



Schmallenberg virus epidemic: Impact on milk production, reproductive performance and mortality in dairy cattle in the Netherlands and Kleve district, Germany

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ARTICLE INFO

Article history:

Received 11 September 2013

Received in revised form 8 March 2014

Accepted 30 April 2014

Keywords:

Schmallenberg virus

Impact

Productivity

Dairy cattle

The Netherlands

Germany

ABSTRACT

Schmallenberg virus (SBV), a novel orthobunyavirus that rapidly spread throughout north-western Europe in 2011, caused congenital malformations in lambs and goat kids (Van den Brom et al., 2012) and newborn calves (Hoffmann et al., 2012). The impact of the SBV epidemic seemed limited however, in terms of the number of affected herds with malformed offspring (European Food Safety Authority, 2012b). Nevertheless, little is known with regard to the overall within-herd impact of SBV infection. The objective of the current study was to quantify the impact of the 2011 SBV epidemic on the productivity of dairy cattle in the Netherlands and the district of Kleve, Germany.

For the Netherlands, several multilevel multivariable statistical models were applied on eight productivity parameters regarding milk production, reproductive performance and mortality. All four fertility parameters analysed were slightly but significantly reduced between August 1st and November 1st 2011 compared to the reference period in 2009–2010. Between August 15th and September 19th 2011, the average loss in milk production per cow was -0.26 kg (95% CI: -0.30 ; -0.22) per day in dairy herds, compared to the reference period ($p < 0.001$). The total loss per cow in a subgroup of dairy herds that notified malformations in newborn calves during the mandatory notification period in the Netherlands was -0.43 kg (95% CI: -0.59 ; -0.28) per day ($p < 0.001$).

For Germany, a study was carried out in the district of Kleve, situated in the state of North Rhine-Westphalia near the Dutch border. Data on milk yield, two fertility parameters and the number of rendered calves in this specific region were analysed. There was a small but significant increase in the number of secondary and third inseminations between August 1st and November 1st 2011, indicating reduced fertility. No significant change in calf mortality was observed in the assumed SBV period. Milk production at district level did not seem to be affected by SBV in August and September 2011.

SBV had no or limited impact on mortality rates, which was as expected given the relatively mild expression of SBV in adult cows and the low incidence of notified malformations

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in newborn calves. Our results indicate that SBV had a limited impact on productivity of dairy cattle. However, the total economic impact of SBV on the ruminant industry not only consists of productivity caused losses; it is expected that international trade restrictions formed a larger part of the total economic impact.

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1. Introduction

From the third week of August 2011 onwards, an unexpected number of reports were made by veterinarians regarding acute diarrhoea, drop in milk production and occasionally fever in dairy cattle herds in the Netherlands (Muskens et al., 2012). At that moment, the cause of the reported symptoms was unknown. In November 2011, the new orthobunyavirus Schmallenberg virus (SBV), belonging to the Simbu serogroup of the genus *Orthobunyavirus* within the family *Orthobunyaviridae* was identified in cattle with similar symptoms in Germany (Hoffmann et al., 2012). The affected animals originated from the state North Rhine-Westphalia, a region bordering the Netherlands. Not long after, SBV was found to have caused an outbreak of congenital malformations in lambs and goat kids (Van den Brom et al., 2012) and newborn calves (Hoffmann et al., 2012). The first malformed calf in the Netherlands was notified on December 13th, 2011. By then, archived serum samples from cows with clinical signs in late August 2011 had been tested using a RT-qPCR test, kindly provided by the Friedrich-Loeffler-Institute (Germany), and SBV had been identified. On December 20th, 2011, the Netherlands was the first country to enforce mandatory notification of SBV infection; malformations in newborn ruminants had to be reported to the authorities. In Germany, SBV infections, i.e. detection of SBV in malformed fetuses or newborn animals by PCR or precolostral antibodies, were officially recorded in the Central Animal Disease Data Base (TierseuchenNachrichtenSystem) since January 2012. During the notification period in the Netherlands, that ended on July 6th, 2012, notifications were made by 1301 cattle herds, 350 sheep flocks and 38 goat farms. In these herds, presence of SBV was confirmed by PCR testing in 18.2% of the cattle herds, 30.6% of the sheep flocks and 15.8% of the goat herds (Anonymous, 2012b). The low proportion of confirmation by PCR is the result of the short duration of viraemia of SBV (Hoffmann et al., 2012) and neutralization and clearance of virus by fetal neutralizing antibodies (Van Maanen et al., 2012). In 2012, a serosurvey estimating the 'final' seroprevalence after the 2011 epidemic revealed that SBV had spread throughout the Netherlands in cattle, sheep and goats, with between-herd seroprevalences per species ranging from 81 to 99% (Veldhuis et al., 2013). High seroprevalences in cattle after the 2011 epidemic have also been described in Belgium (Garigliany et al., 2012; Méroc et al., 2013) and Germany (Beer et al., 2013).

In the Netherlands, a national monitoring system, partly based on routinely collected herd data, is in place to follow trends in cattle health. In this system, quarterly data analyses on milk production, fertility and mortality records are carried out and reported to stakeholders (ministry, veterinary authorities and industry). In the last quarter of

2011, some signs of reduced fertility were observed, i.e. a slight increase in the number of aborting cows per herd and the number of inseminations per cow (Report Monitoring Cattle health, GD Animal Health, 2012q1, unpublished data), indicating a possibly detrimental effect of the SBV epidemic. Also, the number of serum samples of aborting cows, submitted to GD Animal Health (GD-AH) in the framework of the mandatory *Brucella abortus* monitoring program, was significantly elevated in that quarter without *Brucella abortus* antibodies being detected (Brouwer et al., 2012). Akabane virus, another orthobunyavirus of the Simbu serogroup within the family *Bunyaviridae*, is associated with reproductive disorders such as abortions, stillbirths, and congenital malformations in foetuses and newborns (Inaba et al., 1975). The effect of SBV infection on general reproductive performance and gestation in cattle, apart from congenital malformations in offspring, remains however to be clarified. In addition, at this moment it is unclear whether SBV is associated with higher mortality rates in cattle.

The impact of the SBV epidemic seemed limited in north-western Europe, in terms of the number of affected herds with malformed offspring (European Food Safety Authority, 2012b). Conraths et al. (2013) suggested that the direct economic impact of SBV in the sheep and cattle industry is limited, yet major losses are expected to be caused by international trade restrictions. Nevertheless, little is known with regard to the overall within-herd impact of SBV infection (European Food Safety Authority, 2012a). In particular, impact on key performance indicators such as milk production, reproductive performance and mortality rates is unknown. Therefore, the objective of the current study was to quantify the impact of the 2011 SBV epidemic on productivity of dairy cattle in the Netherlands and Kleve district, Germany, using routinely collected data.

2. Materials and methods

2.1. Study population

According to the Dutch Identification and Registration (I&R) database, in which information on birth, death and animal movements are registered, the cattle population in the Netherlands comprised 18,866 dairy herds in 2011. Most dairy herds are located in the northern and eastern region of the Netherlands. To assess the impact of SBV on different productivity parameters, this study focused on dairy cattle, as the first reports of acute clinical signs in August/September 2011 concerned this type of cattle. In addition to the national population of dairy herds (referred to as 'all dairy herds'), this study assessed the impact of SBV on a subgroup of dairy herds. This subgroup reported malformations in newborn calves during the period in

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