Effects of vaccination programs on *Mycobacterium avium ssp. paratuberculosis* (Map) fecal shedding and serological response in height French dairy herds.

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Introduction

- **Paratuberculosis : control in infected herds**
  - Test and cull, hygiene : long term, restrictive, often not very effective
  - Genetic selection towards resistance : promising in some breeds, several years (decades) to be effective
  - Vaccination

- **Vaccination efficacy**
  - Numerous vaccines, inactivated or live attenuated
  - Vaccination in very young animals (< 1 months)
  - Overall positive production / epidemiological effects (Bastida and Juste, 2011)
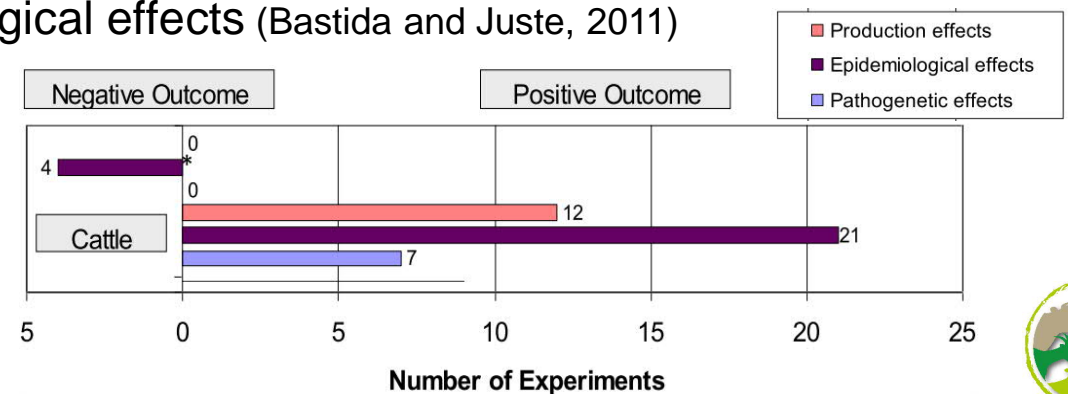
- ## Silirum® vaccine
  - Inactivated 316F Map strain
  - Licensed in France since end of 2014
  - Very few (and potentially biased) fields studies on production and epidemiological effects
    (Juste et al, 2009, Alonso-Hearn et al, 2012)
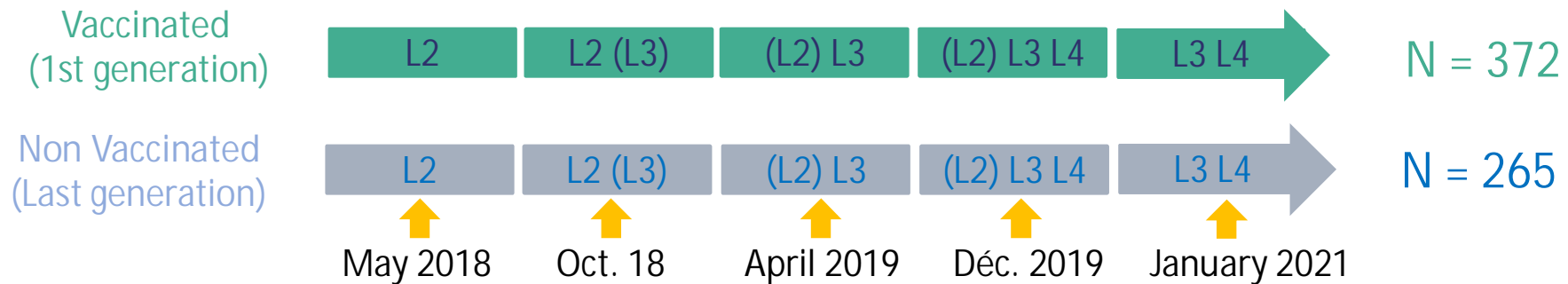 - In practice, not all calves are vaccinated within 1 month of age

- Evaluation the effects of Silirum® vaccination in French dairy herds infected with Map
  - On the probability of Map fecal shedding
  - On the Map fecal shedding load

  - Effect of age at vaccination

- **Herds, animals and sampling scheme**
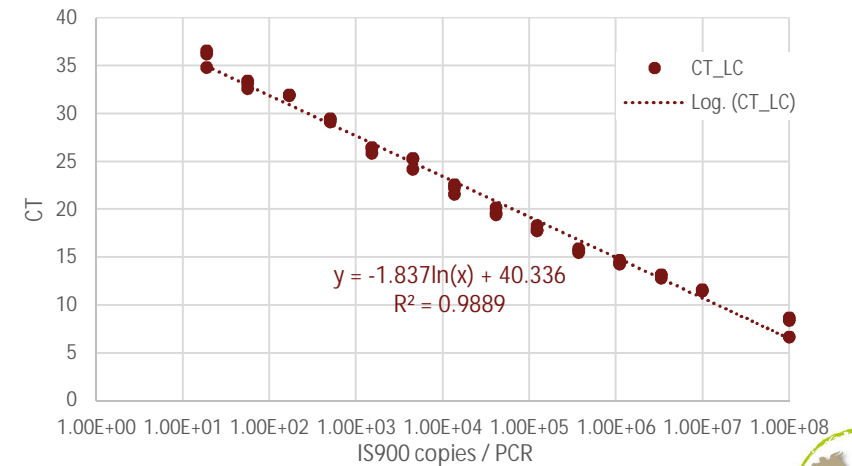 - 8 dairy herds in Meuse France
    - voluntary basis
    - infected with Map > 5 years
    - involved in a control plan including vaccination
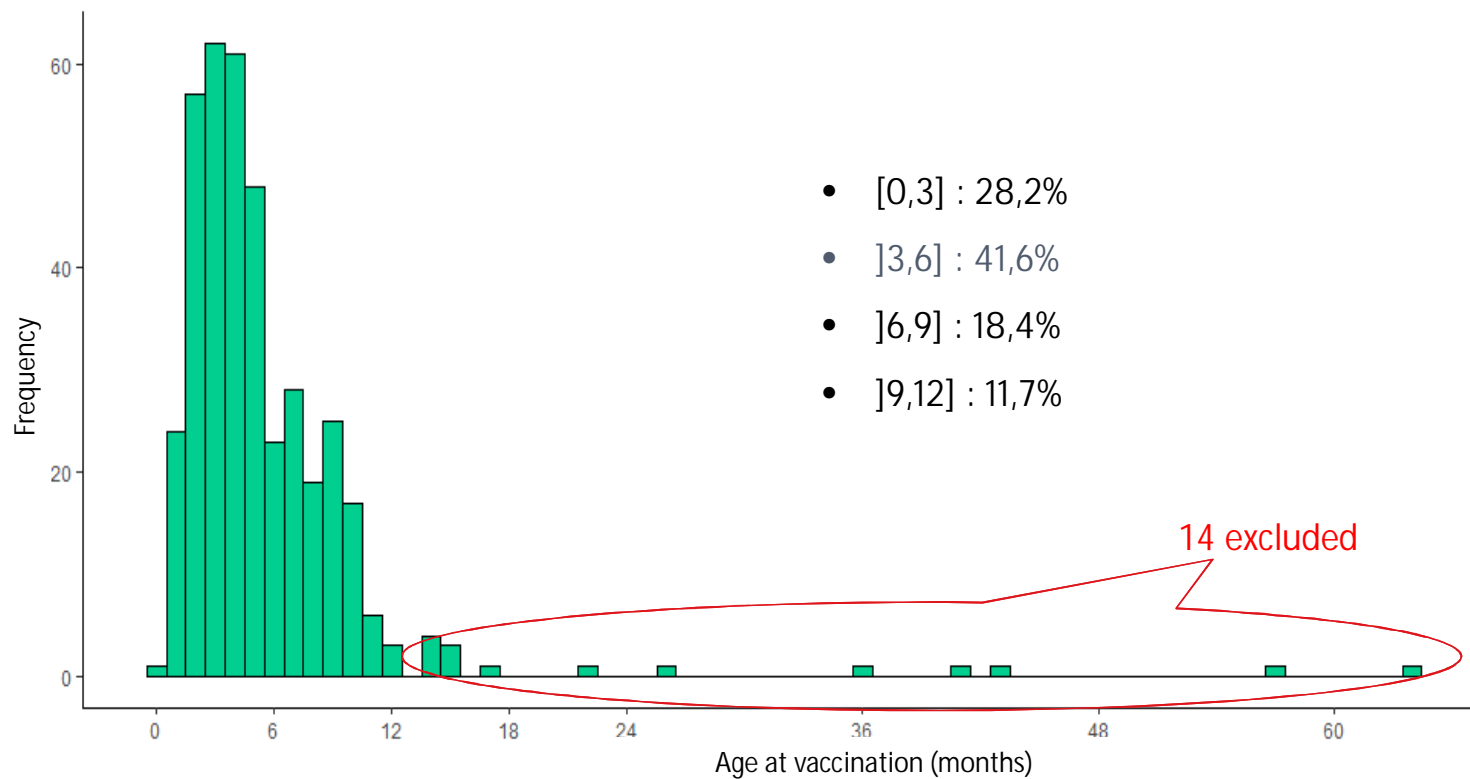   - with vaccinated cows (first generation) and non-vaccinated cows (last generation) in their 2nd lactation (L2)

Vaccinated (1st generation)	L2	L2 (L3)	(L2) L3	(L2) L3 L4	L3 L4	N = 372

Non Vaccinated (Last generation)	L2	L2 (L3)	(L2) L3	(L2) L3 L4	L3 L4	N = 265

May 2018	Oct. 18	April 2019	Déc. 2019	January 2021

- **Biological samples and laboratory analysis**
  - Serum
    - ELISA Kit IDScreen ® paratuberculosis screening (IDvet)
  - Feces
    - Individual qPCR (Adiavet® ParaTB realTime, BioX)
    - Quantification : dilution range of purified Map K10 strain

$$y = -1.837\ln(x) + 40.336$$
$$R^2 = 0.9889$$

- Age at vaccination

- [0,3] : 28,2%
-]3,6] : 41,6%
-]6,9] : 18,4%
-]9,12] : 11,7%

14 excluded

- Statistical analysis : GLM Models
  - response variable
    - positive / negative qPCR on fecal sample ➜ probability of Map fecal shedding
    - $\log([Map]_{fecal\ sample})$ ➜ amount of Map shed in the feces
  - fixed effects
    - age at vaccination
    - serum ELISA status at sampling
    - age at sampling
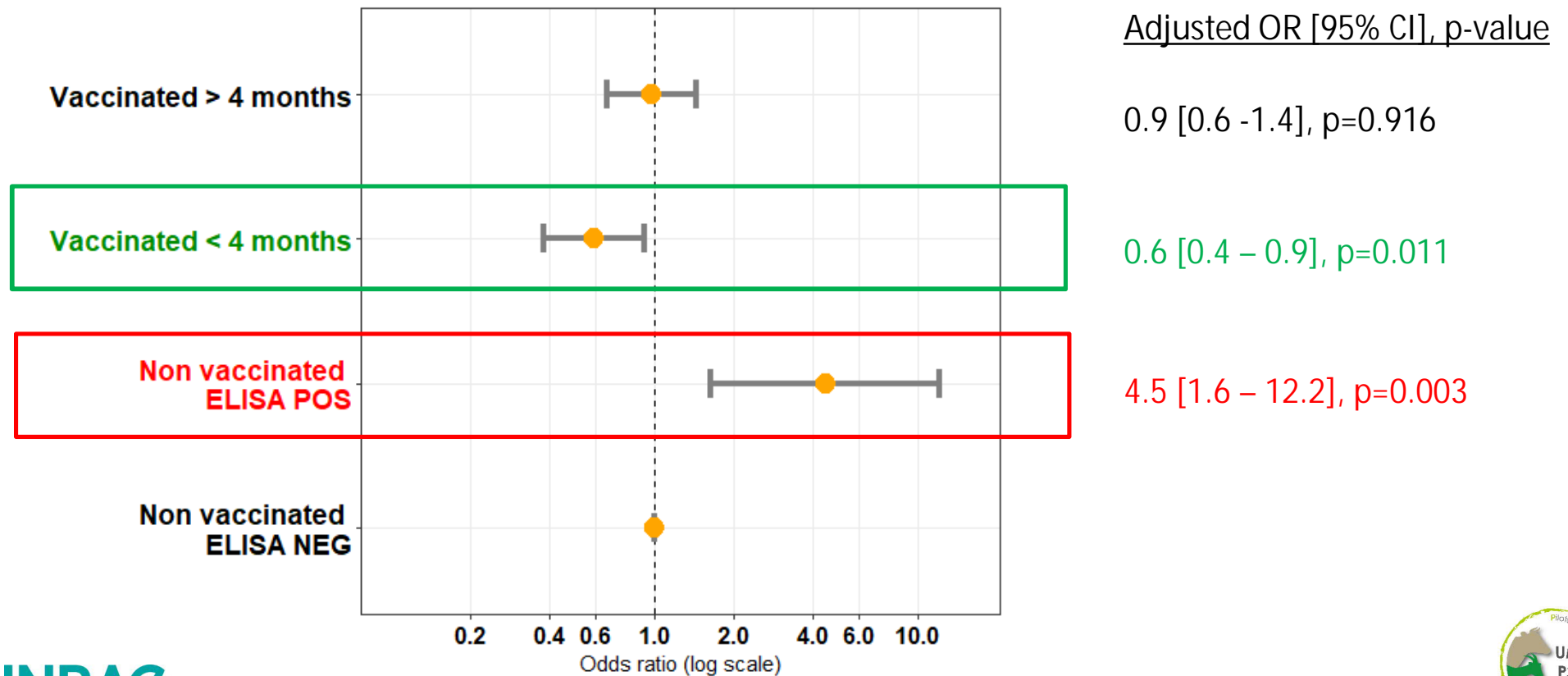   - DIM at sampling
  - random effects
    - cow within herd

- Fecal qPCR
  - 1020 fecal samples submitted to qPCR
  - 276 positives (23.8 %), from 221 cows (34.7%)

Ct value	=< 25	]25-30]	]30-33.5]	]33.5-42.0[	≥42
Bacterial load (Map / g feces)	> 10 000	1000 to 10 000	100 to 1000	1 to 100	< 1
Frequency	11	19	14	232	884

- A significant effect of vaccination on Map shedding in feces

Adjusted OR [95% CI], p-value

0.9 [0.6 -1.4], p=0.916

0.6 [0.4 – 0.9], p=0.011

4.5 [1.6 – 12.2], p=0.003

- A significant effect of vaccination on Map shedding in feces

Adjusted OR [95% CI], p-value

1.0 [0.6 -1.8], p=0.949

0.9 [0.6 – 1.4], p=0.657

0.8 [0.3 – 1.7], p=0.542

0.5 [0.3 – 0.8], p=0.007

4.2 [1.5 – 11.7], p=0.005
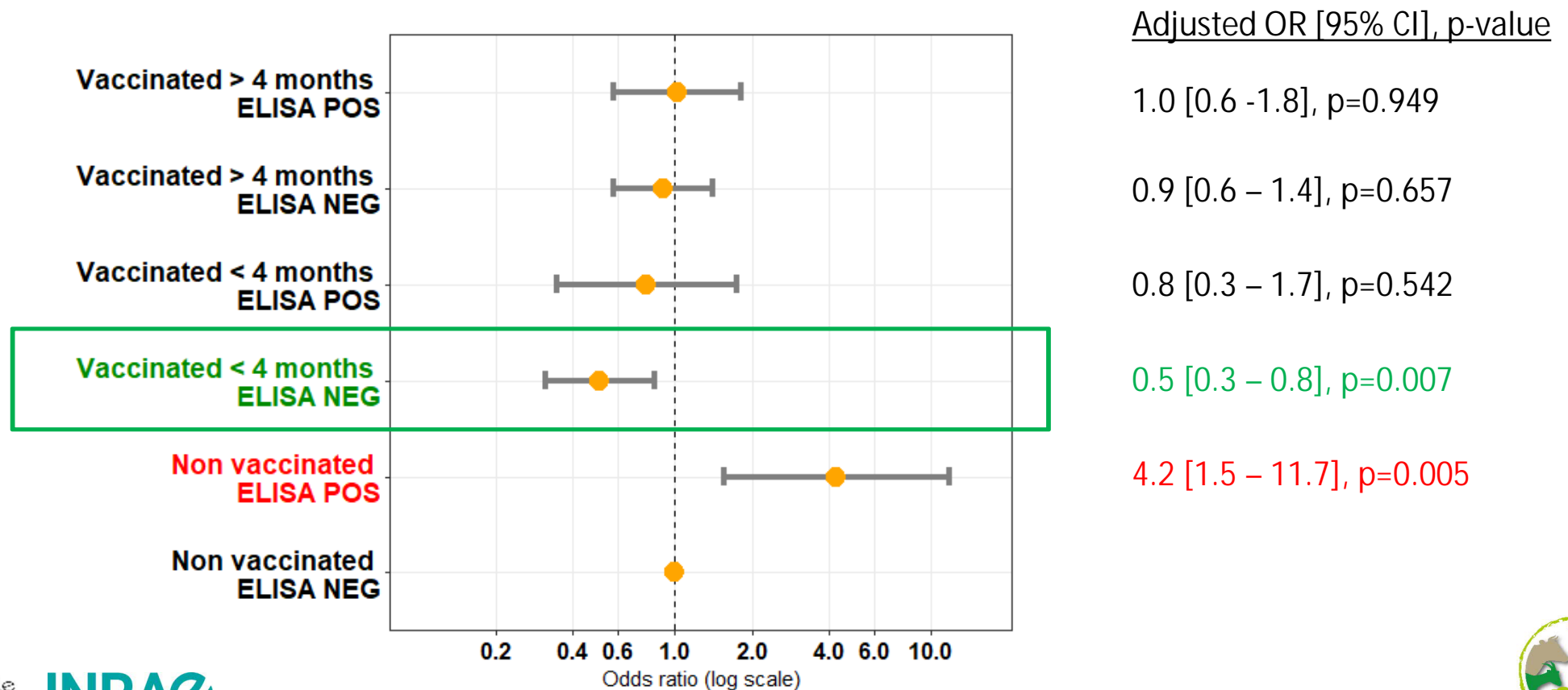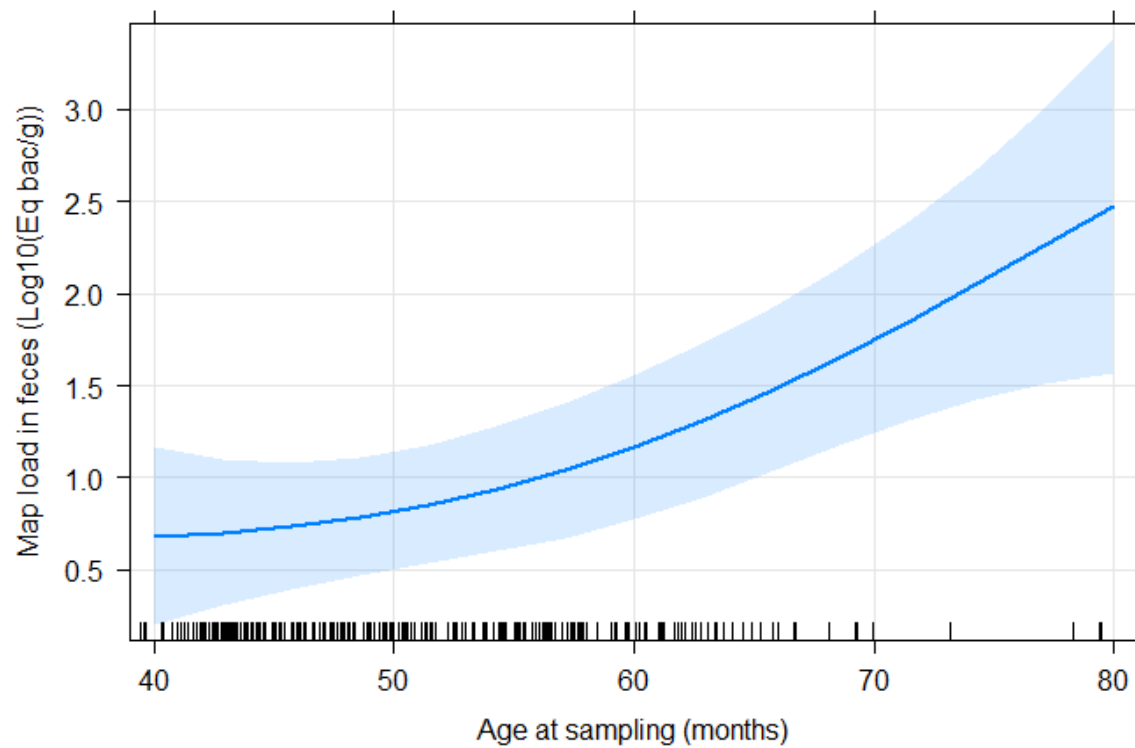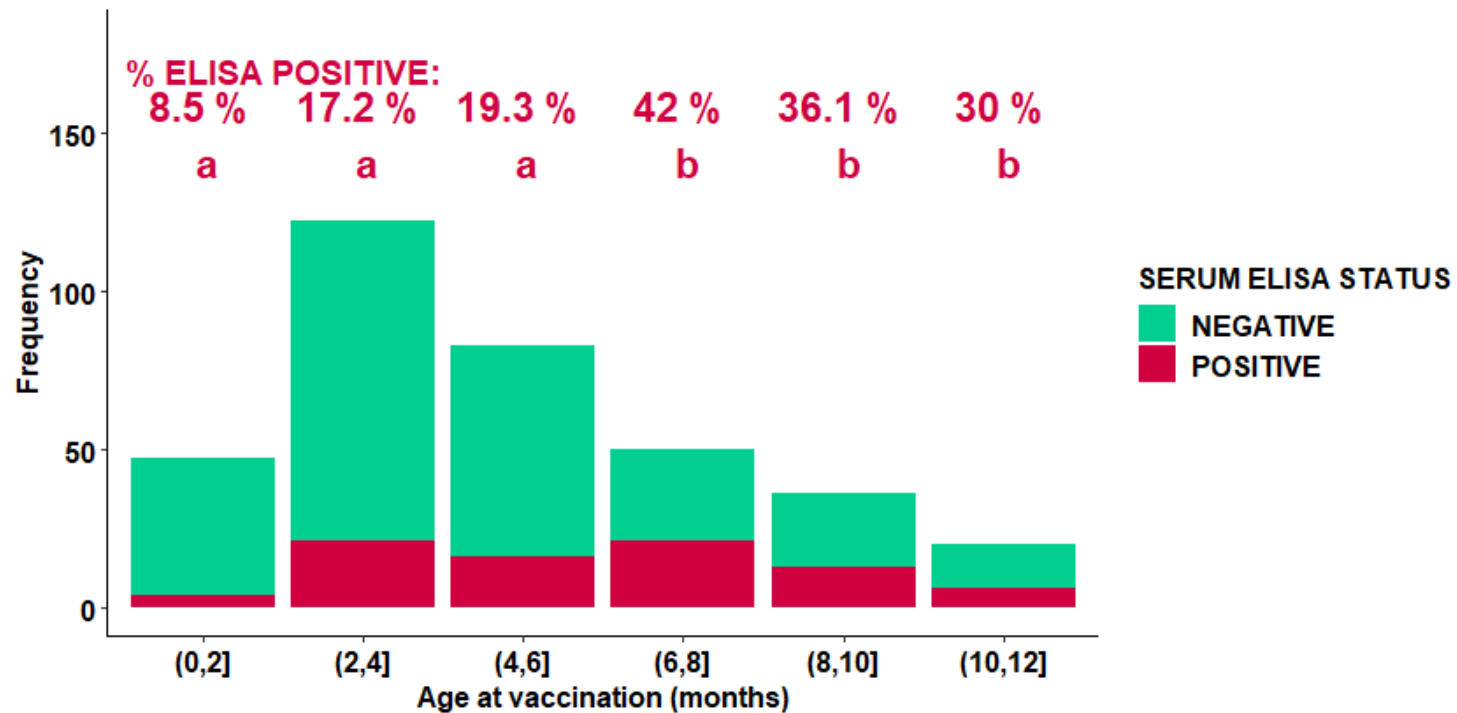
Results (4)

- No effect of vaccination on the amount of Map shed in feces
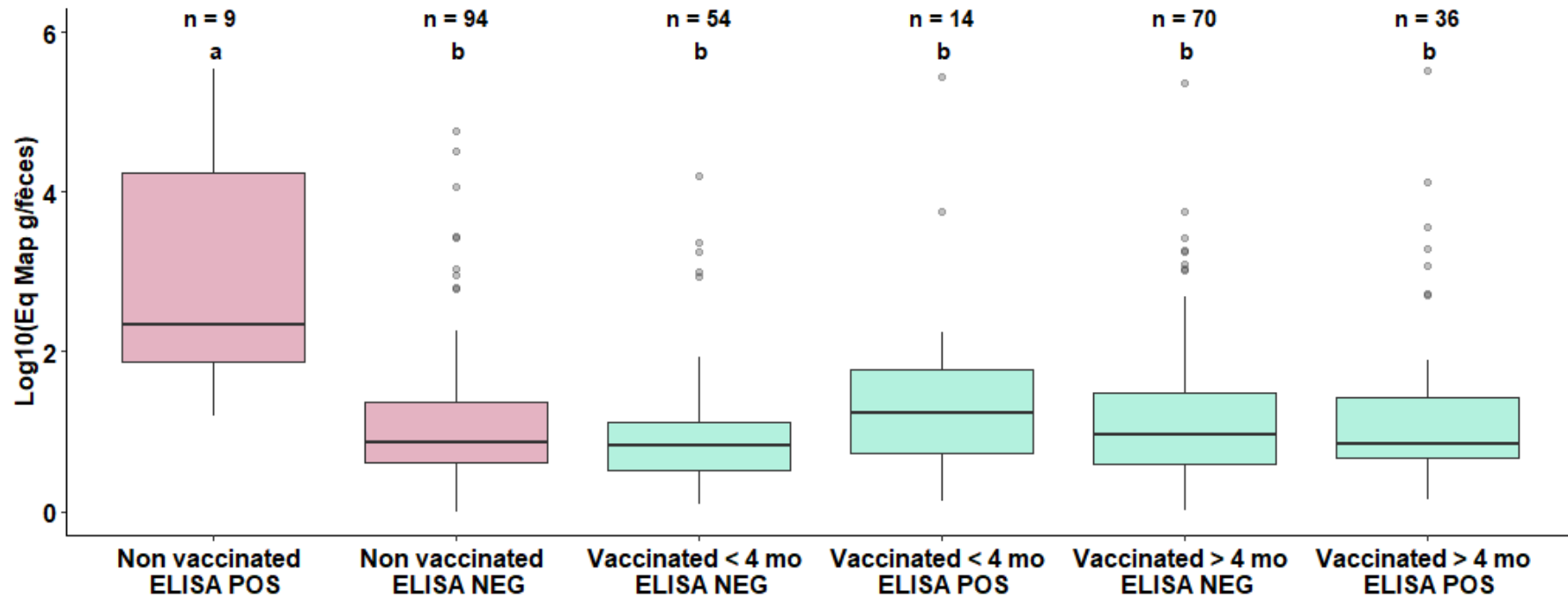
- A significant effect of age at sampling on the amount of Map shed in feces

- A significant effect of age at vaccination on serum ELISA status

Discussion and conclusion

- **Effect of Silirum ® vaccination in dairy herds**
  - Reduced probability of shedding in cows vaccinated < 4 months
  - According to all farmers : no clinical case in vaccinated cows

  - Heavy shedders in vaccinated cows
  - Increased shedding load in cows > 5 years, including vaccinated ones

  Reduced exposition of young calves

- **Main study limit**
  - Control programs also include strong hygiene measures
    - the true effect of vaccination is difficult to estimate
    - results to be confirmed at a larger scale and in other control programs in beef cattle

Thank you for your attention.

Any question ?

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