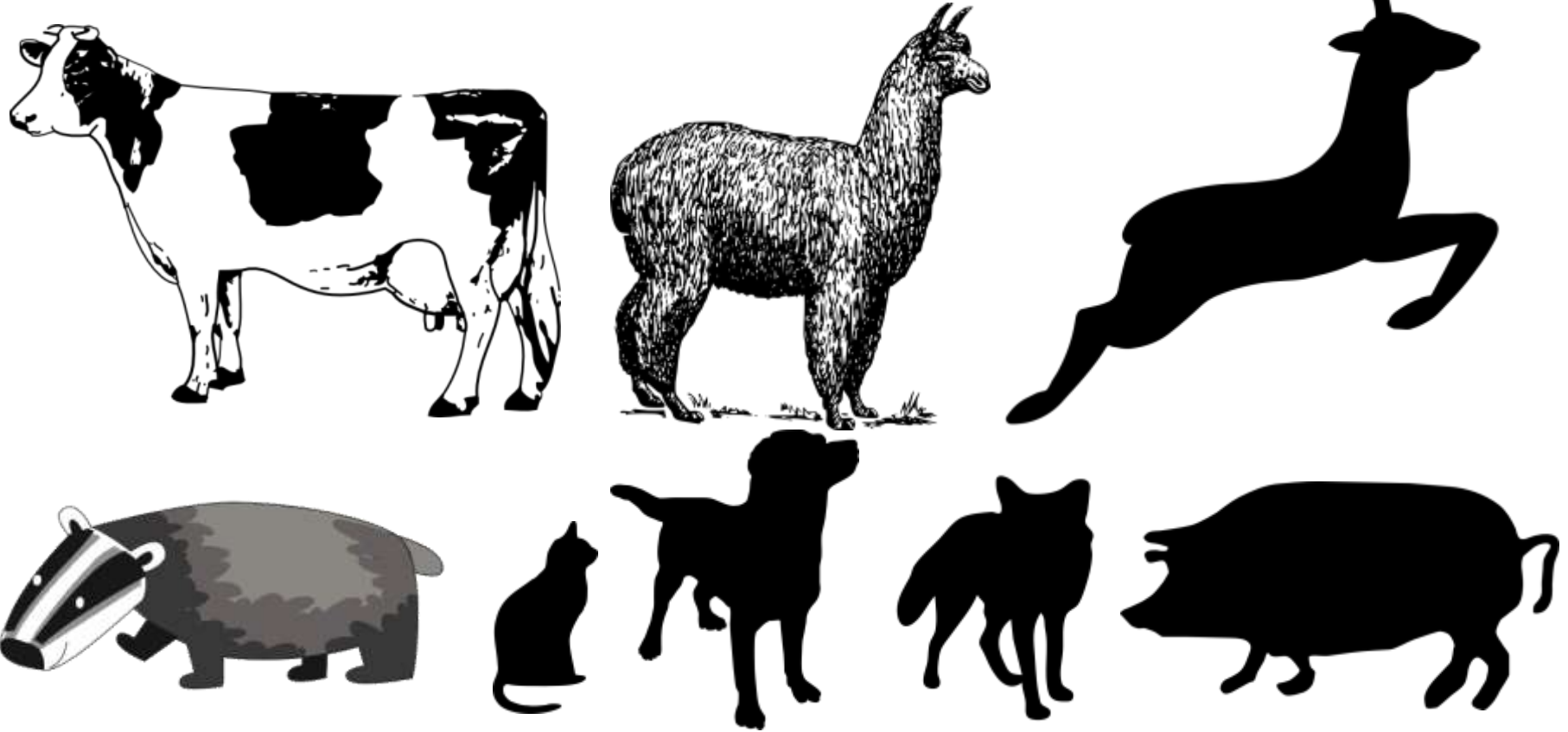


# Magic Bullets or Incremental Gain: what do we need for bovine TB controls?

Andrew Conlan & James Wood

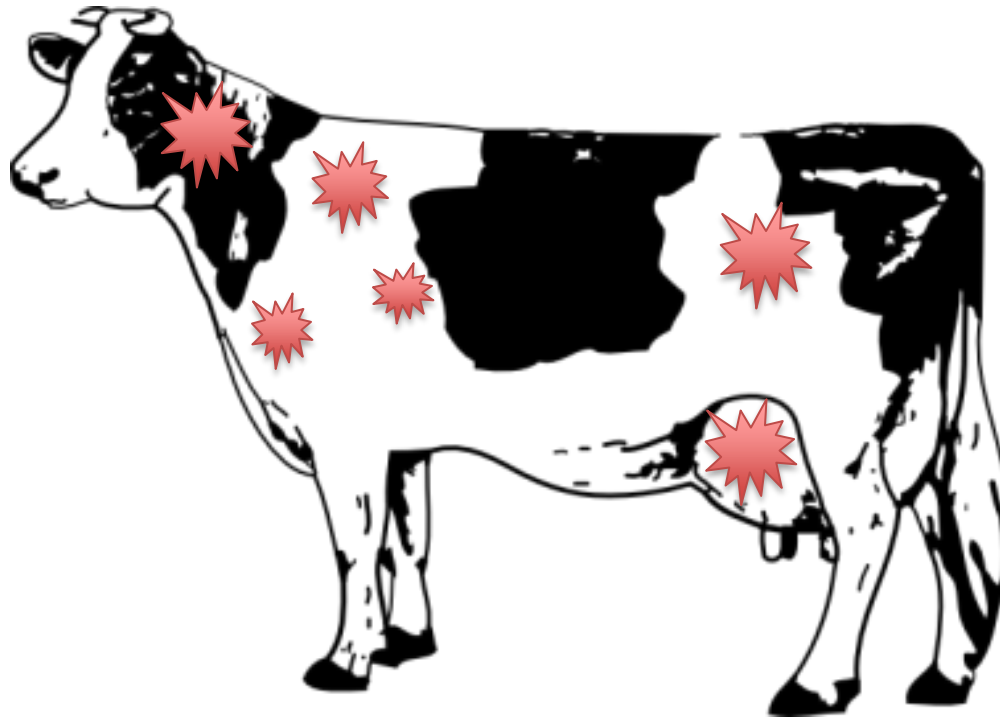
Disease Dynamics Unit  
Department of Veterinary Medicine  
University of Cambridge

# Bovine Tuberculosis is...



An infectious disease of ***cattle*** and other warm-blooded animals

# Bovine Tuberculosis is...



Chronic, progressive and debilitating

# Bovine Tuberculosis is...

“Following infection, the incubation period of tuberculosis ranges from a few weeks to a lifetime.”

Comstock, Livesay and Woolpert AJE 99:2  
131-138

Inconsistent

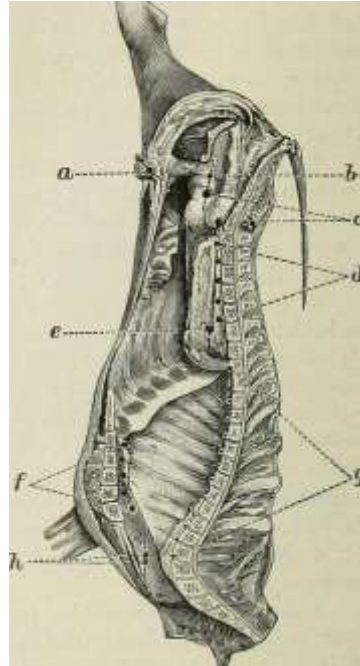
# Bovine Tuberculosis is...

Routine Testing



<http://www.fwi.co.uk>

Meat  
Inspection



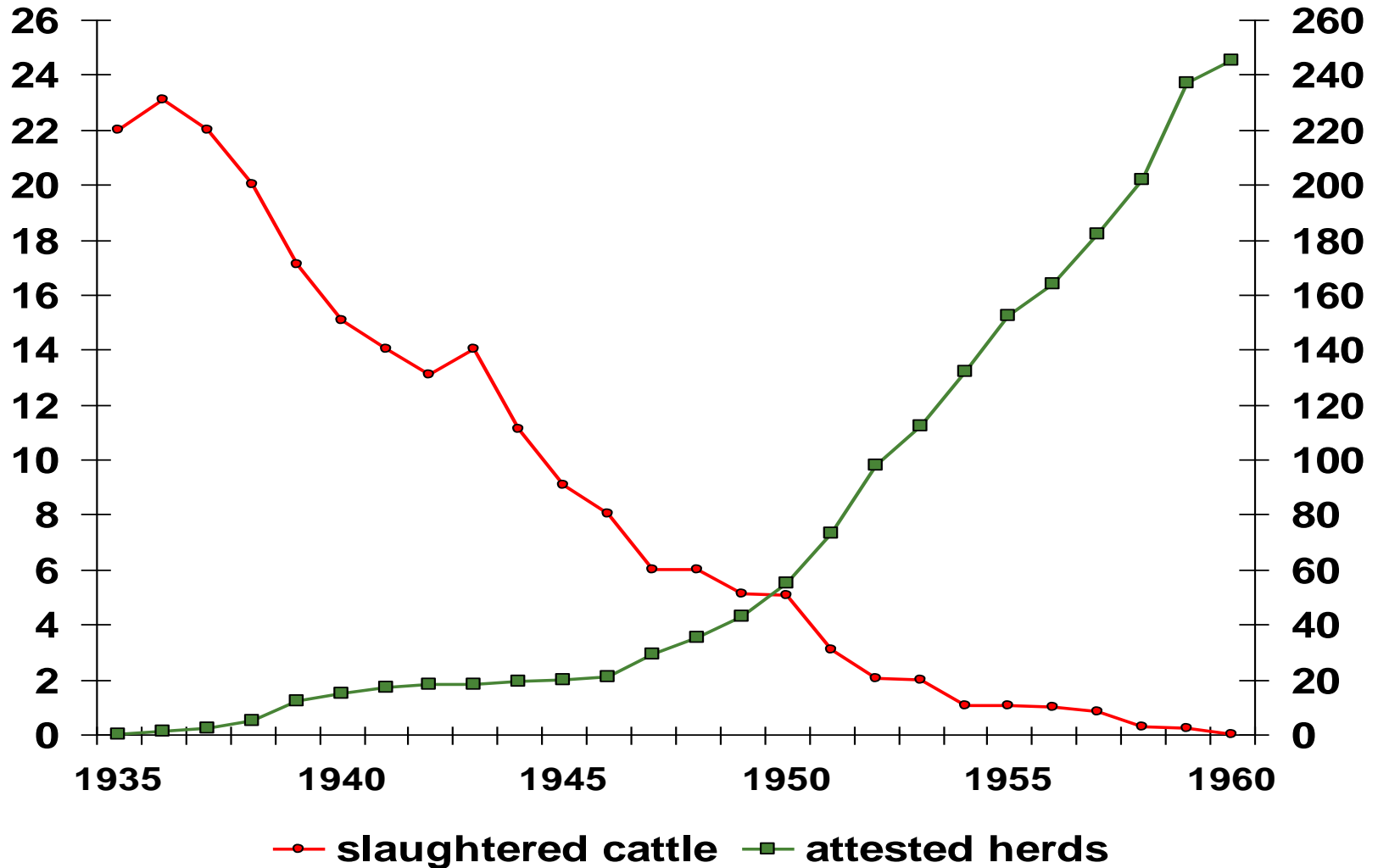
**Managed**

“Breakdown” Testing



<http://www.fwi.co.uk>

# Success of Attestation



# What changed?

## Badger Population

- Badger population density
- Prevalence of bTB in badgers?

## Cattle Population

- Average Herd Size
- Frequency of Cattle movements
- Breed composition

## Controls

- Frequency of Testing
- Potency of Tuberculin?



<http://www.tbfreenland.co.uk>

# Basic Reproduction Ratio

$$R_0$$

“Average number of people an infected person infects when the whole population is susceptible”

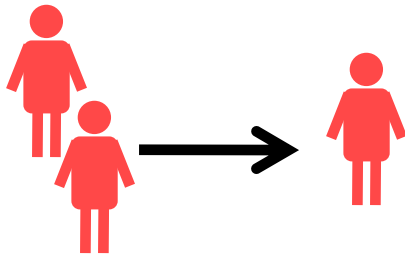
Mathematical concept that captures the potential for a disease to spread



# Basic Reproduction Ratio

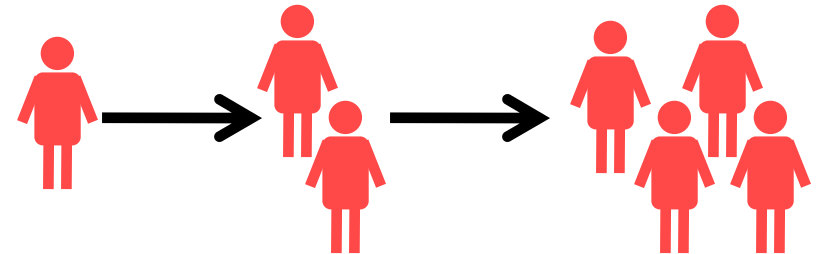
$$R_0 < 1$$

Cases **decrease**  
each generation



$$R_0 > 1$$

Cases **increase**  
each generation



Mathematical concept that captures  
the potential for a disease to spread

# Estimates from cattle *only*

## Within Herd

- O'Hare et al. (2014)
  - High risk area
  - Low risk area
- Conlan et al. (2012)
  - All risk areas
  - Herd Size dependent

**$R_0$**

**1.3-1.9**

**0.6-1.4**

**0.48-2.67**

**(Average 1.27)**

## National Level (with control)

- Cox et al. (2005)
- Brooks-Pollock et al. (2013)
  - Dairy animals
  - Beef animals

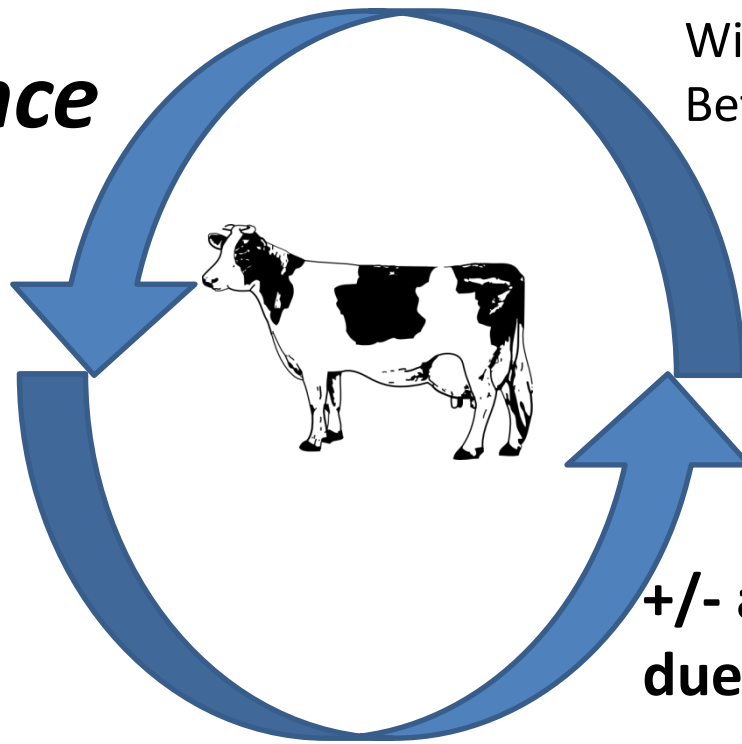
**$R_{Eff}$**

**1.11**

**> 1.03**

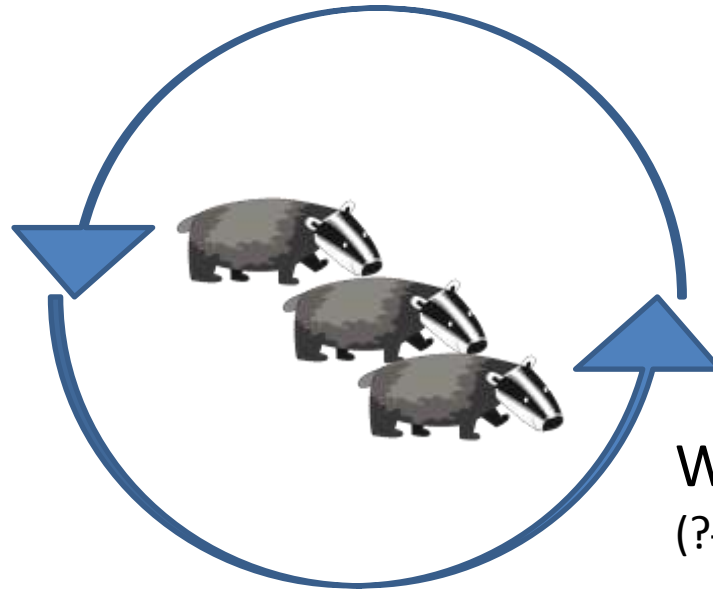
**> 1.015**

***In low incidence  
areas  
(Scotland)***



Within herd transmission  
Between herd transmission

**+/- all cattle breakdowns  
due to cattle transmission**

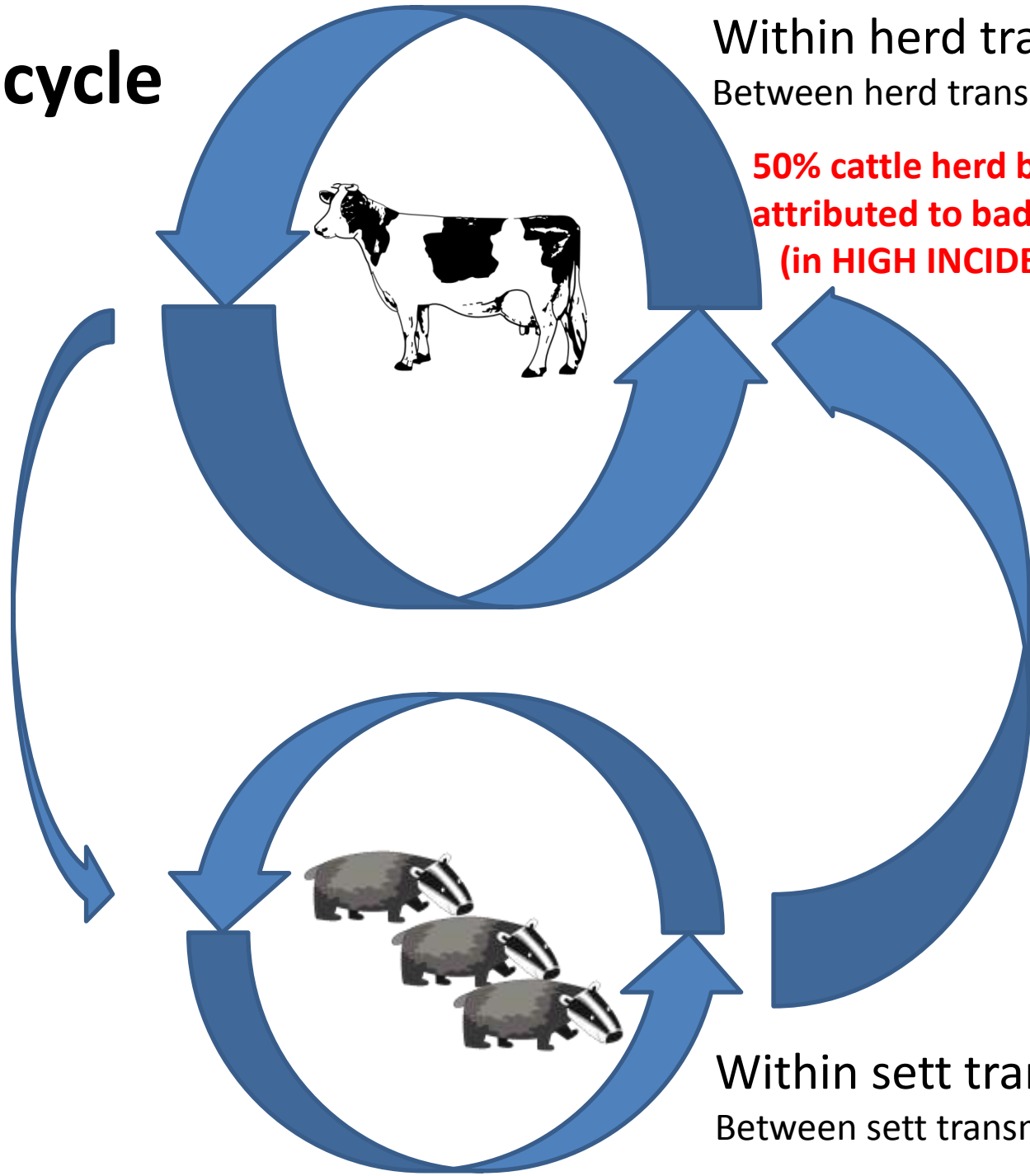


Zero or very low incidence

Within sett transmission  
(?Between sett transmission)

# *M. bovis* cycle

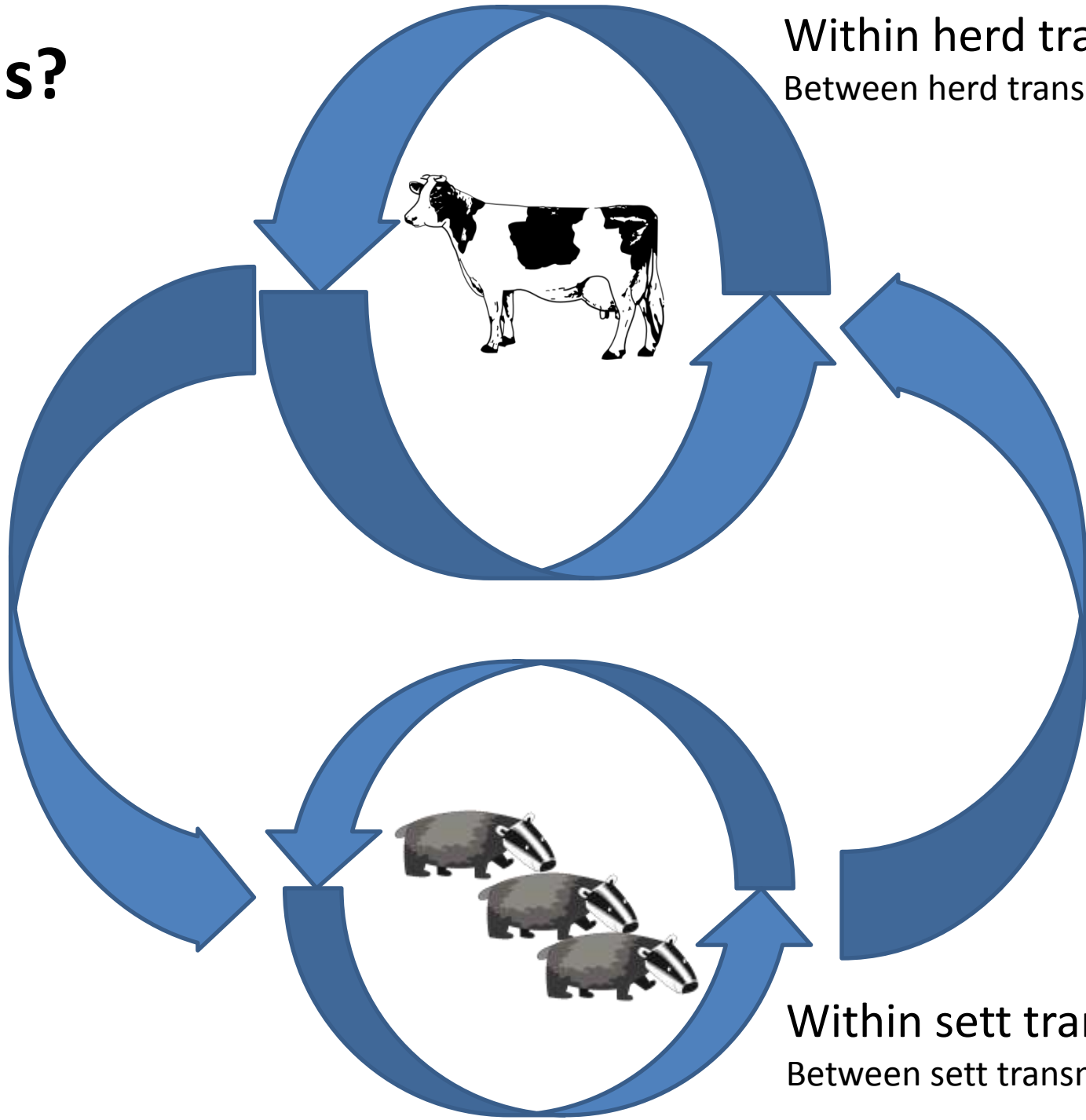
Cattle to badger transmission  
*(never estimated)*



Within sett transmission  
Between sett transmission

**Or this?**

Cattle to badger transmission  
*(never estimated)*



Within sett transmission  
Between sett transmission

# Magic Bullets?



## Wildlife control

- Pro-active culling
- Reactive culling
- Vaccination

## More Cattle Controls

- Increased frequency of testing
- Longer movement restrictions
- New diagnostic tests
- Stricter bio-security
- Vaccination

## Behavioural incentives

- Stakeholder responsibility
- The attestation era
- Post-movement testing

