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Prevention of *Coxiella burnetii* shedding in infected dairy herds using a monovalent vaccine containing phase-1 *Coxiella burnetii*

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Coxiella burnetii … Q fever

Animal Health Issue

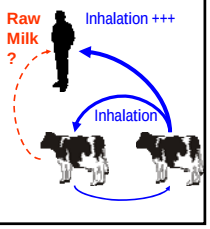
Reproductive disorders
abortions, metritis, infertility

Economic impact at herd level

Human Health Issue

Zoonosis
flu-like illness, pneumonia, hepatitis, fatigue syndrome, endocarditis
in pregnant women: abortions, stillbirth

Ruminants: main source of infection



Dairy Industry Issue

Raw Milk commercialization
Pasteurization of products

Coxiella burnetii: risk reduction

Animal Health Issue

Human Health Issue

Dairy Industry Issue

Reduction of *Coxiella burnetii* shedding

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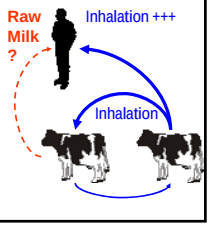
Limit the within-herd transmission
Limit the zoonotic risk
Satisfaction of dairy industry



Coxiella burnetii: shedding and consequences

Different shedding routes: Milk, Vaginal Mucus, Faeces

Frequent shedding, non concomitant routes

Vaginal shedding at any stage of lactation (not only around parturition)

Faecal shedding (sporadic)
=> bedding material is a major source of contamination

Shedding by healthy cows

Control measures
- not only focused on clinical signs (abortions)
- long-lasting effects

Coxiella burnetii: control

Antibiotics (tetracyclins)

Limit abortions
Don't stop shedding

Vaccine phase I

Strong reduction of shedding in goats (Arricau-Bouvery, 2005)

Susceptible goats, vaccinated then challenged

In cattle (no recent studies)

status of cows before vaccination ?

not evaluated in infected herds

no placebo

Aim of the study

To assess in susceptible dairy cattle

the prevention of *Coxiella burnetii* shedding

conferred by a phase I vaccine in comparison to a placebo

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Materials and Methods

Study population & study sample

Herds

- Dairy herds
- Repeated abortions
- PCR positive on aborted cow (placenta or vaginal mucus)
- Acceptation of vaccination in last third of pregnancy
- No control measure before the start of the study

Animals

- All dairy cows
- Heifers with expected calving within a year
- Excluded if culled < 45 days after inclusion

Experimental design

To assess In susceptible animals

Determination of initial status before treatment

the prevention of *Coxiella* shedding

Follow up of shedding after treatment

Conferred by vaccine in comparison to placebo

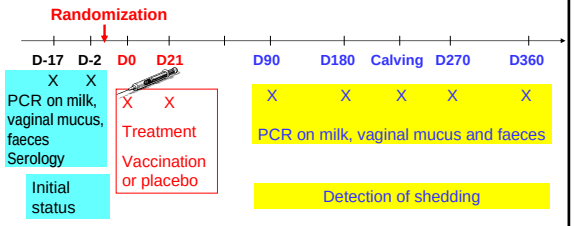
Randomization of treatment allocation, blind study

Theoretical number : 90 vacc vs 90 placebo

i.e. 6 herds (herd size 40; 75% susceptible)

Finally included: 6 herds, 336 animals, 175 susceptible

Experimental design



Shedding follow up among initially susceptible animals

Following over time of animals becoming shedder according to their treatment

Survival analysis method (Cox regression model)

Quantification of bacterium load when shedding occurred

Experimental design

Allocation of treatments

Pregnancy status (license product)

Interference with vaccination: randomization criteria

Randomization

According to infectious status and pregnancy status

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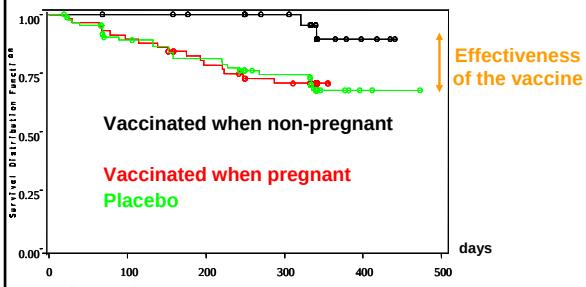
Results

Study sample

	Status	Non pregnant	Pregnant	Total
Cows	S	30	62	92
	NS	52	105	157
Heifers	S	30	53	83
	NS	1	3	4
	Total	114	222	336

Preventive effect

« Survival » = probability of non-shedding



Kaplan-Meier curves

Censored animals are marked with circles

Preventive effect

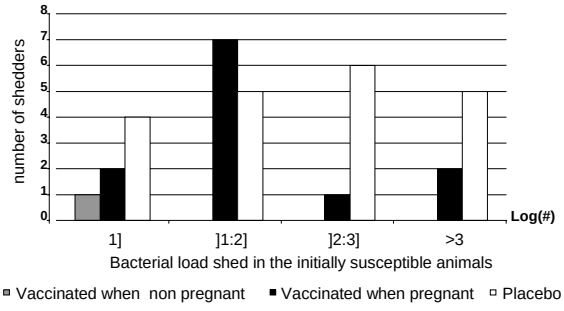
Survival analysis results

Risk of becoming shedder = [Treatment] + [Lactation Number] + [Herd]

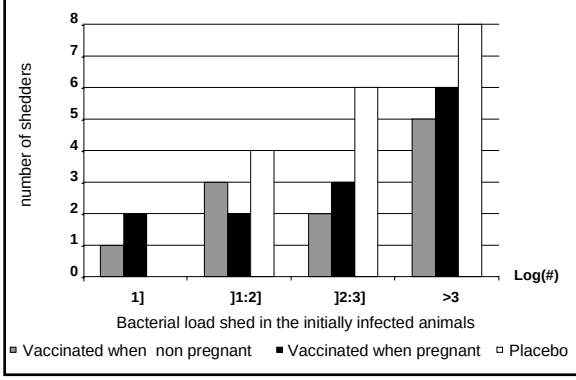
	Risk of shedding		*P value*
	Hazard Ratio	95% CI	
Treatment			
Vaccinated when not pregnant	0.21	0.05-0.90	*0.04*
Vaccinated when pregnant	0.90	0.48-1.71	*0.75*
Placebo	1	1	*ref*
Lactation number			
Primiparous	1.19	0.64-2.20	*0.59*
Multiparous	1	-	

When vaccinated non pregnant, the risk of becoming shedder was 5 times lower

Bacterial load shed …among susceptible animals



Bacterial load shed …among infected animals



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Discussion and conclusion

Results & Discussion

***Coxiella* Vaccine phase I**

Strong prevention of shedding among susceptible animals

Risk 5 times lower

Probably under-estimated (split populations vacc/placebo)

Confirmation of very good results shown on goats

Pregnancy: interference with cellular immunity

Shedding after treatment among initially non susceptible animals: No treatment effect

Perspectives

How to implement vaccination

Very good safety of the vaccine (even in the last third of pregnancy)

Target population : susceptible animals

- **Heifers before first service**
- **Adults: if the within-herd prevalence is low *(can be estimated with PCR on Bulk tank milk [Guatteo et al., 2007])***

Pending questions

Duration of immunity

Effectiveness of control programmes

[Antibiotics +/- Vaccination]

Thank you …