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Does long-term vaccination eliminate leptospiral shedding?

A "test of concept" study in pastoral dairy cattle

Peter Wilson, Cord Heuer, Jackie Benschop, Julie Collins-Emerson, Jenny Weston, Jennifer Parramore and Ruth Meenks

Institute of Veterinary, Animal and Biomedical Sciences
Massey University
New Zealand

THE ENGINE OF THE NEW NEW ZEALAND

This presentation

- Background
  - Lepto in NZ livestock
  - Vaccine and Vaccination programme efficacy
- Test of concept study
  - Elimination of lepto in dairy cattle?

Leptospirosis in New Zealand livestock

- Dairy cattle
  - 1970s, most herds +, ~80% cows (prior to vaccination)
  - **BUT:** No recent data
    - Should be low due to vaccination
- Beef cattle, sheep and deer
  - >80% farms, ~50% animals
- Vaccination
  - Dairy
    - ~95% herds:
    - some for >30 years
  - Beef and deer
    - ~10% herds




Are vaccines efficacious? - *Urine shedding*

- 2012 review: 25 studies: Cattle (22), deer (2), Sheep (1)
  - Variable
    - Challenge
      - » Artificial and natural
    - Routes
    - Doses
    - Serovar/s
    - Timing and time intervals
    - Vaccines
    - Animal numbers
    - Age
    - Prior exposure
    - Detection method
    - Etc.!!!

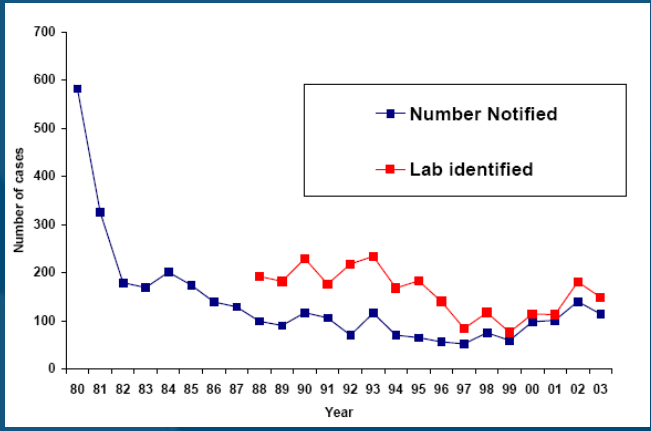
A typical meta-analysis!

Are vaccines efficacious? - *Urine shedding*

- Review range: 0 - 100%!!!
- ≥ ~70% in natural challenge situations
- Cattle and Deer (NZ)
  - Infected herds
    - Deer: 44% ↓ no. shedding, Cattle: 38%
  - If animals vaccinated before natural challenge
    - Zero shedding in some studies

The real question is effectiveness of long-term vaccination programmes rather than vaccine *per se*

Does dairy cattle vaccination reduce human disease?



- Difficult question because of confounding
- Reduced incidence after vaccination
  - from late 1970's
- 1980's surveys
  - Lower rate in workers with vaccinated herds
  - Lower rate in regions where dairy companies mandated vaccination
- Smaller proportion of current cases are dairy farmers
- Dairy-only vets at lower risk of sero-positivity

Cattle vaccination appears to reduce human disease.
Likely due to reduced shedding

Does long-term vaccination eliminate shedding?

Pilot study: Methodology

- 44 dairy herds, 2 seasons
  - Vaccination 5 – 25 years
    - 4 vaccine formulations
  - 3 regions
- 10 (8 – 12) urine samples/herd
  - Adult cows
  - Opportunistic mid-stream urination
- RT-PCR (all samples) and DFM (34 herds)
- Questionnaire
  - Farm/herd details, vaccine and vaccine use

Results:
Urine DFM and PCR

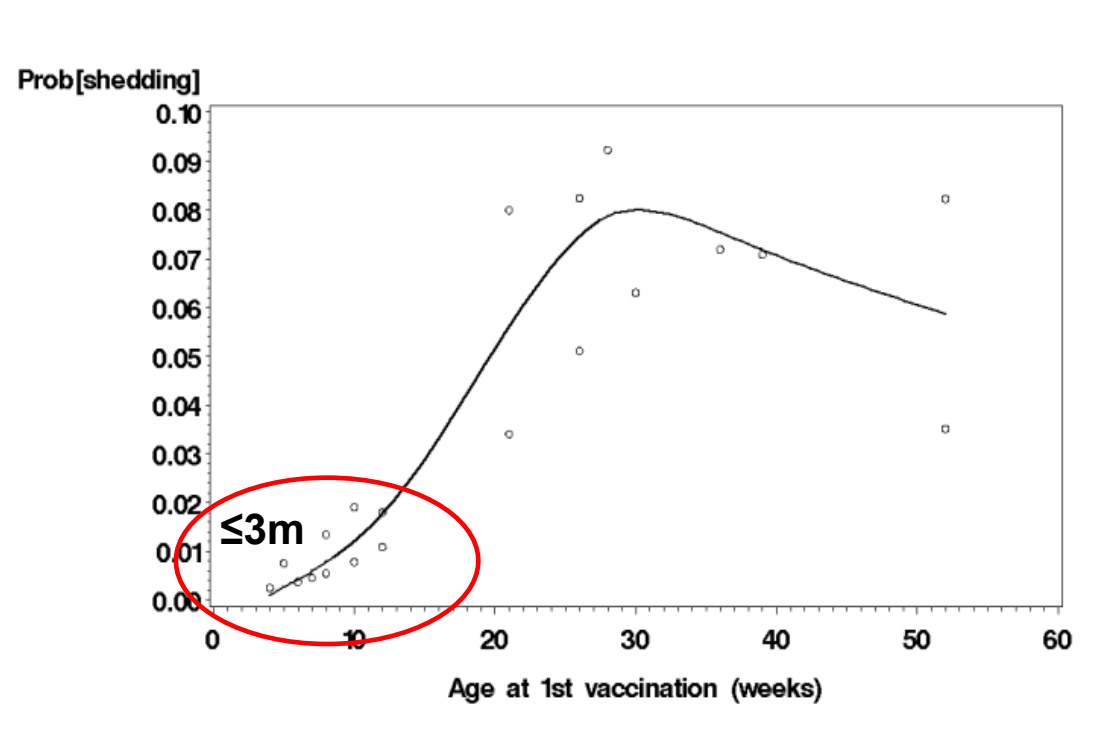
	DFM	RT-PCR	Combined	
			No.	%
Herds	6/34	8/44	13/44	30
Cows	6/347	12/445	18/445	4
Pos. cows in pos. herds	6/62	12/82	18/134	13.5

Multivariable analysis: probability of shedding

- Not associated with:
  - Vaccine brand name or type
    - bivalent/trivalent/7-in-1
  - No. of serovars in vaccine (2 or 3)
  - Booster interval
  - Herd size
  - Other animal species
  - Biosecurity

- **BUT:** Associated with timing of first vaccination

Probability of shedding vs, timing of first vaccination



Approximately 6x higher probability of shedding if vaccination starts ~6 months c.f. < 3 months (p = 0.04)

Discussion: study robustness

- Pilot: test of concept study
- Limited power
- Non-random selection of herds/animals
- Accuracy of farmer recall/response
  - E.g. unknown vaccine type
- No culture for serovar identification
- PCR and viable/non-viable urine leptospires

But:

- Positive samples in both years

- Plausible effect of age at first vaccination

Conclusions

- Evidence of shedding
  - Despite long-term vaccination
  - Low incidence
  - Vaccines *per se* not implicated
- Hypothesis generated:
  - Timing of vaccination is critical
- Result prompted vet/industry re-think
  - What is needed to achieve a better result?
  - Best practice guidelines: holistic approach

Essential data:

- *Maternally derived antibody w.r.t. vaccine timing*
- *On-farm confirmation that early vaccination actually works!*

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