A case-control study of the effect of winter dysentery on herd level milk production

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Background

Winter dysentery (WD) is a contagious disease in cattle caused by bovine corona virus (BCoV), causing diarrhea, decreased milk production, anorexia and sometimes respiratory symptoms in adult animals (Alenius et al. 1991, Boileau et al. 2010). Norwegian cattle are free of many infectious diseases, however BCoV is highly prevalent with consequences on production and animal welfare.

The aim of this study was to estimate the effect of a WD outbreak on herd level milk production.

Results

For herds of average size and milk production prior to outbreak (Table 1), the maximum difference in estimated milk production between cases and control herds in a fourteen day period post outbreak was 105 liters or 24% (Figure 3). The estimated relative difference was larger for small herds than for large herds.

In conclusion, the estimated effect of WD on herd level milk production is notable, and an outbreak can have great influence on the farmers economy.

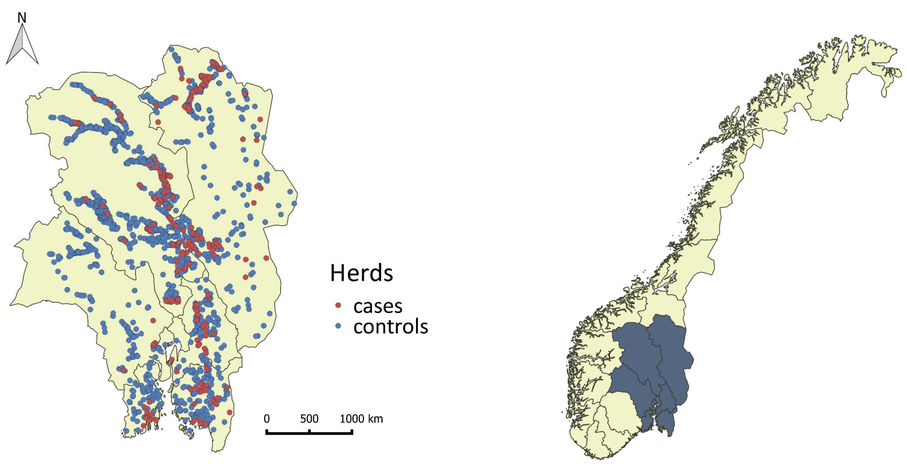

Figure1. Study population and study area. n= 2084, 225 cases and 1859 control herds.

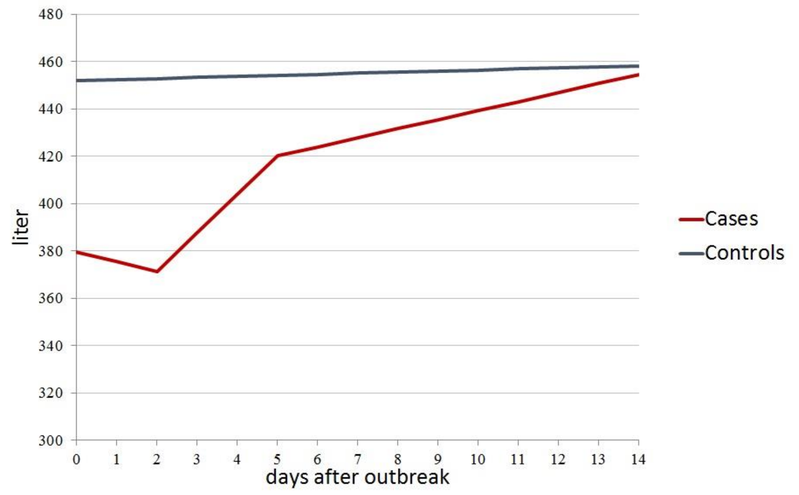

Figure 3. The graph shows the herd level milk production as estimated by a linear mixed model, in the period 0-14 days after outbreak was reported for a case- and control herd of average size, and with average milk production prior to outbreak.

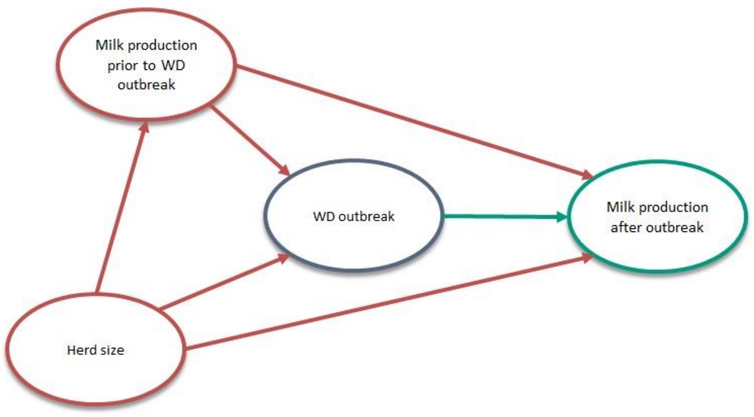

Figure2. Causal diagram showing the outcome variable (green), primary predictor (blue) and confounding factors (red).

Table 1. Distribution of the main variables in cases and control herds.

	WD + n = 225		**WD -** n = 1859	
	Mean	StD	Mean	StD
Milk prior[1]	571.3	342.7	423.3	313.3
Milk after[2]	547.8	335.1	439.2	320.7
Herd size	29.9	16.6	25.1	15.9

[1]Average milk production 21-7 days prior to outbreak (l/day)
[2]Average milk production 0-14 days after outbreak (l/day)

Materials and methods

- Case control study. Study unit: The herd, n=2084 (225 cases, 1859 controls). Outcome variable: Average volume of milk delivered per day.
- Cases: Herds from which farmer diagnosed WD was voluntarily reported to the advisory service of the dairy company (Tine SA).
- Control group: Herds in the same area that did not report an outbreak of WD (Figure 1).
- Information on herd characteristics from the Norwegian Dairy Herd Recording System (NDHRS). Recordings on volume of milk delivered to the dairy plant from the dairy company.
- A pseudo-outbreak date, drawn from the distribution of the actual outbreak dates for the cases, was randomly assigned to each of the control herds.
- Assessment of the effect of winter dysentery on milk production was carried out by fitting a linear mixed model with a herd random effect and a Toeplitz six correlation structure accounting for dependency between repeated measures of milk delivery for each herd. A linear spline of the interaction between WD and days since outbreak was included, and milk production prior to outbreak and herd size were included in the model as confounders.

References:
Alenius, S., et al. (1991). "Bovine coronavirus as the causative agent of winter dysentery: serological evidence." Acta Vet Scand **32**(2): 163-170.
Boileau, M. J. and S. Kapil (2010). "Bovine coronavirus associated syndromes. (Special Issue: Emerging, reemerging, and persistent infectious diseases of cattle.)." Veterinary Clinics of North America, Food Animal Practice **26**(1): 123-146.