Economic assessment of an emerging disease: the case of Schmallenberg virus in France

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Summary
Schmallenberg virus (SBV) was first detected in 2011 in Germany and then in France in 2012. This study simulates the production of different ruminant systems in France and estimates, through partial budget analyses, the economic cost of SBV at the farm level, under two disease scenarios (a high-impact and low-impact scenario). A partial budget is used to evaluate the financial effect of incremental changes, and includes only resources or production that will be changed. In the high-impact scenario, the estimated impact of SBV ranged from €23 to €43 per cow per year and €19 to €37 per ewe per year. In the low-impact scenario, it was approximately half (for cows) or one-third (for ewes) of this amount. These financial impacts represent 0.6% to 63% of the gross margin, depending on the chosen scenario and the livestock system being considered. The impacts of SBV come mainly from: the extra costs from purchasing and raising replacement heifers and losses in milk production (dairy cows); the losses in calf or lamb production (beef systems and meat sheep); and the losses in milk production and from unsold replacement lambs (dairy sheep).

The use of integrated production and economic models enabled the authors to estimate the cost of SBV and to tackle the problem of scarce data, which is a difficulty for most emerging diseases, such as Schmallenberg virus (SBV), these complexities are often increased by a lack of epidemiological data, making it very difficult to calibrate the economic model correctly (1).

Emerging diseases are diseases that appear in a population for the first time, or which may have previously existed but are now rapidly increasing in incidence or geographic range (2). Thus, the difficulties mentioned above make economic assessment all the more demanding and present a number of challenges. Firstly, due to the lack of data, or data inconsistency, emerging diseases involve unpredictable components not easily manageable over a short time span, such as those related to disease dynamics and the direct impact of the disease in the field.

Introduction
The money spent on animal disease management is considerable and an important part of resource allocation is based on the biological processes of transmission and infection, and does not include economic considerations. If efforts were made to include the economic aspect in rational decision-making, from the farm to the global level, the prioritisation of diseases would still present huge difficulties and the efficient allocation of financial resources would remain challenging. This is probably due to the multiple challenges faced in the financial assessment of animal diseases from a methodological point of view. However, particularly in the case of emerging diseases, such as Schmallenberg virus (SBV), these complexities are often increased by a lack of epidemiological data, making it very difficult to calibrate the economic model correctly (1).
Secondly, uncertainty may also arise from changes in trade or restrictions placed on animal movement, which can hardly be defined a priori, and depend on the circumstances of neighbouring areas at the time of the outbreak. An economic assessment of an emerging disease may also have to account for dramatic changes in the behaviour of the people and stakeholders involved, due to the presence of a new disease and any (new) measures or policy introduced to control it, which may affect its impact (3).

Thirdly, there is little time for economic evaluations of emerging diseases in the case of an unexpected outbreak, since all decisions must be taken quickly, to limit its spread. This is sometimes handled through available ex ante economic assessment and mitigation strategies for devastating or expected diseases, e.g. foot and mouth disease (4).

The last and fourth challenge comes from the uncertain validity of the results in the long run, since the epidemiological situation in the field may rapidly change. An extrapolation from an economic assessment performed during an emerging disease situation, as opposed to when the disease is almost endemic, may depend on the length of the production cycle and on the biological behaviour of the disease (immunity).

The authors propose to investigate how to deal with some of these challenges – in particular, economic assessment in the case of data inconsistency, when the disease is unknown, and with the long-term extrapolation of results – by taking the example of the recent outbreak of SBV in France.

The virus was first detected in November 2011 in Germany (5). It affects ruminant animals and appears to be transmitted mainly by insect vectors of the Culicoides spp. group, and vertically in utero (6, 7, 8). The virus was officially declared endemic in many European countries, including France, by the end of May 2012. In France, the circulation of the virus seemed to have declined between 2013 and 2014. However, its presence was demonstrated by new cases of abortion in March 2015. The intensity of disease circulation remains unknown.

One study showed that, in the Netherlands, in 2013, the maximum possible prevalence of herds in which SBV was circulating was less than 1% (9). In Belgium, virus circulation declined considerably between 2013 and 2014, but re-circulation was judged probable from 2014 to 2015 (10). The decrease in virus circulation after 2013, accompanied by fewer and less severe animal impacts, probably originated from the high inter-herd and intra-herd prevalence of SBV in cattle and sheep at the end of 2012, as well as from the long immunity period after infection (up to two years) (11, 12, 13). In Switzerland, the prevalence of infection between July 2013 and May 2014 was estimated to be 2% (14).

The impact of SBV is limited, but probably greater on sheep farms than on cattle farms (7). In cows and ewes, the clinical signs are mainly associated with reproductive disorders. Depending on the time of infection, abortion, stillbirths, premature deliveries and neurological disorders (such as blindness, deafness, recumbency, an inability to suck and convulsions) may occur (15, 16, 17). In adult ruminants, acute infection can result in transient and non-specific symptoms, such as diarrhoea, inappetence, fever and a reduction in milk yield (5, 6, 18). Such acute infections cause production losses in terms of animals and milk yield, and require additional expenditure for palliative treatment of the affected animals. The economic evaluation of SBV proposed in this paper focuses on production losses on the farm early in the outbreak (2012), in the most common French cattle and sheep production systems. The economic consequences of movement restrictions and market changes are not included.

For producers to make an informed decision about a potential intervention to control a disease such as SBV (e.g. vaccination, pesticide use, housing and repellents), it is essential to understand the trade-off between intervention costs and disease losses that can be avoided. This can be explored soon after the beginning of the outbreak, as shown in this study, overcoming the problem of limited data availability.

Methods and results

Full details of the method and results can be found elsewhere (19, 20, 21), but an outline is provided below.

Production systems and gross margins

For this research, the most typical ruminant production systems in France were identified, using available benchmarking data and expert opinion (22, 23, 24, 25). The three systems of milk cow production examined (Table I) included combinations of:

- lowland or highland areas
- corn silage and/or grass-based diets, and
- the production of generic milk or quality cheese.

Four of the beef suckler production systems focused on calving, with calves sold at six to ten months of age (breeds: Charolais, Limousin, Blonde d’Aquitaine and Salers), while the fifth was a calving and fattening system. Two meat systems (one intensive and one extensive) and a dairy
sheep system were selected. Each production system was individually modelled to simulate within-farm population dynamics. For beef suckler production models, for example, the models included:

- revenue from sales of heifers and steers
- replacement costs for these animals
- feeding costs
- veterinary and medicine costs
- other variable costs, such as bedding costs.

Gross-margin-analysis models were then integrated into the production model to calculate the annual gross margin (a measure of profitability) of each system (Equation 1):

\[
\text{Gross margin} = \text{Revenue} - \text{Replacement costs and breeding depreciation} - \text{Feed costs} - \text{Veterinary costs} - \text{other variable costs}
\]

Comparison with published annual gross margins enabled the authors to validate the models. Indeed, the results for the estimated annual gross margins (Table I) matched those found in the references (22, 23, 24, 25), with three exceptions: the present model found a 20% lower gross margin for milk and cheese production in the dairy cow system (€2,229 versus €2,709); a 35% lower estimate (€329 versus €500) for the calving–fattening beef system; and a 23% greater estimate (€39 versus €30) for the extensive sheep meat system. Differences are mainly due to difficulties – and resulting decisions – regarding estimates for feed costs (market costs or production costs, for example). However, the figures for product sales always matched those of the references perfectly.

### Assessment of the impact of Schmallenberg virus, using partial-budget models

The Schmallenberg virus disease parameters (Table II) were included in the production models under two scenarios, according to the literature and an expert workshop. The high-impact scenario represents a herd that is highly susceptible to disease (for example, when the susceptible gestation period occurs during a season of high vector activity), whereas the low-impact scenario represents a less-susceptible herd (for example, one located in an area

<table>
<thead>
<tr>
<th>Type of animal</th>
<th>Livestock system</th>
<th>Impact</th>
<th>Net cost per cow/ewe (€)</th>
<th>Range of values to be considered (€ per cow/ewe)</th>
<th>Annual gross margin (€ per cow/ewe)</th>
<th>Net cost on gross margin (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dairy cows</td>
<td>Lowland, corn silage</td>
<td>High</td>
<td>23.5</td>
<td>2–64</td>
<td>1,688</td>
<td>1.3%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Low</td>
<td>11.5</td>
<td>1–12</td>
<td></td>
<td>0.6%</td>
</tr>
<tr>
<td>Lowland, corn silage and grass</td>
<td>High</td>
<td>23.1</td>
<td>2–63</td>
<td>1,686</td>
<td>1.3%</td>
<td></td>
</tr>
<tr>
<td>Highland-grass, quality cheese</td>
<td>High</td>
<td>57.3</td>
<td>3–102</td>
<td>2,229</td>
<td>2.5%</td>
<td></td>
</tr>
<tr>
<td>Beef cows</td>
<td>Calving, Charolais</td>
<td>High</td>
<td>30.7</td>
<td>8–99</td>
<td>293</td>
<td>10.4%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Low</td>
<td>15.3</td>
<td>0–14</td>
<td></td>
<td>5.2%</td>
</tr>
<tr>
<td>Calving, Salers</td>
<td>High</td>
<td>26.9</td>
<td>7–84</td>
<td>209</td>
<td>12.8%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Low</td>
<td>13.5</td>
<td>0–15</td>
<td></td>
<td></td>
<td>6.4%</td>
</tr>
<tr>
<td>Calving and fattening, Charolais</td>
<td>High</td>
<td>42.6</td>
<td>11–135</td>
<td>329</td>
<td>12.9%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Low</td>
<td>21.6</td>
<td>0–22</td>
<td></td>
<td></td>
<td>6.4%</td>
</tr>
<tr>
<td>Sheep</td>
<td>Meat, intensive</td>
<td>High</td>
<td>21.2</td>
<td>6–33</td>
<td>33</td>
<td>64.0%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Low</td>
<td>6.5</td>
<td>3–10</td>
<td></td>
<td>20.0%</td>
</tr>
<tr>
<td>Meats, extensive</td>
<td>High</td>
<td>19.3</td>
<td>5–30</td>
<td>39</td>
<td>51.0%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Low</td>
<td>5.8</td>
<td>3–9</td>
<td></td>
<td></td>
<td>15.0%</td>
</tr>
<tr>
<td>Dairy</td>
<td>High</td>
<td>36.7</td>
<td>10–65</td>
<td></td>
<td>219</td>
<td>16.7%</td>
</tr>
<tr>
<td></td>
<td>Low</td>
<td>12.7</td>
<td>7–18</td>
<td></td>
<td></td>
<td>5.7%</td>
</tr>
</tbody>
</table>

a) The range of values to be considered represents the results of the model in the minimum and maximum values of input parameters from Table II
b) Equals the net cost per cow/ewe divided by annual gross margin, expressed as a percentage
c) Not reported in this Table: results for highland corn silage and grass (similar to those of lowland, corn silage); results for highland grass (similar to those of lowland, corn silage and grass)
d) Not reported in this Table: results for calving for Limousin and Blonde d’Aquitaine breeds (similar to those of calving Charolais)
of low vector density or whose gestation period occurs during a season with low vector activity). For the most variable and uncertain parameters, minimum, most likely and maximum values were agreed upon. A partial-budget analysis was used to compare the net value of farm-level infection, which represents the costs of SBV. Partial-budget analyses include additional costs, revenue foregone, costs saved and additional revenue due to SBV (Table III).

The net value of SBV (in €/cow or ewe/year) is presented in Table I for each system and more details are given for beef suckler farms in Figure 1. For beef suckler farms, the costs of SBV accrued mainly from steers and heifers that were not sold (at least 90% of the sum of costs), whatever the system and the scenario (high or low impact). For dairy cows, the main costs of SBV in open systems were associated with purchasing or raising extra heifers for replacement stock. For the highland-grass, quality-cheese dairy system, the highest costs were due to the revenues lost from milk that was not produced. In the meat-sheep production systems, costs accrued mainly from young lambs not being sold (50–55% of the sum of costs), replacing dead or culled ewes (22–23%) and revenue foregone from dead ewes, due to SBV (12–13% of the sum of costs). For dairy sheep, the main costs were related to the revenues foregone from lost milk because ewes were culled or died from SBV (50% of the sum of costs), and lost revenue from not selling lambs, since these were needed to replace the lost stock (37% of the sum of costs).

### Table II
**Input parameters for high- and low-impact scenarios during the Schmallenberg virus outbreak**

Data refer to mean values used by default within the models. Data within brackets are minimum and maximum values used in the sensitivity analysis, to define the ranges of variations of the economic estimation.

<table>
<thead>
<tr>
<th>Input parameter</th>
<th>High impact</th>
<th>Low impact</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage of stillborn or malformed calves due to SBV out of 100 calves born</td>
<td>2% (1–10%)</td>
<td>1% (0–1%)</td>
<td>26 and expert opinion</td>
</tr>
<tr>
<td>Percentage of cows/ewes with dystocia out of cows/ewes giving birth to a stillborn or malformed calf/lamb due to SBV</td>
<td>Cows: 30% Exwes: 80%</td>
<td>Cows: 30% Exwes: 80%</td>
<td>27, 28, 29 and expert opinion</td>
</tr>
<tr>
<td>Percentage of cows/ewes that need a caesarean out of cows/ewes with dystocia due to SBV</td>
<td>Cows: 6% (5–7%) Exwes: 5% (2–10%)</td>
<td>Cows: 6% (5–7%) Exwes: 5% (2–10%)</td>
<td>5, 16, 30 and expert opinion</td>
</tr>
<tr>
<td>Percentage of cows/ewes aborting due to SBV</td>
<td>Cows: 2% (0–2%) Exwes: 3% (1–3.5%)</td>
<td>Cows: 1% (0–1%) Exwes: 1.5% (1–2%)</td>
<td>29 and expert opinion</td>
</tr>
<tr>
<td>Percentage of lambs stillborn, malformed or dying under one week of age due to SBV</td>
<td>7% (2–12%)</td>
<td>2% (1–3)</td>
<td>29, 31, 32 and expert opinion</td>
</tr>
<tr>
<td>Percentage of cows treated out of cows with clinical signs</td>
<td>Dairy: 15% (10–20%) Beef: 10%</td>
<td>Dairy: 15% (10–20%) Beef: 10%</td>
<td>Expert opinion</td>
</tr>
<tr>
<td>Percentage of ewes treated with antibiotics out of ewes that aborted</td>
<td>1%</td>
<td>1%</td>
<td>Expert opinion</td>
</tr>
<tr>
<td>Percentage of fetuses with malformation out of aborted fetuses</td>
<td>60%</td>
<td>60%</td>
<td>Expert opinion</td>
</tr>
<tr>
<td>Percentage of aborted fetuses or calves/lambs tested for SBV</td>
<td>Cows: 5% Exwes: 0%</td>
<td>Cows: 5% Exwes: 0%</td>
<td>Expert opinion</td>
</tr>
<tr>
<td>Probability of a farmer preventing SBV with insecticide</td>
<td>0</td>
<td>0</td>
<td>Expert opinion</td>
</tr>
<tr>
<td>Percentage of cows/ewes with clinical signs (dystocia and abortion excluded) due to SBV</td>
<td>7.5 (3–31%)</td>
<td>0</td>
<td>26 and expert opinion</td>
</tr>
<tr>
<td>Duration of clinical signs for dairy animals (days)</td>
<td>14 (14–21)</td>
<td>14 (14–21)</td>
<td>26 and expert opinion</td>
</tr>
<tr>
<td>Decrease in milk production during the clinical phase</td>
<td>10%</td>
<td>10%</td>
<td>Expert opinion</td>
</tr>
<tr>
<td>Percentage of cows/ewes with dystocia due to SBV that die</td>
<td>Beef: 10% Exwes: 50%</td>
<td>Beef: 10% Exwes: 50%</td>
<td>26, 28, 33 and expert opinion</td>
</tr>
<tr>
<td>Percentage of cows having aborted that are culled</td>
<td>Dairy: 100% Beef: 10%</td>
<td>Dairy: 100% Beef: 10%</td>
<td>Expert opinion</td>
</tr>
<tr>
<td>Percentage of ewes with dystocia that are culled</td>
<td>20%</td>
<td>20%</td>
<td>Expert opinion</td>
</tr>
<tr>
<td>Percentage of cows with a malformed calf that are culled</td>
<td>Dairy: 0%</td>
<td>Dairy: 0%</td>
<td>Expert opinion</td>
</tr>
</tbody>
</table>

SBV: Schmallenberg virus
Sensitivity analyses were conducted to assess the variability of the disease's impact with different combinations of disease parameter values. The input parameters that varied simultaneously were '% of stillborn or malformed fetuses' and '% of abortions'. They were selected by taking into account the uncertainty attached to them and their hierarchical position in the model. Uncertainty was determined by considering the range of estimates collated from the literature and expert opinion, and the input from discussions during the expert workshop. In addition, the models were run with all the lowest and all the highest values to estimate the potential range of impacts (Fig. 2).

**Discussion**

**Economic assessment of emerging diseases and uncertainty**

As stated earlier, economic assessment of emerging diseases can be a real challenge. Epidemiological data needed to calibrate the economic model may be scarce, leading to highly uncertain results (challenge 1). The results of the economic evaluation must be produced quickly after the start of the outbreak to allow policy-makers to include...
economics in their decisions (challenge 3). However, policymakers and advisors in the field need accurate estimates to support such decisions.

Schmallenberg virus provides a good example of the possibility for economic evaluation in spite of limited data on the biological impact of the disease. At the time of this study, the scientific literature available described the situation on SBV-affected farms but did not compare it to that of non-affected farms, or of previous years, before the emergence of SBV, except in rare cases. No experimental data were available. This issue was addressed, thanks to:

i) expert opinion consultations, which help to increase the accuracy of the attribution of disease estimates, and

ii) sensitivity analyses of the disease estimates, which help to account for the remaining uncertainty.

Such an approach allows us to validate and improve the economic assessment accuracy as new data (for instance, 34, 35, 36) become available. In the case of slight changes provided by novel literature, the sensitivity analyses that were initially performed enable us to easily identify the contributions of the main parameters (Fig. 2). However, if the new data do not fall into the range defined by the initial sensitivity analysis, new modelling is needed. It is important for end users to understand the strategic information provided by the sensitivity analysis, as opposed to the average value, which is often focused on. The content of the sensitivity analysis is the key information needed to evaluate the relevance of the results for situations other than those included in the main scenario(s).

In addition to uncertainty linked to data, uncertainty may also be linked to changes in trade or regulations restricting movement. Such changes often cause further costs for farmers, particularly in the case of emerging diseases, because infected animals cannot be moved off the farm (and must still be housed, fed and cared for) and because disease-free countries may impose specific requirements on any imports. Since production losses and immobilisation costs are two separate components of emerging disease, a separate economic assessment can be conducted for each.

Need for accurate estimations of different livestock systems

Economic assessments of emerging diseases should be performed with a method adapted to the characteristics of the disease, which includes the diversity of the livestock systems involved. In the present study, farm models were developed that combine herd dynamics and gross margin analyses of different production systems as a basis for partial-budget analysis. The production models proved particularly useful in estimating the effects of disease parameters that have a cascade effect – a common situation with emerging diseases that lead to major changes in animal reproductive performance. For example, an increase in abortions means that fewer calves are born. This results in a loss, since fewer calves can be sold, but also incurs a cost since more adult animals may die or be culled because they aborted. When we account for financial consequences related to specific management practices, we see that the impact of a disease varies substantially depending on the underlying production system, based on:

– the type of farm, i.e. closed or open (in relation to dairy farms)
– the seasonality of calving or lambing (for dairy cows and meat sheep)
– the selling season and weight of calves sold (for beef)
– the replacement rate and management of replacement animals (for all production systems)
– various combinations of all these factors.

For instance, the extra cost of SBV to the highland-grass, quality-cheese production system was not really due to the higher price of milk but rather to the fact that the herd involved was a closed herd, limiting the ability to make changes in herd management practices when disease occurred.

By building on the gross margin models, we can calculate expenditure saved, new revenues, new expenditure, and revenues lost, by comparing the values between farms modelled as healthy and those modelled as diseased.
Importantly, the net value obtained in the partial-budget analysis is equivalent to the difference of the gross margins with and without disease. The partial budget could have been calculated without the underlying production model by, for example, using equations that take into account animal numbers, prices and the cascade effects of disease parameters. In this study, the design of the production models allowed straightforward validation of the costs, revenues and gross margins by comparing them to published values on gross margins. Consequently, both the partial-budget analysis and the gross-margin analysis provide crucial information in relation to SBV (or to disease in general).

In spite of the potential lack of data to perform an economic assessment for some emerging diseases, the inclusion of several livestock systems for a given species is of interest. The disease impact differs more between livestock systems within a country than between countries. In the worst cases, the disease impact may reach up to 1–2% (for dairy cow production), 5–17% (for beef production), and 6–65% (for sheep production) of the gross margin, depending on the system, the country and the impact scenario. As a consequence, SBV may only slightly change the economic performance of some farms but have a considerable effect on others. This highlights the need to analyse the results of the economic impact in comparison to the gross margin, or to

![Graph](image_url)
investigate the consequences of the disease on the turnover of the farm or the income of the farmer. Such information is highly useful for decision-making, whether in the field or by national policy-makers.

These results show that a big part of the economic impact arises from replacement or reproduction. Many emerging diseases, in particular those carried by vectors, may induce reproductive disorders, which have an impact both at the animal level and the farm level. For instance, an outbreak of bluetongue virus (BTV) that caused significant reproductive disorders in some animals also led to major changes in herd dynamics (37). The impact of BTV was increased by a high adult mortality rate (38), which is not usually seen with SBV. This demonstrates the need for calculation methods that mimic, at least at a minimal level, the effects on individual animals and the changes in the dynamics of the herd. Making economic evaluations of changes in culling, reproduction and replacement practices remains a challenge, as does defining the optimal situations of these practices at the initial stage (before the disease emerges). The proposed model may, however, be more easily developed in other countries. It requires data on livestock systems and their associated gross margins.

How end users may use economic assessments of emerging diseases during the outbreak

Economic assessments of emerging diseases, performed before or very early on in the course of an outbreak, are of great interest for farmers and veterinarians in the field, as well as decision-makers. When using the results, two considerations apply. First, the estimations often—as they do here for SBV—represent the total cost of the disease at the farm level and not the avoidable costs. Thus, if seeking a trade-off with the cost of vaccination, the current results may be used but only if we acknowledge the gap between the total costs and avoidable costs. The best way to evaluate such a trade-off would be to perform an economic efficiency analysis of possible SBV vaccination strategies, with the efficacy and prices of the vaccines known. Secondly, the use of such results to make a first, raw calculation of the national impact of a disease is possible by multiplying the disease impact (nil, low or high) by the number of farms or animals concerned. This will only provide the total cost related to production losses but not institution, trade-related or intervention costs. Yet the set of possible situations depends on i) the high, low or nil vectorial activity for a given period and location, and ii) the period(s) of sensitivity of the animals to the disease.

In the case of SBV, the main difficulties in interpreting the results remain, one of which is knowing when the low-impact or high-impact scenario applies. For instance, knowledge of the beef production system suggests that autumn- and early winter-calving herds should be considered in the high-impact scenario. Recent work in sheep production suggests that the odds of malformation in lambs are higher for ewes mated in the middle of the year, compared to those mated in autumn (39), suggesting that high- and low-impact scenarios may apply to ewes mated in the spring–summer and autumn, respectively.

Extrapolation of results in the transition period from emerging disease to endemic disease

One of the characteristics of an emerging disease is the continual change in the epidemiological situation in the field. This leads to an ever-present uncertainty as to whether the economic assessment made at the time of the pathogen introduction was also appropriate to more chronic situations. In the present example, the impact is likely to be great when a naïve herd is infected with SBV, but may remain low and perhaps nil in the case of re-infection in an endemic situation. At the time of the study, no data were available on the duration of immunity, and only one yearly cycle of production was considered. Recent information shows that the period of immunity seems to be at least two years for cows, and the decay of maternally derived antibody is achieved at approximately six months of age (12). In a dairy cattle herd in Germany, 90% of naturally infected dairy cows remained seropositive three years after infection (13). Another German study showed a 58% decrease in intra-herd seroprevalence observed within two to three years, partly due to zero-negativity, but mostly due to the turnover of cows within the herd (13). The Australian experience with Akabane virus shows a re-emergence pattern of five to ten years for cattle and seven years for sheep (40). Surveillance of virus circulation at these times, coupled with knowledge of vector activity—which may differ among various livestock systems—may give us a good overview of the epidemiological situation and economic impact that can be expected in the years after emergence. In this context, the generic way in which results are shown—two impact scenarios for each livestock production system—provides a powerful tool to help decision-making in both the short and long term after disease emergence.

As a result of the biological and economic consequences of SBV, there is a demand for effective animal health interventions (41). Given the epidemiology of the virus and nature of the infection in wildlife (42, 43), eliminating SBV from populations may prove challenging. The focus must therefore be directed towards interventions to avoid the negative impacts of the disease. SBV vaccines for ruminants have been developed in Europe and licences to market the vaccine have been approved in some EU countries (44, 45). The purpose of SBV vaccines is to induce an immune response that prevents the virus from reaching the fetus. Farmers will need to make a judgement as to whether the additional investment is justified by the resulting loss avoidance. Apart from vaccination, there are limited
Évaluation économique d’une maladie émergente : le cas du virus de Schmallenberg en France

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Résumé

L’utilisation de modèles intégrant les aspects économiques et les données de production a permis aux auteurs d’estimer le coût du virus de Schmallenberg malgré la pénurie de données, s’attaquant ainsi à une difficulté inhérente à la

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El virus de Schmallenberg fue detectado por primera vez en 2011 en Alemania y ulteriormente en 2012 en Francia. Los autores describen un estudio en el que se simularon distintos sistemas de producción de rumiantes en Francia y se estimó, con análisis presupuestarios parciales, el coste económico que entrañaría para una explotación el virus de Schmallenberg en dos hipotéticas situaciones sanitarias (una situación con efectos profundos y otra con efectos leves). El análisis presupuestario parcial sirve para evaluar los efectos económicos de cambios graduales, e incluye únicamente aquellos recursos y aspectos de la producción que experimentarán cambios. En la hipótesis de efectos profundos, el impacto estimado de la infección por el virus de Schmallenberg oscilaba entre 23 y 43 euros anuales por vaca y entre 19 y 37 euros anuales por oveja hembra. La hipótesis de efectos leves deparaba importes de aproximadamente la mitad (en el caso de las vacas) o un tercio (en el de las ovejas). Este impacto económico representa del 0,6% al 63% del margen bruto, dependiendo de la hipótesis elegida y del sistema productivo de que se trate. Los efectos de la infección por el virus de Schmallenberg se concretan básicamente en: los costos suplementarios derivados de adquirir y criar vaquillas de sustitución y de obtener una menor producción de leche (vacas lecheras); las pérdidas de terneros o corderos (sistemas de bovino u ovino cárnicos); y los costos derivados de la menor producción de leche y de no vender las corderas de sustitución (ovejas lecheras). El uso de modelos que integran los factores productivos y económicos sirvió a los autores para estimar el costo del virus de Schmallenberg a pesar de la escasez de datos, que, por la propia naturaleza de las enfermedades emergentes, es una dificultad común a la mayoría de ellas. También les permitió evaluar con exactitud el impacto de la enfermedad en distintos sistemas productivos en un breve lapso de tiempo. La realización de extrapolaciones a partir de esta evaluación económica para pronosticar la situación en años venideros depende del periodo de inmunidad respecto de la enfermedad y de la duración de los ciclos productivos.

**Palabras clave**

References


