Risk assessment in practice: 
a foot and mouth disease control strategy for the European Community

G. DAVIES *

Summary: The European Community (EC) has been a single market for trade 
in livestock and livestock products since the end of 1992. Previously, some of 
the Member States of the EC practised routine prophylactic vaccination against 
foot and mouth disease (FMD), while others banned the use of vaccine. Policy 
had to be harmonised and the European Commission carried out a risk 
assessment to determine the best option.

The assessment compared the costs and benefits of vaccination and non- 
vaccination strategies and assumed that, in either case, FMD outbreaks would 
be stamped out. The costs of vaccination strategy include the cost of 
prophylactic vaccination and the costs of any outbreaks which might occur. The 
costs of a non-vaccination policy are largely confined to outbreaks. The risk 
assessment depended crucially on a prediction of the number of outbreaks 
which might be expected under either policy; this was based on historical 
evidence of outbreaks in vaccinating and non-vaccinating EC Member States.

KEYWORDS: European Community – Foot and mouth disease – Risk 
assessment – Vaccination.

INTRODUCTION

The European Community (EC) currently comprises twelve Member States (the 
name “European Community” has now been superseded by “European Union”). Prior 
to the formation of the EC, each individual state had separate rules for the control 
of animal diseases; these have since been harmonised and consolidated in EC 
legislation.

Free trade within the EC has always been a major objective, and in 1985 the 
European Commission set out a programme and time-table for removing physical, 
technical and fiscal barriers to trade within the EC by the end of 1992. In the animal 
health field, this required the establishment of common standards for trade in animals 
and animal products, the removal of restrictions and the acceptance of a common 
system of checks and controls on the movement of animals and animal products. The

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abolition of controls on trade meant that it was desirable to have common policies for
the control and eradication of disease.

A major stumbling-block to free trade in live animals within the EC was that the
methods used for controlling foot and mouth disease (FMD) differed between the
various Member States. Four countries (Denmark, Greece, Ireland and the United
Kingdom) relied entirely on the slaughter of infected herds (termed “stamping out”),
while the remainder employed prophylactic vaccination supplemented by total or
partial herd slaughter whenever outbreaks occurred. All other FMD control measures –
including import controls, surveillance of susceptible animals, provision of diagnostic
facilities and controls on the movement of livestock in the event of an outbreak – were
common to all EC Member States.

The Member States employing a non-vaccination policy barred the entry of FMD-
susceptible, vaccinated livestock. This policy was justified partly on the grounds that such
animals might harbour covert infection, but also because the presence of vaccinated animals
in the national herd would restrict trade with certain other countries outside the EC.

The situation had to be resolved and the European Commission decided to carry out
a cost/benefit study of alternative policies. This study evolved into an analysis of the
risks attached to vaccination and non-vaccination policies, and the final report led
directly to the eventual abandonment of FMD vaccination throughout the EC.

METHODS

Costs and benefits

There have been several attempts to assess the costs and benefits of FMD control
policies (1, 2, 3). These evaluations rely on estimates of the production losses and other
economic losses caused by the disease, and are largely based on expert opinion. While
such evaluations may be valid for livestock kept in primitive agricultural systems, they
are highly speculative in the context of European agriculture.

For the European Commission study, an alternative approach was adopted. It was
assumed, a priori, that endemic FMD would not be tolerated within the EC under any
circumstances. In other words, the disease must be eradicated before it causes
significant production losses. Thus, the costs incurred are the costs of the control
procedures under different policies, and these can be compared directly.

Two control policies were compared:

a) prophylactic vaccination supplemented by the slaughter of infected herds (termed
“vaccination”)

b) slaughter of infected herds (termed “stamping out”).

The analysis assumed that routine surveillance and diagnostic measures, movement
control and other measures to combat FMD were common to both policies, and that
neither policy would allow FMD epidemics so massive as to result in complete
disruption of the domestic markets in meat, milk and other animal products.

The costs were compared on an annual basis. It was assumed that neither policy
required investment in capital assets which could not potentially be used for the alternative
policy, and that it would be possible to switch from either policy to the other after a single year without having to dispose of any capital equipment which would no longer be needed.

An outline of the costs of the alternative policies is set out in Table I.

### Table I

**Outline of costs of two alternative policies for the control of foot and mouth disease (FMD) in Europe**

<table>
<thead>
<tr>
<th>Routine vaccination</th>
<th>Stamping out</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Vaccination programme</strong></td>
<td><strong>Vaccination provision</strong></td>
</tr>
<tr>
<td>Vaccine (including emergency vaccine bank)</td>
<td>Emergency vaccine bank</td>
</tr>
<tr>
<td>Vaccination</td>
<td></td>
</tr>
<tr>
<td>Side effects *</td>
<td></td>
</tr>
<tr>
<td><strong>FMD outbreaks</strong></td>
<td><strong>FMD outbreaks</strong></td>
</tr>
<tr>
<td>Controlling outbreaks (including ring vaccination, if carried out) *</td>
<td>Controlling outbreaks (including ring vaccination, if carried out) *</td>
</tr>
<tr>
<td>Slaughtered herds *</td>
<td>Slaughtered herds *</td>
</tr>
<tr>
<td>Loss of production *</td>
<td>Loss of production *</td>
</tr>
</tbody>
</table>

* uncertain costs

### Analysis of risk

While the cost of vaccinating susceptible livestock is predictable, the total cost of slaughtering infected herds is largely dependent on the number of outbreaks which might occur under either policy.

A scientific group advising the European Commission was asked to provide an opinion on the extent of the risk of FMD occurring in the EC following the introduction of the open market in 1992. This group based its assessment on the epidemiological and laboratory evidence available for the FMD outbreaks which occurred between 1977 and 1987. The group first identified the primary outbreaks in each epidemic in order to determine the source of infection, as far as possible, and then examined the spread of infection (number of secondary outbreaks) to determine the extent to which this spread had been affected by vaccination and other control measures.

### Comparison of the alternative policies

Comparison of the costs of the two alternative policies ("vaccination" and "stamping out") is rendered difficult by a number of major, unpredictable factors, namely:

- the random nature of outbreaks of the disease
- the size of the herds in which outbreaks might occur (cattle herd sizes within the EC vary from one to two cows to several hundred animals)
- the extent to which disease might spread
- possible errors in the measurement of values for slaughtered stock
- the cost of controls on infected premises.
These uncertainties were dealt with by a scenario analysis. This technique involves the construction of two sets of alternative scenarios, one for each policy. Each scenario consists of a set of values for all the variables which enter into the calculation of the cost of the two policies. For a given policy, the values of the uncertain variables will differ between scenarios, while the values of the certain variables do not change. Usually, at least three alternative values will be used for each uncertain variable under each policy: the "most likely" value and two extreme values (high and low). Every possible combination of values for the uncertain variables is then used to generate the two sets of scenarios for the two policies.

The next step in the scenario analysis is to calculate the total cost of each policy under each scenario. In order to simplify the analysis, it is necessary to restrict the number of scenarios under consideration; however, these must include the "worst" and the "best" cases, as well as a "central" estimate, however slight the risk may be of each scenario occurring.

The final step is to compare the sets of total costs which have been calculated for the two policies under the alternative scenarios.

**RESULTS**

**Cost of vaccination**

Each Member State was asked to calculate the cost of a single annual vaccination of all eligible cattle in the national herd (Table II). These costs were available from records for all states, except those which prohibited vaccination. For the latter, estimates were provided.

**Cost of outbreaks**

Figures for the cost of outbreaks were provided by the EC Member States (Table III). The costs varied considerably, the most important variables being the difference in the size of the herds and the value of the livestock slaughtered. The values shown represent the average for each Member State; however, even within Member States, there is great variation in herd size from smallholdings to large intensive units. The average of costs submitted (excluding those of Portugal, where the herd size of four cattle and five pigs is untypically small) was ECU158,000 (ECU: European Currency Unit), and this was used as the central estimate in the analysis. The cost of slaughtering a small herd was taken as ECU32,000 (as submitted by Greece) and the cost of a large herd as ECU600,000 (the cost of slaughtering a large pig unit in Italy).

**Number of outbreaks**

The number of outbreaks used in constructing the most likely (central), worst and best cases was derived from estimates provided by the scientific group.

Between 1977 and 1987, a total of 1,923 outbreaks of FMD occurred in the twelve EC Member States. Specific data relating to primary and secondary outbreaks were not available for Spain; however, in the other eleven Member States, there were a total of 1,858 outbreaks of which 34 were considered to be primaries (Table IV).

The sources of the 34 primary outbreaks were investigated by the scientific group. In eight outbreaks, the evidence suggested that the source was outside the EC; the majority seemed to be associated with imports of meat, while others were probably due
TABLE II
Cost of a vaccination programme for foot and mouth disease in the European Community in 1987 *

<table>
<thead>
<tr>
<th>Country</th>
<th>No. of cattle vaccinated (thousands)</th>
<th>Cost per head</th>
<th>National cost</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>in national</td>
<td>in ECU</td>
</tr>
<tr>
<td></td>
<td></td>
<td>currency</td>
<td>(millions)</td>
</tr>
<tr>
<td>Belgium</td>
<td>2,232</td>
<td>54 BFR</td>
<td>1.25</td>
</tr>
<tr>
<td>Denmark **</td>
<td>2,250</td>
<td>17.90 DKR</td>
<td>2.25</td>
</tr>
<tr>
<td>France</td>
<td>21,052</td>
<td>10.93 FRF</td>
<td>1.42</td>
</tr>
<tr>
<td>Germany</td>
<td>14,560</td>
<td>3.14 DM</td>
<td>1.18</td>
</tr>
<tr>
<td>Greece **</td>
<td>761</td>
<td>122 DRA</td>
<td>0.74</td>
</tr>
<tr>
<td>Ireland **</td>
<td>6,647</td>
<td>1.50 IRL</td>
<td>1.94</td>
</tr>
<tr>
<td>Italy</td>
<td>11,000</td>
<td>15.00 LIT</td>
<td>1.87</td>
</tr>
<tr>
<td>Luxembourg</td>
<td>209</td>
<td>24 LFR</td>
<td>0.55</td>
</tr>
<tr>
<td>Netherlands</td>
<td>3,800</td>
<td>5.77 HFL</td>
<td>2.48</td>
</tr>
<tr>
<td>Portugal</td>
<td>1,200</td>
<td>177 ESC</td>
<td>1.00</td>
</tr>
<tr>
<td>Spain</td>
<td>5,200</td>
<td>207 PTA</td>
<td>1.50</td>
</tr>
<tr>
<td>United Kingdom **</td>
<td>11,152</td>
<td>1.77 UKL</td>
<td>2.66</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* annual costs at 1987 prices, based on annual vaccination of all eligible cattle (except for France and Luxembourg, where only total cattle population figures were available), including vaccine, vaccination and general administration; costs did not include possible side-effects

** European Community Member States which did not vaccinate at that time (estimated costs)

ECU: European currency unit (ECU1 = US$1.13)

to airborne transmission across the external borders of the EC (outbreaks associated with imports of meat ceased when EC regulations were amended to prohibit importation of meat on the bone in 1978).

A further thirteen primary outbreaks could not be attributed with any certainty to sources outside the EC and, in the absence of any endemic source of FMD in the herds and flocks within the EC, it seemed likely that all of these outbreaks were connected, in one way or another, either with the escape of virus from laboratories or with the use of improperly inactivated vaccines. The origin of the remaining thirteen primary outbreaks was unknown.

The spread of disease from these primary outbreaks (the ratio of primary to epidemiologically-connected secondaries) varied considerably (Table IV). In some cases, the primary outbreaks were extinguished before they led to any secondaries, but during the epidemic in Italy in 1984-1985, the ratio was 1:153.

An attempt was made to determine whether this variation in spread was connected with the presence or absence of vaccinated animals. Where vaccination had been
TABLE III
Costs of a single outbreak of foot and mouth disease
(estimated by European Community Member States at 1987 prices) *

<table>
<thead>
<tr>
<th>Country</th>
<th>National currency</th>
<th>ECU</th>
</tr>
</thead>
<tbody>
<tr>
<td>Belgium</td>
<td>2,203,055 BFR</td>
<td>50,650</td>
</tr>
<tr>
<td>Denmark</td>
<td>1,210,000 DKR</td>
<td>150,239</td>
</tr>
<tr>
<td>France</td>
<td>2,000,000 FRF</td>
<td>284,000</td>
</tr>
<tr>
<td>Germany</td>
<td>100,000 DM</td>
<td>48,309</td>
</tr>
<tr>
<td>Greece</td>
<td>5,281,911 DRA</td>
<td>31,914</td>
</tr>
<tr>
<td>Ireland</td>
<td>164,500 IRL</td>
<td>212,258</td>
</tr>
<tr>
<td>Italy</td>
<td>420,000,000 LIT</td>
<td>270,000</td>
</tr>
<tr>
<td>Luxembourg</td>
<td>2,360,000 LFR</td>
<td>54,402</td>
</tr>
<tr>
<td>Netherlands</td>
<td>146,000 HFL</td>
<td>62,300</td>
</tr>
<tr>
<td>Portugal</td>
<td>957,113 ESC</td>
<td>5,630</td>
</tr>
<tr>
<td>Spain</td>
<td>64,574,000 PTA</td>
<td>469,731</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>70,000 UKL</td>
<td>104,979</td>
</tr>
</tbody>
</table>

* costs at 1987 prices, including: compensation; cleansing, disinfection and associated measures; loss of production on farm; general administration of outbreak control (costs did not include ring vaccination)

** disease occurring on one farm or holding (Office International des Epizooties definition for European conditions)

ECU: European currency unit (ECU1 = US$1.13)

employed to protect the cattle population, the secondary outbreaks occurred mainly (but by no means entirely) in non-vaccinated pig herds. Infected pigs excrete large quantities of virus particles and these perpetuated the epidemics.

Perhaps surprisingly, the four Member States which did not employ vaccination experienced a ratio of seven primaries to twenty-eight secondaries, despite the large pig populations in these countries. This was a lower ratio than found in most, but not all, of the vaccinating states and suggests that, in the absence of vaccination, veterinary services employ a more rigorous approach to eradication. One can also infer that good control measures are quite as important as vaccination in preventing the spread of FMD.

These ratios of primary to secondary outbreaks were important in predicting the rate of spread which could be expected under the two alternative strategies. The scientific group decided that it could not determine any difference in risk.

ANALYSIS OF RESULTS

The data presented in Tables II to IV were used to predict the risk of outbreaks occurring in the EC after 1992, under the two alternative policies. A scenario analysis was constructed on the basis of this prediction.
### TABLE IV

*Rate of spread of outbreaks of foot and mouth disease in European Community (EC) Member States*

<table>
<thead>
<tr>
<th>Country</th>
<th>Outbreaks</th>
<th>Ratio of primary to secondary outbreaks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Primary</td>
<td>Secondary</td>
</tr>
<tr>
<td><strong>EC Member States using a non-vaccination policy</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Denmark</td>
<td>2</td>
<td>21</td>
</tr>
<tr>
<td>Greece</td>
<td>3</td>
<td>7</td>
</tr>
<tr>
<td>Ireland</td>
<td></td>
<td>No outbreaks recorded</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td><strong>EC Member States using a vaccination policy</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Belgium</td>
<td></td>
<td>No outbreaks recorded</td>
</tr>
<tr>
<td>France</td>
<td>2</td>
<td>38</td>
</tr>
<tr>
<td>Germany</td>
<td>8</td>
<td>20</td>
</tr>
<tr>
<td>Italy</td>
<td>13</td>
<td>551</td>
</tr>
<tr>
<td>Luxembourg</td>
<td></td>
<td>No outbreaks recorded</td>
</tr>
<tr>
<td>Netherlands</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>Portugal</td>
<td>2</td>
<td>1,182</td>
</tr>
<tr>
<td>Spain</td>
<td>Number of outbreaks not known</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>34</td>
<td>1,824</td>
</tr>
</tbody>
</table>

* range of values

The best estimate of the scientific group was that the risk of infection from a source external to the EC in the years 1993-2003 would be no worse and no better than between 1977 and 1987, i.e. causing approximately eight primary outbreaks. To these could be added a proportion of the 13 outbreaks where the origin was unknown, thus increasing the risk to 12-13 primary outbreaks over the 11-year period. It was recognised that this was probably an overestimate of the risk, as meat on bone imports had been banned.

Predicting the number of primary outbreaks which would occur in the presence or absence of vaccination was crucial to the analysis. On the one hand, it was possible that vaccination would prevent the establishment of a primary outbreak, although this probability could not be assessed. On the other hand, experience in areas of the EC where vaccine had not been used suggested that the probability was small. Thus, the 12-13 outbreaks attributed to external sources would occur even with vaccination.

On the basis of the data recorded between 1977 and 1987, if vaccination was not used in the EC after 1992, it seemed unlikely that there would be any primary outbreaks in addition to those originating from outside the EC (i.e. 12-13 over an 11-year period; this sum includes a proportion of the 13 primary outbreaks of unknown origin). This
prediction presumed that laboratories handling FMD virus operated effectively in conditions of high security. The prediction for a non-vaccination policy was therefore 13 primary outbreaks over ten years.

If vaccination continued to be employed within the EC, there was a risk that additional outbreaks associated with the production and administration of the vaccine would occur. The group deemed it reasonable to expect some 12-13 primary outbreaks from these sources, although it acknowledged that vaccine inactivation techniques were improving. When these are added to the eight outbreaks due to external sources, the prediction for a vaccination policy was 20 primary outbreaks over ten years.

The scenario analysis presented three possible outcomes, depending on the number and cost of outbreaks, as follows:

- **the best case**, or the most optimistic outcome, i.e. all outbreaks occurring in the smallest livestock holdings (cost of one outbreak = ECU32,000) and no secondary outbreaks arising out of the primary

- **the central case**, or the most likely outcome, based on the cost of an average outbreak (ECU158,000) and the most likely number of secondary outbreaks per primary (i.e. 20)

- **the worst case**, which assumes that 150 secondaries would arise from each primary and that the outbreaks would all occur in the largest herds (at a cost of ECU600,000 per outbreak).

The outcome of the analysis is shown in Table V. It can be seen that a stamping out policy was predicted to cost less than a vaccination policy under all three scenarios.

### Table V

Estimated costs (in ECU) of two alternative policies for the control of foot and mouth disease in the European Community

<table>
<thead>
<tr>
<th>Scenario</th>
<th>No. of outbreaks *</th>
<th>Cost (million ECU)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Primary</td>
<td>Secondary **</td>
</tr>
<tr>
<td><strong>Stamping out policy</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Best case</td>
<td>13</td>
<td>0</td>
</tr>
<tr>
<td>Central case</td>
<td>13</td>
<td>20</td>
</tr>
<tr>
<td>Worst case</td>
<td>13</td>
<td>150</td>
</tr>
<tr>
<td><strong>Vaccination policy</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Best case</td>
<td>20</td>
<td>0</td>
</tr>
<tr>
<td>Central case</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Worst case</td>
<td>20</td>
<td>150</td>
</tr>
</tbody>
</table>

* over 10 years (discounted at 5%)

** number of secondaries assumed per primary

ECU: European currency unit (ECU1 = US$1.13)
The above study formed the core of a report by the Commission of the European Communities presented to the Council of Ministers of the EC. In addition to the risk analysis, the report commented on the potential effects of the alternative policies on trade, reviewed the effects on veterinary manpower and vaccine production plants, and considered possible risk-aversion measures to be taken after 1992. Vaccination was abandoned in 1991.

DISCUSSION AND POSTSCRIPT

The results of a cost/benefit and risk analysis, as described above, can provide no more than a guide to determining future policy. In this case, there were two major imponderables which could have influenced the final decision to abandon or persevere with vaccination.

The first area of uncertainty was related to the benefits attached to the flow of trade in and out of the EC. Trade in animals and animal products is open to a great variety of influences, but it would be difficult to envisage a set of circumstances in which the EC would be able to export greater quantities if FMD vaccination had been performed within Member States than if vaccination were prohibited. Consideration of external trade benefits favoured a non-vaccination policy.

The second area of uncertainty was political and social change, the great disrupter of disease control schemes across the world – as evinced by the rinderpest campaigns in Africa. The major change in Europe has been the fall of the "Iron Curtain" which has meant that the EC now faces an entirely different set of circumstances and risks, including the illegal importation of live animals from areas where the health status may not be entirely secure.

Nevertheless, at the present time – three years after the initiation of the non-vaccination regime – the actual financial benefits have proved to be greater than the actual costs. Vaccination has ceased, most of the fifteen vaccine plants which were operating in the EC have closed down and the number of laboratories handling FMD virus has been reduced to a minimum. Stringent measures have been taken to ensure that the remaining laboratories conform to recommended safety standards. The EC Member States have adopted contingency plans for dealing with FMD outbreaks, and the main thrust of activities is increasingly to extinguish epidemics as soon as possible, using every available technological aid (such as meteorological analysis).

The costs to be set against these benefits can be measured as the cost of extinguishing the outbreaks which have occurred. The importation of infected cattle into Italy in early 1993 resulted in approximately 70 outbreaks. Fortunately, the majority of the herds involved were very small and, to date, the cost of slaughter and control measures has not been onerous.

ACKNOWLEDGEMENTS

The author wishes to acknowledge the help of M. Watts of the Economics Division of the Ministry of Agriculture, London (United Kingdom), who devised the scenario analysis, and R. Lorenz, who originally suggested comparing two alternative policies.
rather than becoming embroiled in the actual costs of FMD. The late M. Eskildsen led the Scientific Committee which determined the likely risk of outbreaks, and without his meticulous chairmanship the whole process might have foundered.

*L*

**L’ÉVALUATION DES RISQUES APPLIQUÉE À UNE STRATÉGIE DE CONTRÔLE DE LA FIÈVRE APHTEUSE DANS LA COMMUNAUTÉ EUROPÉENNE.** - G. Davies.

Résumé : Depuis la fin de l’année 1992, le commerce du bétail et des produits d’origine animale en Europe s’effectue dans le cadre du marché unique. Auparavant, quelques États membres de la Communauté européenne pratiquaient une vaccination systématique contre la fièvre aphteuse, tandis que d’autres interdisaient l’usage de vaccins. Devant la nécessité d’harmoniser les politiques en la matière, la Commission européenne a procédé à une évaluation des risques en vue de déterminer la meilleure option.

L’évaluation comparait les coûts et avantages des stratégies de vaccination et de non-vaccination et supposait que, dans chaque cas, on devrait recourir à l’abattage des animaux malades. Les coûts d’une stratégie de prophylaxie comprenaient le coût de la vaccination proprement dite et celui des foyers éventuels, alors que les coûts d’une politique de non-vaccination se limitent essentiellement aux cas de maladie apparus. L’évaluation des risques a été en grande partie déterminée par les prévisions relatives au nombre de foyers attendus dans les deux cas ; ces prévisions ont été basées sur le nombre de foyers observés antérieurement dans les États qui pratiquaient la vaccination et dans ceux qui l’interdisaient.


**LA EVALUACIÓN DE RIESGOS Y SU APLICACIÓN PRÁCTICA: UNA ESTRATEGIA PARA EL CONTROL DE LA FIEBRE AFTOSA EN LA COMUNIDAD EUROPEA.** – G. Davies.

Resumen: Desde fines de 1992, el comercio de animales y de productos de origen animal en Europa se realiza en el marco del mercado único. Antes de esto, algunos países miembros de la Comunidad Europea habían vacunado sistemáticamente contra la fiebre aftosa mientras que otros, por el contrario, habían prohibido el uso de vacunas. Ante la necesidad de armonizar estas diversas políticas, la Comunidad europea decidió llevar a cabo una evaluación de riesgos que permitiera elegir la mejor opción.

La evaluación realizada comparaba los costos y los beneficios respectivos de la política de vacunación y de la de no vacunación, y suponía que en ambos casos sería necesario el sacrificio de los animales enfermos. El costo de una estrategia de vacunación incluye el de la vacunación preventiva más el que resulte de los brotes de enfermedad que pudieran aparecer; el costo de la estrategia de no vacunación se limita esencialmente a los brotes. La evaluación
de riesgos se determinó en gran medida a partir de las previsiones sobre la cantidad de brotes esperados en uno y otro caso, que se calculó a partir de la cantidad de brotes observados en los países que habían vacunado y de la cantidad de brotes en los países que habían prohibido la vacunación.


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REFERENCES

