In the Netherlands, dairy goats are commonly kept in larger herds (600-1000 animals) than elsewhere in the world.



However, the influence of herd size and other demographic characteristics typical for goat herds such as seasonality of kidding on the within-herd infection dynamics of Q fever were never studied.



## Question

Can herd demographics alone explain the abortion waves in the Dutch dairy goat herds?

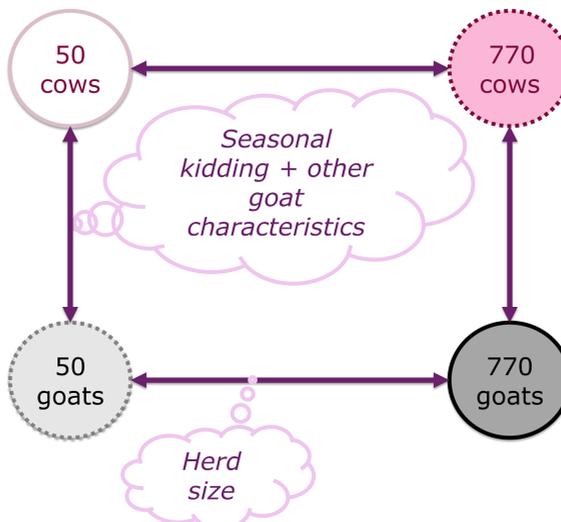
## Materials & Methods

We adapted an existing, fully parameterized model for Q fever transmission in French dairy cattle herds (Courcoul *et al.*, 2011, *Vet Res* 42:68), to represent dairy goat herds in the Netherlands.

The original model represents the infection dynamics in a herd of 50 dairy cows after introduction of a single infected animal; the adapted model has 770 dairy goats. For a full comparison, also herds of 770 cows and 50 goats were modeled.

The effects of herd size and demographic (goat versus cattle) characteristics on the environmental bacterial load and abortion patterns were studied.

## Model simulations



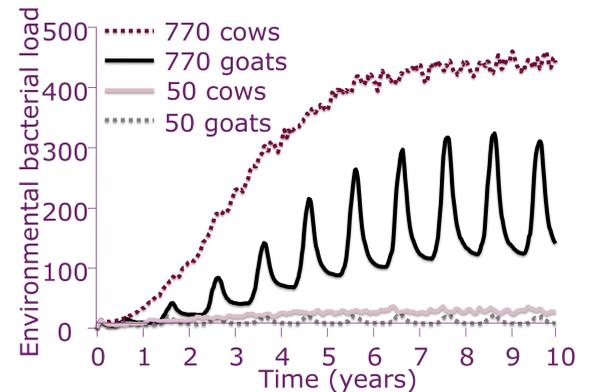
- Four models
- Simulation period 10 years
- Time steps of 1 week
- 100 iterations for each model
- 1 infected animal introduced in a fully susceptible herd at t=0

## Main model outputs

- Within-farm environmental bacterial load, in dimensionless units
- Rolling monthly incidence of abortions, as % of pregnant animals / 4 weeks

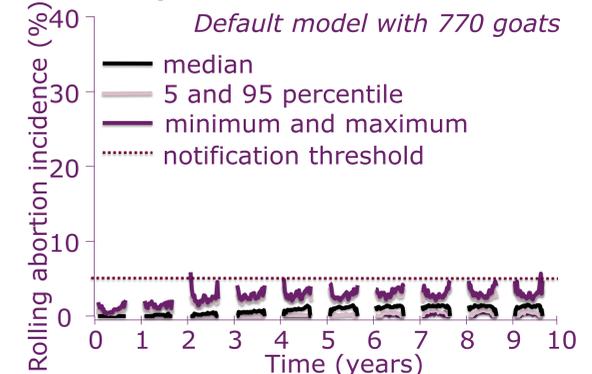
## Results

### Environmental contamination



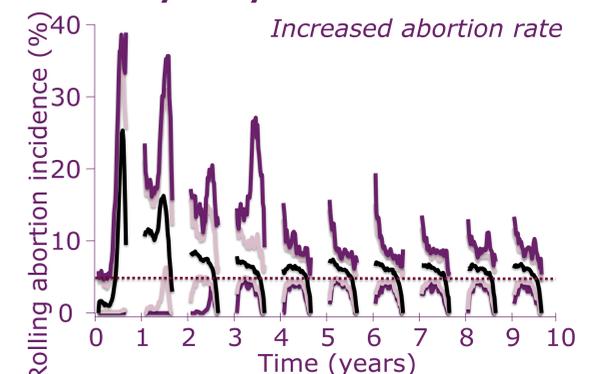
- Higher in large herds
- Seasonal peaks in goat herds
- Higher in cattle herds

### Abortion patterns



- Model: rolling abortion incidence < 5%
- Field observations:
  - most infected herds < 5%
  - some herds 5 – 80 % (in subgroups)

### Sensitivity analysis



An increased abortion rate leads to abortion storms as observed in some herds, but the heterogeneity across herds is not reproduced.

## Conclusions

- Demographics alone could not fully explain the abortion waves in Dutch goat herds.
- Gaps in the current understanding of the drivers of Q fever abortion storms exist, and may hamper prevention.
- Infected cattle herds may have higher within-herd environmental contamination levels than infected goat herds.