ECONOMIC IMPACT OF FMDV CARRIERS

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Summary

Potential economic impact of FMDV carriers is discussed based on some general principles and the results of a theoretical example of an FMD-epidemic in the Netherlands.

Introduction

Within the field of animal health economics, the main aim is to provide decision makers with tools and information to support their decisions related to animal health control (Dijkhuizen and Morris, 1997). For FMD control the decisions are made at the national and supra-national level within the EU Commision (EU 85/511) and decision support should aim at those levels. No studies on the economic effect of FMDV carriers are available, and within our group we have not specifically calculated this effect. This presentation will therefore provide a general discussion on the potential economic impact of carrier animals within the EU, illustrated with some preliminary quantitative results for the Netherlands.

Economics of FMD epidemics

Previous research, and recent developments in the UK and the Netherlands, showed that FMD epidemics within the EU may be very costly (Meuwissen et al, 1997). For the Netherlands which is an exporting country, the direct costs of an FMD or CSF epidemic are of minor importance relative to the losses that may occur due to trade restrictions, called indirect costs. However, even the direct costs can be very high for the agricultural industry within restricted areas as was calculated for the recent Dutch CSF-epidemic (Meuwissen et al, 1999). In general, the total length of the epidemic has a very large effect on the total direct and indirect costs related to that epidemic (Mahul et al., 2000). From an economic point of view the control efforts should aim at the shortest possible duration, particularly if the indirect costs are very high, as for exporting countries.

General potential economic effect of carriers within the EU

The economic risk of carrier animals would be introduction of FMD into the EU, re-occurrence of FMD within a recent epidemic area, or introduction of FMD into another EU area by movement of the carrier animal. For the Dutch situation only cattle, sheep and goat carriers are relevant, as pigs are not expected to show carrier status. In our discussion we will assume, firstly, that carrier animals are serologically positive and can not be differentiated from non carrier infected animals. Secondly, we will assume that carrier animals are infectious for other susceptible animals for a period of 28 – 365 days post infection, after which they clear the virus. Thirdly, we will define four periods for each epidemic as explained below.

1) Introduction of virus into EU area.

Undetected infectious carrier animals may be the cause of introduction into the EU. Money can be spend on prevention of entrance of seropositive animals, which will automatically include the carriers. FMD epidemics may have a very large economic impact, so large costs on prevention of introduction may still be economically attractive. The relative risk of introduction by seropositive (carrier) animals versus other introduction routes, such as animal products or swill, should be taken into account, however.

2) The high risk period (HRP), when the infection has not yet been detected.

Carrier animals are of some economical importance only if they can cause spread to other areas within the HRP, thereby expanding the subsequent epidemic. However, the HRP within the EU has been estimated between 1-4 weeks (Horst et al, 1998). It is therefore much more likely that recently infected and infectious animals are moved, instead of carrier animals.

3) Epidemic period, initial growth followed by decline through control measures.

Carrier animals are economically not important. All decisions are made on herd level, a few positive animals will condemn the whole herd. Herds will be detected based on clinical signs and/or serological tests and subsequently culled, including the carrier animals.

4) Post epidemic period, the area is declared free of infection.

Undetected carrier animals may be economically very important in this phase. The animals could cause re-occurrence of FMD in the same area or in another area up to 1 year after the epidemic is declared over. Consequently, trading partners may restrict trade for such a long period. Both a new epidemic or a long restriction of trade may be very costly. For this situation, the economic impact of carrier animals asks for a closer look, which we will discuss with the Netherlands as example.

Results of theoretical example for the Netherlands.

The Dutch FMD contingency plan includes preventive eradication of herds within a radius of 1 km of the infective herd, as well as emergency vaccination, particularly if the capacity to kill and destroy designated animals is not deemed sufficient. All emergency vaccinated herds in the Netherlands are currently culled to reduce trade restrictions within the EU from 12 to 3 months. Carrier animals within vaccinated herds are thereby destroyed. The economic implications for the current Dutch strategy are shown in Table 1.

Table 1. Indication of expected direct and indirect costs (in Million Dutch guilders) as calculated for a hypothetical FMD-epidemic with an HRP of 2 weeks in areas of the Netherlands with various animal densities, for two Dutch control strategies.

Characteristics of area similar to	Preventive eradication, radius 1 km			Vaccination + cull, radius 3 km		
	Direct	Indirect	Ratio D/I	Direct	Indirect	Ratio D/I
1 North	38	2039	.02	51	2350	.02
3 'Veluwe'	146	2595	.06	169	2690	.06
4 'Gelderse Vallei'	Endemic	Endemic	-	445	2963	.15
6 South	2123	7387	.29	830	4186	.20

However, if free trade of emergency-vaccinated animals would be allowed, undetected carrier animals from vaccinated herds might become a risk again. The economic value to prevent that risk is somewhat quantifiable as follows. We have to assume that a differentiating test is available to detect all vaccinated/infected herds, which are subsequently culled. All vaccinated herds that are tested FMD-negative are not culled and declared free to trade after a certain period. In such scheme carrier animals would again be of no importance, as they are present in the infected herds only, and thus culled. Economic results are based on the assumption that vaccinated animals (and products) are traded within the EU for the same prices as unvaccinated. Results for this hypothetical situation are shown in Table 2.

Table 2. Indication of expected direct and indirect costs (in Million Dutch guilders) as calculated for a hypothetical FMD-epidemic with an HRP of 2 weeks in areas of the Netherlands with various animal densities. Differentiation of infected and uninfected vaccinated herds is assumed. Uninfected vaccinated herds are not culled and free trade is resumed after 12 or 3 months.

Characteristics of area similar to	12 months export restrictions			3 months export restrictions		
	Direct	Indirect	Ratio D/I	Direct	Indirect	Ratio D/I
1 North	39	2536	.02	39	2257	.02
3 'Veluwe'	138	3139	.04	138	2511	.05
4 'Gelderse Vallei'	329	3470	.10	329	2465	.13
6 South	680	5632	.12	680	2709	.25

Discussion of theoretical example for the Netherlands

From table 1 it is clear that vaccination is needed to control an FMD epidemic in certain areas of the Netherlands. For region 4-like areas, vaccination seems the only possible strategy. The high indirect losses are partly caused by the delay in destruction of the vaccinated herds, which delays the end of the epidemic. In region 6-like areas, which are very dense, the delay in destruction causes the indirect losses to be extremely high in case of vaccination. However, control without vaccination is in total even more expensive for such area (9510 million versus 5016), because the epidemic would include more infected herds and thus last longer. In region 6-like areas, the direct costs are relatively high, which coincides with the calculated direct costs of the Dutch CSF-epidemic in that area (Meuwissen et al, 1999). For region 1-like areas, vaccination is not needed to control the epidemic, and will only increase the total costs.

From table 2 it is clear that the length of export restriction has a large impact on the indirect costs, which were calculated without price and substitution effects due to the epidemic. The economic effect of carrier animals is related to the difference in total losses between the 3 vaccination scenarios. For region 6-like areas, vaccination followed by destruction totals 5016 million, vaccination with trade after 12 months totals 6312 million, and vaccination with trade after 3 months totals only 3389 million. For this hypothetical example, the potential risk of export of undetected vaccinated carrier animals thus causes the total epidemic costs to rise from around 3 billion to around 6 billion, with the current Dutch strategy in between at around 5 billion.

In conclusion, for certain areas of the Netherlands, emergency vaccination is needed to control an FMD-epidemic. The potential risk of carrier animals causes a large increase in the total epidemic costs for the Netherlands, because either all vaccinated herds are culled or trade is restricted for a minimum of 12 months. Consequently, a lot of money could be spend on the development and acceptation by trading partners of a differentiating test for vaccinated herds, because this could lower the costs of future Dutch epidemics dramatically.

Final comments

All above is based on the assumption that carrier animals are indeed infectious up to 1 year after infection and can thus cause the start of an epidemic within that period. This is a very important assumption. If carrier animals carry virus but are not infectious, than economically speaking they should be of no relevance. In that case, no (research) money should be spend on detection of carrier animals but more on early detection of infectious animals. If carrier animals are infectious much longer than a 1 year period, their economic relevance may be higher, particularly for exporting countries that may find their markets closed for a long period.

For an exporting country within the EU, such as the Netherlands, the main economic impact of carrier animals is related to emergency vaccination and the lack of a differentiating test for infected and uninfected vaccinated herds. For non-exporting countries, reoccurrence within the own country due to carrier animals should be prevented. Control should thus aim at the lowest direct costs, which might include a combination of emergency vaccination followed by culling in high density areas.

In conclusion, 1) a sound scientific indication of the infectiousness and risk of (vaccinated) carrier animals and 2) the availability and acceptance of a differentiating test could alter the rules and economics of trade dramatically.

References

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