Schmallenberg virus epidemic in the Netherlands: spatiotemporal introduction in 2011 and seroprevalence in ruminants

A.M.B. Veldhuis[1], G. van Schaik[1], P. Vellema[1], A.R.W. Elbers[2], R. Bouwstra[2], H.M.J.F. van der Heijden[1], M.H. Mars[1]

[1] GD Animal Health Service, Deventer, the Netherlands
[2] Central Veterinary Institute, part of Wageningen UR, Lelystad, the Netherlands

Background & aim

- The new orthobunyavirus Schmallenberg virus (SBV) caused acute diarrhea, drop in milk production and fever in dairy cattle in the Netherlands in the late summer of 2011.
- An outbreak of congenital malformations in newborn ruminants manifested in newborn lambs and goat kids and calves from November 2011 on.
- The **aim of the current study** was to determine SBV seroprevalence in the Netherlands to:
    1. gain insight in the true rate of infection in cattle, sheep and goats after cessation of the vector-active period in 2011
    2. to identify potential risk factors for SBV infection, and
    3. to identify the spatiotemporal introduction of this new virus in the Netherlands.

Material and Methods:

- A large-scale seroprevalence study was conducted using archived serum samples submitted to the GD Animal Health Service for monitoring purposes (from November 2011-March 2012). Samples were tested for presence of SBV-specific antibodies using an in-house ELISA (Se=98,8% ; Sp=98,8%).
- Multivariable linear regression analyses were carried out to describe the relationship between potential risk factors and the quantitative ELISA test outcome S/P ratio.
- Archived sheep serum samples from April-November 2011 were tested to detect emergence of SBV in space and time.
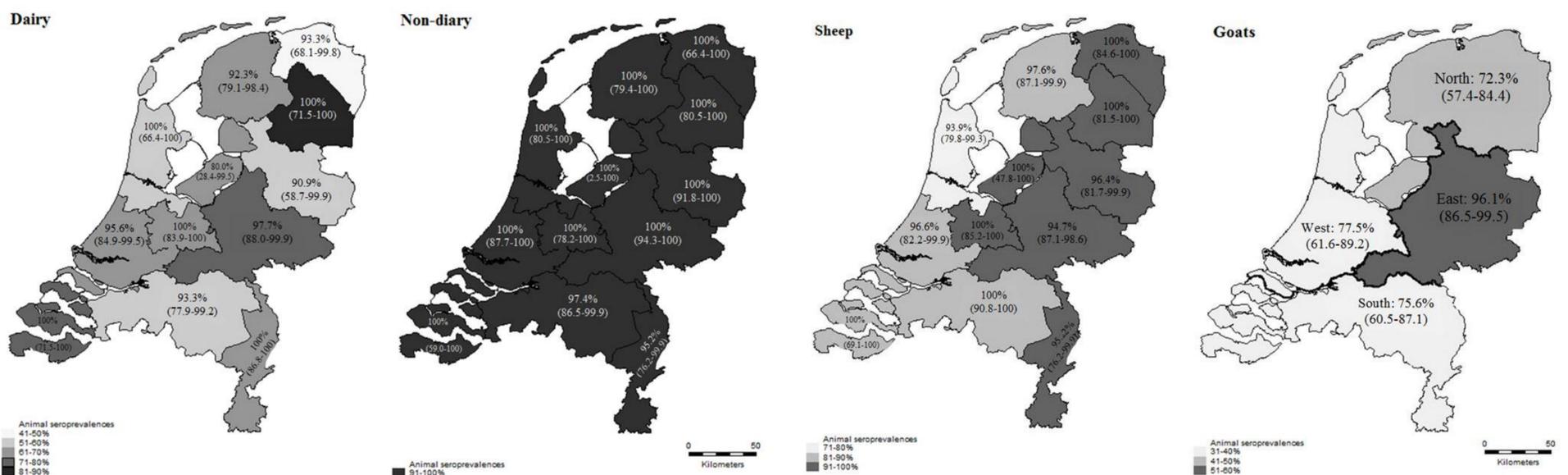

Figure 1. SBV seroprevalences in dairy heifers, non-dairy adult cattle, sheep and goats in the Netherlands after the 2011 epidemic. Shaded areas represent animal seroprevalences, herd prevalences are displayed in numbers. Herd prevalences are calculated based on a cut-off of one seropositive animal per herd.

Results:

- Seroprevalence estimations are displayed in Table 1 and Figure 1.
- In dairy heifers, S/P ratios increased with 0,55% with each month of age (*p=0,015*). Also, heifers and sheep from larger herds had a slightly lower S/P ratio (*p=0,000*). Whether herds were located in the coastal area or in the eastern region (both defined based on a distance of approximately 20 km inland and from the eastern border, respectively) did not affect the S/P ratio in dairy heifers.
- No difference in S/P ratio in the eastern region could be found in sheep, but sheep from herds in the coastal area had a lower S/P ratio compared to sheep in the non-coastal area (p=0.000).
- By tracing back, about 2% of sheep serum samples were ELISA positive in April, June and July 2011, but could not be confirmed with a virus neutralization test. A clear increase in seroprevalence was found in August 2011 (4,5% ; N=2,922) and September 2011 (66,3% ; N=1,251). From mid-August 2011 onwards, seropositive samples were confirmed positive by virus neutralization testing.

Table 1. Overall apparent and true seroprevalences for Schmallenberg virus in ruminants and small ruminants in the Netherlands.

Species	Herd level		Animal level		Time period
	N	Seroprevalence (95% CI)	N	True prevalence (95% CI)	
Cattle, adult non-dairy	276	99.3% (97.4 -99.9)	1347	99.6% (99.0 -99.8)	1/nov/2011 - 31/dec/2011
Cattle, dairy heifers	268	95.5% (92.3 –97.7)	3261	64.2% (62.5 -65.8)	27/oct/2011 - 12/dec/2011
Sheep	343	97.1% (94.7 -98.6)	2833	89.6% (88.4 -90.7)	1/dec/2011 - 29/feb/2012
Goats	185	81.1% (74.7 -86.5)	1546	41.3% (38.8 -43.8)	1/dec/2011 - 29/feb/2012

Conclusion:

- The epidemic of SBV started in mid-August and has rapidly led to high seroprevalences in ruminants in the Netherlands, in particular in non-dairy cattle.
- No clear spatial pattern was detected that could indicate the area where the epidemic started.
- Differences in seroprevalence between species or types may be due to differences in grazing management.

[**contact**: a.veldhuis@gddeventer.com]