Assessing the wind effect on Q fever transmission between dairy cattle herds

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Introduction

- Q fever is a zoonotic disease caused by the bacterium *Coxiella burnetii (Cb)*.
- Infected cattle, sheep and goats generate contaminated dust and aerosols, in which *Cb* survives for a long time, providing the potential for animals or humans to get infected through inhalation.
- There is a consensus on the main role of the wind in the transmission of *Cb*, between ruminants and from ruminants to humans.
- However, no study so far has focused on the mechanisms associated with this airborne transmission.
- **The objective of the present study was to investigate the processes underlying the wind effect and to assess its influence on the incidence risk for a dairy herd to become *Cb* infected.**

Materials and methods

- 95 dairy cattle herds located in the department of Finistère.
- Samplings of bulk tank milk (BTM), milk of primiparous cows and indoor dust were collected every 4 months over a one-year period (4 sampling times ST for each herd).
- PCR tests were performed in BTM samples (PCR BTM) and dust samples (PCR DUST) and ELISA tests were performed in primiparous cows' milk (ELISA PRIMI).
- *Cb* statuses determined using responses of two consecutive sampling times STn and STn+1:
  - **Incident cases:** At STn, PCR BTM and ELISA PRIMI negative
At STn+1, PCR BTM or ELISA PRIMI positive
  - **Negative cases:** At STn and STn+1, PCR BTM and ELISA PRIMI negative

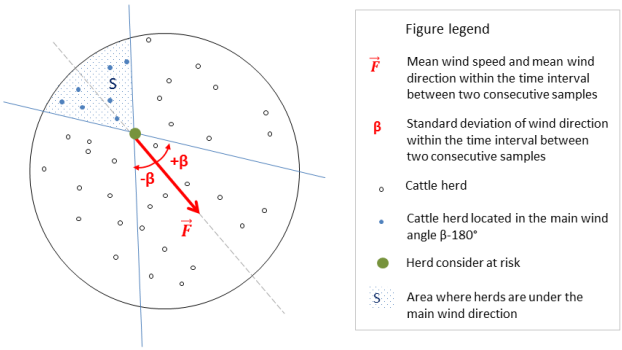

Figure 1: Principle of calculation of the cumulated number of *C. burnetii* from neighbor herds located under the main wind direction

- Calculation of the main wind direction and standard deviation between STn and STn+1 (**Figure 1**).
- Calculation of the cumulated number of bacteria in the herds located in the area under the main wind direction at STn (from quantitative responses of PCR DUST) (blue points in **Figure 1**).
- Logistic regression to assess the risk for a given herd of becoming incident in relation to (i) the cumulated number of bacteria in the herds located in the area under the main wind direction, and (ii) the mean wind speed between ST and STn+1 in this area.

Results

- 27 Incident cases; 71 negative cases.
- Incidence risk increased with increasing cumulated number of bacteria under the main wind direction (OR=17 [2,5;110] when there is a high bacterial load in the area under the main wind direction).
- The mean wind speed has no significant effect on the incidence risk.
- A combined effect existed: compared to areas with low wind speed, the incidence risk was significantly higher in areas with high wind speed and high cumulated number of bacteria (**Table 1**).

Table 1: Combined effect of the wind speed and of the bacterial load (cumulated number of bacteria in herds located under the main wind direction)

	OR	95% CI	P
Low wind speed	1		
High wind speed and no bacterial load	0.67	0.13,3.5	0.64
High wind speed and low bacterial load	1.39	0.43,4.47	0.58
High wind speed and high bacterial load	4.76	1.42,15.95	0.01

Conclusion

***C. burnetii* transmission to a free herd occurs only in case (i) the wind itself transporting from infected sources, and (ii) the burden in contaminated particles/aerosols generated, are high enough to act jointly.**

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