Combating foot and mouth disease in Denmark: economic consequences of various control methods

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Summary: The combating of foot and mouth disease (FMD) can be achieved by different methods, but the economic consequences to the agricultural sector and the national economy can differ greatly. In Europe, since 1938, the first year of FMD vaccination, three control methods have been applied in various countries according to the circumstances:

A) Non-vaccination with slaughter and burying of all contaminated animals on affected farms.
B) Ring-zonal vaccination combined with slaughter and burying of infected herds.
C) Annual preventive vaccination of the entire herd.

In 1982, when FMD reappeared in Denmark for the first time since 1970, the Danish veterinary services assessed the losses and inherent expenses for each method, the first having been applied effectively.

Over a period of 10 years, the expenditures and losses would be 487 m., 1,424 m. and 2,820 m. Danish kroner, respectively, for methods A, B and C.

Control method A would have less economic repercussions than the two other methods, but necessitates a greater degree of mobilisation of the veterinary services and farmers.

KEY-WORDS: Denmark - Cattle diseases - Foot and mouth disease - Disease control - Economics.

To a country such as Denmark, which depends on being able to export agricultural products, an outbreak of foot and mouth disease (FMD) results in substantial economic losses to agriculture and to society as a whole, since a number of attractive export markets will immediately be closed.

Countries which introduce such import bans are those that have not experienced outbreaks of FMD for a number of years, and which do not vaccinate against the disease, such as the Scandinavian countries, the USA, Canada, the Central American countries, Japan and Korea.

The period which has to elapse from the time the disease has been combated in an exporting country until the countries that are free will once again allow import, is laid down by the individual States and varies from a few months to over a year. That is, however, on condition that the disease has been combated without the use of vaccination. This should be understood in the sense that vaccinated animals in a contaminated area may be carriers as they may have an immune status which, though sufficient to protect the animals against the disease proper, is not good enough to prevent the FMD virus from surviving and regenerating locally, say in

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the pharynx. The vaccine in itself does not represent a risk of causing an outbreak of FMD.

Thus the ban on import by the so-called FMD-free countries is directed not only against countries with outbreaks of FMD, but also those that use vaccination to combat the disease and countries which, in order to protect themselves against the disease, allow the cattle population to be vaccinated annually.

Until 1938, when the first FMD vaccine was produced, the customary method of combating outbreaks of the disease in Denmark was by initially putting down and burying affected herds.

However, if the epizootic was of major proportion, this form of combating the disease was dropped and attempts made solely to prevent dissemination of the infection by isolating the herds affected. At times preventive treatment with serum from convalescent animals was used in herds in the vicinity.

During the years prior to 1938, the policy of putting down herds only led to success a few times. Often the disease spread. Thus it should be mentioned that, in 1926, 97,434 Danish herds were affected by FMD and, in 1938, the figure was 98,307.

After 1938, vaccination was used at the outbreak of FMD. But it was not until 1960, when an Act was introduced enabling the Minister of Agriculture to order vaccination in an area where there was a danger of infection, that a vaccination strategy was actually developed. This strategy was used during the period 1960-1970 as zonal vaccination at a distance of 2-10 km around an outbreak of the disease, i.e. ring-zonal vaccination.

During the 1950's many European herds continued to be affected every year by FMD. In order to discontinue this development, in 1953 the Netherlands resolved to introduce compulsory annual vaccination of all cattle over the age of 4 months, the first country to do so. Later, annual preventive vaccination was introduced in West Germany, East Germany, Belgium, Luxembourg, France and Italy.

As indicated above, several ways are found in which to prevent and combat FMD:

A. Non-vaccination with slaughter and burying of all contaminated animals on affected farms.

B. Ring-zonal vaccination combined with slaughter and burying of infected herds.

C. Annual preventive vaccination of the entire herd.

When, on March 18, 1982, Denmark was affected by FMD for the first time since 1970, it was of great importance for export reasons to avoid the use of vaccination to combat the disease.

The difference between the situation in 1982 and the time prior to 1938 when, as mentioned, destruction of infected herds was resorted to at the beginning of an epizootic, is that we now have technical facilities available for a much faster destruction and burial of herds that have been infected. A further condition for combating without vaccination being successful is that contact between herds with cloven-footed animals be reduced to an absolute minimum, and that persons who necessarily have to be in contact with herds of cloven-footed animals, for example, drivers
of milk lorries and veterinary surgeons, operate according to stringent hygiene rules to avoid transfer of infection between herds.

A comparison between losses to Danish agriculture and to the Danish community with regard to the various forms of combating FMD shows the economic advantages of combating the disease without vaccination. This comparison is based on the economic conditions around the FMD epizootic in Denmark in 1982 where the disease broke out in 22 herds.

A. **Combating without vaccination.**

Costs and losses in connection with the 1982 outbreak in 22 herds:

1) **Public expenditure** (compensation, destruction, burial, disinfection, etc.):
   - 26m. kr.

2) **Costs and losses to agriculture**:
   - **Direct**: (Loss on return of products and change of production methods at the Funen slaughterhouses, etc.)
     - Pig slaughterhouses: 60m. kr.
     - Cattle slaughterhouses: 6m. kr.
   - **Indirect**: (Estimated losses on the discontinuation of export to third countries and reduction of prices in the EEC)
     - Pig sector: 320m. kr.
     - Cattle sector: 75m. kr.

Total costs and losses caused by the FMD epizootic in Denmark in 1982: 487m. kr.

B. **Combating by ring-zonal vaccination.**

It is assumed that the number of infected herds would have been reduced from 22 to 17 if ring-zonal vaccination comprising the whole of Funen had been introduced after the first outbreaks.

1) **Public expenditure**:
   - Destruction, etc. (17 herds): 20m. kr.
   - Vaccination (194,000 head of cattle): 3m. kr.

2) **Costs and losses to agriculture**:
   - (1st year, same as under A)
     - Direct: 66m. kr.
     - Indirect: 395m. kr.

Total costs and export losses in connection with ring-zonal vaccination policy, 1st year: 484m. kr.

While combating without vaccination results in most markets opening up again to Danish agricultural products about a year after the disease has been combated, combating by ring-zonal vaccination will result in a major number of markets being closed for at least 5 years.

The annual loss to slaughterhouses after the first year when ring-zonal vaccination is used is estimated at: 235m. kr.
Export losses to slaughterhouses during the four years following the outbreak of the disease: 940m. kr.

Total cost of ring-zonal vaccination control until FMD-free countries reopen to import from Denmark: 1,424m. kr.

C. **Annual preventive vaccination.**

- Vaccination of 2,873,000 animals: 29m. kr.
- Vaccine (trivalent) 2,873,000 doses: 18m. kr.
- Total annual expenditure: 47m. kr.

Annual estimated loss to industry by not having access to export to FMD-free countries: 235m. kr.

Total annual expenditure and export loss on the introduction of annual preventive vaccination: 282m. kr.

For a comparison between costs and losses on the various methods of combating the disease, it is naturally of decisive importance how often Denmark may be affected by FMD if annual preventive vaccination is not used.

If it is assumed that Denmark will experience an outbreak of FMD every tenth year corresponding to the outbreak in 1982, the three methods of combating it should be compared over a ten-year period; in this connection, it should be borne in mind that, prior to the 1982 outbreaks, Denmark had been free of FMD for 12 years.

Estimated total expenditure and loss over a 10-year period by the use of combating methods A, B and C would be:

- A. Combating without vaccination: 487m. kr.
- B. Combating by ring-zonal vaccination: 1,424m. kr.
- C. Annual preventive vaccination: 2,820m. kr.

The losses consequent upon reduced export possibilities have been calculated by the Organisation of Danish Slaughterhouses and the Danish Livestock and Meat Board. The estimated losses have been calculated most cautiously as pig production in Denmark may be assumed to be considerably lower owing to reduced settlement prices if B or C are used.

As export losses and export restrictions in connection with the outbreak of FMD are chiefly in the meat sector, no attempt has been made to assess export losses for the dairy sector as they are restricted compared with those of the meat sector.

The comparison clearly shows that for both Danish agriculture and the Danish community, high economic advantages will be connected with possible future outbreaks of FMD being combated without vaccination. However, such a strategy of combating the disease presupposes that the Veterinary Department has the possibility, based on votes, of maintaining a high state of readiness.

Furthermore, it is of great importance that owners of herds report suspicion of FMD as early as possible, as merely a few days' erroneous assessment of signs of the disease in a herd will result in it having been able to infect so many herds that even the best state of readiness would not enable the Veterinary Department to stop it spreading further. It is, therefore, important that, if suspecting FMD in cattle or pig herds, a farmer immediately call in the veterinary surgeon.
FMD may affect a Danish herd without the owner or any one else being able to prevent it as, under certain meteorological conditions, the FMD virus may be borne by the wind over long distances. The transfer of FMD, as with other infectious diseases of domestic animals, may, however, take place by contact with infected herds abroad. As a result, it is important for farmers to observe strict precautionary methods when visiting foreign herds, or if visited by foreign guests.