

# Simulation of *Salmonella* Dublin infection dynamics in dairy herds



Liza Rosenbaum Nielsen<sup>1</sup>, Anne Braad Kudahl<sup>2</sup>, Søren Østergaard<sup>2</sup>

<sup>1</sup> Department of Large Animal Sciences, University of Copenhagen, Denmark, lrn@life.ku.dk

<sup>2</sup> Department of Animal Science, Foulum, Aarhus University, Denmark

## BACKGROUND

National prevalence of test-positive dairy herds reduced from 26% to 8.3% from 2002 to 2012

Growing demand for decision support for control strategies in the Danish cattle industry to target control options in the remaining infected dairy herds

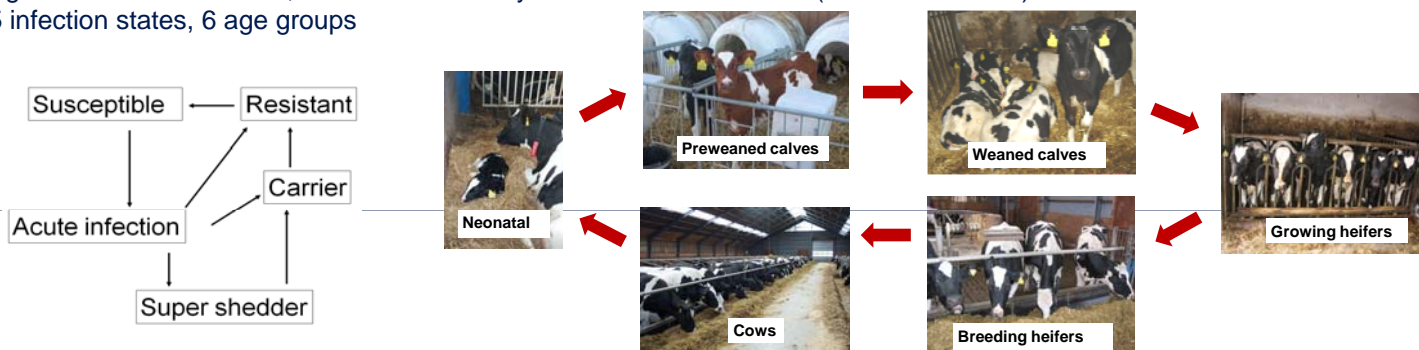


## OBJECTIVE

To construct a simulation model to mimic real life infection dynamics of *Salmonella* Dublin in Danish dairy herds with different herd sizes, hygiene and management levels

## METHODS

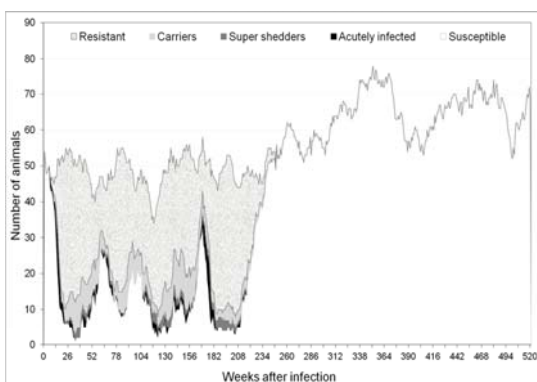
Age-structured stochastic, mechanistic and dynamic simulation model (**Dublin-Simherd**)  
5 infection states, 6 age groups



## Key facts about the modelling and the scenarios

Weekly time steps, 10-years simulations, 1000 iterations + sensitivity analyses  
Infection state probabilities, morbidity, mortality mainly from field data and literature  
Herd susceptibility determined by management. Number of contacts per week determined by hygiene level  
Introduction of infection to a naïve dairy herd by purchase of one acutely, asymptotically infected heifer  
48 scenarios combining 4 hygiene levels, 4 herd susceptibility levels 3 herd sizes (70 cows, 200 cows and 400 cows)

## RESULTS



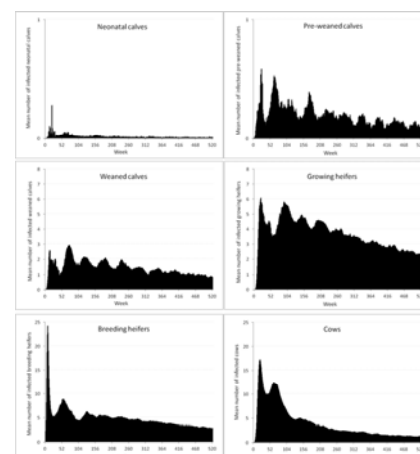
Example of infection dynamics among growing heifers in one iteration out of 1000 in a simulated 200 cow dairy herd

### Reduced hygiene and increased herd susceptibility lead to

- increased probability of spread
- increased duration of infection
- larger epidemic size
- decreased probability of extinction

Common for *S. Dublin* to become endemic – in particular in large herds (>200 cows)

Persistent carriers – but not super shedders – were required in the model to mimic real life infections



Mean number of infected animals in the 6 age groups in 835 iterations with spread of *Salmonella* Dublin in a simulated 200 cow dairy herd. Note the multi-peak patterns, representing repeated waves of infections at approximately yearly intervals