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## Technical and economic evaluation method for use in improving infectious animal disease surveillance networks

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**Abstract** – With hope of improving the increasing number of epidemiological surveillance networks for animal diseases set up in recent years, a qualitative and quantitative technical and economic evaluation tool was developed and then applied to three epidemiological surveillance networks: RENESA (a French surveillance network for salmonella and mycoplasma contamination in poultry production units subject to official sanitary controls), the French Foot and Mouth Disease Epidemiovigilance Network and REPIMAT (the epidemiological surveillance network in Chad for major cattle diseases). We identified critical points in epidemiological surveillance networks using a modified version of the hazard analysis: critical control point (HACCP) method. An evaluation grid was then developed and validated by experts who were consulted in accordance with the Delphi method. A questionnaire to collect the information required for the evaluation and a scoring guide were then designed. Our evaluation procedure also included a calculation of the annual operating costs for two of the three networks studied. On the basis of the detailed results of the technical and economic evaluation, we formulated specific suggestions for improving the networks. The cost of implementing these proposals was calculated. We then simulated the effects of implementing each of the proposed improvements and a new global evaluation score was determined for each network. The ‘cost per point’ of each improvement was then calculated and discussed. This tool for the technical and economic evaluation of epidemiological surveillance networks for animal diseases is proposed so that it may be tested on a far wider scale and eventually be used in improving the functioning of such networks and for risk analysis in international trade. © Inra/Elsevier, Paris.

**epidemiological surveillance / evaluation / network / Delphi method / infectious animal disease**

**Résumé** – Méthode d’évaluation technico-économique de la qualité du fonctionnement des réseaux de surveillance épidémiologique des maladies infectieuses animales en vue de leur amélioration. Afin de contribuer à l’amélioration du fonctionnement des réseaux de surveillance épidémiologique des maladies animales qui se sont multipliés ces dernières années, un outil d’évalua-

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tion technico-économique à la fois qualitatif et quantitatif a été créé et appliqué à trois réseaux de surveillance épidémiologiques : le Renesa (réseau français de suivi des salmonelles et des mycoplasmes dans les élevages avicoles inscrits au contrôle sanitaire officiel), le réseau d'épidémiologie de la fièvre aphteuse en France et le Repimat, réseau tchadien de surveillance épidémiologique des principales maladies du bétail. Pour construire la méthode d'évaluation, il a été nécessaire d'identifier les points critiques des réseaux de surveillance épidémiologique par transposition de la méthode HACCP (*hazard analysis: critical control point*) à leur fonctionnement, une grille d'évaluation des principaux points critiques a été ensuite élaborée et validée auprès d'experts en utilisant la méthode Delphi. Un questionnaire de collecte de l'information nécessaire à l'évaluation et un guide de notation ont ensuite été conçus. Le coût annuel de fonctionnement des réseaux a également été déterminé. Les résultats détaillés de cette évaluation technico-économique ont conduit à formuler des propositions d'amélioration pour chaque réseau. Le coût de ces propositions a été établi ; une simulation des conséquences de l'application des propositions d'amélioration a été réalisée et a conduit à une nouvelle note globale d'évaluation de chacun des réseaux. Le « coût par point » de chaque amélioration a ensuite été établi et discuté. Cet outil d'évaluation technico-économique des réseaux de surveillance épidémiologique des maladies animales est proposé en vue de validation à plus large échelle et d'utilisation tant pour l'amélioration du fonctionnement de tels réseaux que pour l'analyse de risque lors d'échanges internationaux. © Inra/Elsevier, Paris.

## surveillance épidémiologique / évaluation / réseaux / méthode Delphi / maladies infectieuses animales

### 1. INTRODUCTION

Since the opening of the European market in 1993 and the resulting liberalisation of trade among the different Member States of the European Union, the volume of international trade in animals and animal products has greatly increased. The signing of the General Agreement on Tariffs and Trade (GATT) and the establishment of the World Trade Organization (WTO) have recently further extended this trading zone.

In order that the health risks associated with such trade be kept within acceptable limits, the sanitary standards developed by the Office International des Epizooties (OIE) and the Codex Alimentarius should be respected.

Within this new trading environment, a precise and up-to-date knowledge of the epidemiological status of the major transmissible diseases is becoming increasingly essential for each country involved.

The quality of the available epidemiological data is a vital element in health policy decision making. Data quality depends on various factors relating to the manage-

ment and organisation of the veterinary services in a given area or country, as well as the way in which the epidemiological surveillance networks are run.

Apart from its importance in helping to gain access to international markets, epidemiological surveillance is essential to protect animal populations from exotic or emerging diseases and for implementing and evaluating control programmes for enzootic or epizootic diseases.

The role and position of epidemiological surveillance in the field of animal health and international trade in animals and animal products have gained considerable importance. The quality of data produced by an epidemiological surveillance network is highly dependent on the way in which it is run. It is therefore vital to assess the quality of its operational management.

To date, very little work has been published on the evaluation of epidemiological surveillance networks [1, 2, 4, 11]. None of the previous studies used a quantitative method and economic implications were not considered.

Evaluation of an epidemiological surveillance network can be undertaken simply to assess the quality of data produced by the network (for example for risk analysis purposes). However, when evaluation is conducted in close collaboration with the coordinators of the network, it is logical to use the results of the evaluation to make proposals for improving the network. Any such improvements must be cost effective; in other words, they must provide a satisfactory level of improvement for an acceptable cost.

Technical and economic evaluation of an epidemiological surveillance network aimed at making improvements requires the following three stages:

- technical evaluation and estimation of the network's operating costs;
- evaluation of the scope for improvements and estimation of their cost;
- second technical and economic evaluation of the network after implementation of the improvements, and comparison with the previous situation.

With the aim of making a contribution to improving the management of epidemiological animal disease surveillance networks, our work consisted of developing a qualitative and quantitative method to evaluate epidemiological surveillance networks including an economic approach. The method was then applied to three epidemiological surveillance networks in order to test the entire procedure, including a comparison of cost-effective ratios.

## 2. MATERIALS AND METHODS

### 2.1. Technical evaluation

In order to carry out a technical evaluation of the quality of epidemiological surveillance networks, a specific method had to be developed. The method we devised was both qualitative and quantitative. It assigns a global score out of 100, which accounts for the quality of the network under study, thus providing a measurement of

the improvement potential and, after changes have been introduced, the progress actually achieved.

We prepared a grid containing a list of the critical points in the operation of an epidemiological surveillance network and submitted it to experts for validation. We also designed a questionnaire, to collect the information needed for the evaluation, and a scoring guide.

#### 2.1.1. Development of the evaluation grid and review by experts

Identifying critical points in the operation of epidemiological surveillance networks was a prerequisite for developing an evaluation grid. The hazard analysis: critical control point (HACCP) method was used to identify critical points. This method, which provides a logical, organised and systematic approach, enables the risks associated with the production of foodstuffs to be identified and controlled [12]. It was adapted to epidemiological surveillance [8]. This is why the list of the 'hazards' linked to all possible biases coming from the incorrect working of networks had been established; then critical points allowing the control of these hazards were identified. Several networks were then studied in order to verify whether the critical points identified were the same for different networks.

The resulting list of critical points corresponds to those aspects of the network whose quality largely determines its overall effectiveness (and thus the lack of the main bias conditioning the reliability of the information produced by the network). These critical points are those that need to be covered by the evaluation procedure.

This list of critical points, along with a number of other criteria for each critical point considered to be important for the evaluation (*table 1*) process, constituted the evaluation grid.

We nevertheless found slight differences in the operating methods of surveillance networks for diseases occurring frequently in a given territory (i.e. enzootic diseases) and for diseases that do not occur (i.e. exotic diseases) or that are rare (i.e. epizootic or sporadic in occurrence). In the case of exotic or rare diseases, surveillance has to cover the entire population of susceptible animals to ensure that even single cases are detected, whereas for enzootic diseases sampling the population is usually sufficient. Surveillance for transmissible diseases involves the detection of clinical signs and/or infection. For exotic or rare diseases, surveillance for clinical signs is

**Table I.** Mean overall scores<sup>a</sup> given by 11 experts (1–11) during two consecutive Delphi method consultations on the evaluation grids for: a) enzootic and b) exotic disease networks.

	1	2	3	4	5	6	7	8	9	10	11	Global mean
Enzootic diseases: 1st round	8.8	7.9	8.2	6.4	7.5	8.8	7.6	7.7	7.3	7.0	4.7	7.45
Enzootic diseases: 2nd round	8.0	8.2	9.4	7.7	8.1	9.5	8.0	8.8	8.3	9.5	7.8	8.51
Exotic diseases: 1st round	8.7	8.1	8.3	8.3	8.6	7.0	7.3	8.3	9.9			8.28
Exotic diseases: 2nd round	8.0	7.5	9.1	8.6	9.8	7.5	8.9	8.8	7.6			8.44

<sup>a</sup> Scores represent the mean, for each expert, of all scores for questions relating to the choice of critical points, the respective weighting for the critical points and proposed criteria.

the rule and surveillance for infection is far more rarely carried out than for enzootic diseases.

Two different evaluation grids, therefore, needed to be designed: one for surveillance networks for enzootic diseases (epidemiological surveillance) and one for surveillance networks for serious exotic or rare diseases (epidemiological surveillance). These two grids were then submitted to a panel of experts.

A quantitative approach was achieved by assigning a number of points to each of these critical points so as to give a total score of 100 points. The score obtained at the end of the evaluation process thus enables: 1) the potential improvement for each critical point to be measured; and 2) the quality and functioning of different networks to be compared.

In order to validate our choice of critical points, the criteria selected for each critical point and their relative weighting in the score, a draft evaluation grid was submitted to a panel of experts from France and other countries using a consultation method called Delphi [3].

This method consists in obtaining the views of approximately ten experts per post. The aim is to test a proposal by means of a quantified questionnaire that each expert marks according to a predetermined scale (usually from 0 to 10) depending on the extent to which the expert agrees with the proposal. To try to reach a consensus among the various experts (who have no contact with each other), several series of consultations can be organised. After the first questionnaire returns have been analysed, the experts

receive a second questionnaire in addition to the results of the first round of consultation. They are asked to justify any differences between their own scores and the mean scores of the other experts. This process can then be repeated until a consensus has been reached.

The 11 experts selected to take part in the consultation were all surveillance network coordinators, and therefore experienced in network management. Eight of them were coordinators of animal disease epidemiological surveillance networks and three belonged to human disease surveillance networks. Seven were from France and four from other countries.

### **2.1.2. Development of additional documentation**

Additional tools were created to guide users in the use of the evaluation grids and to standardise scoring. These included a questionnaire to obtain information on the operation of the network. This questionnaire was made up of nine parts: a general part to obtain basic information about the network under study and eight parts corresponding to the eight critical points on the evaluation grid. A user's guide was also designed.

These items were discussed and approved by a working group, and then tested on several operational networks.

## 2.2. Evaluation of operating costs and cost of improvements

The aim of an economic evaluation is to optimise the decision-making process by introducing an economic factor. To achieve this objective, it is necessary to calculate the cost of operating a network and the cost of implementing improvements, to relate these costs to performance (measured on the basis of the results of the quantitative evaluation) and to make comparisons.

The method of estimating the annual cost of operating a network involves drawing up a list of items that need to be included in the calculations. The resulting list varies according to the type of network. For networks integrated into control programmes, only those items relating to the centralisation, processing and dissemination of data should be taken into account. In contrast, for networks not linked to control programmes, the collection of data in the field (including sampling and testing) also has to be included in the calculations.

In estimating the annual operating costs, standard methods of amortisation [7] were used for materials and activities such as training whose effects are felt over a period of several years.

After the quantitative technical evaluation of the way the networks were run, conducted in collaboration with the network coordinators concerned, improvement proposals were put forward for the critical points where the management was less effective. The cost of the proposed improvements was also determined, using the same unit costs that were used to calculate annual operating costs.

In order to evaluate the effect of implementing the various proposed improvements, it was necessary to create a ratio relating the annual operating costs to increased effectiveness measured by the score obtained at the end of the quantitative evaluation. The 'cost per point' was thus created. It is calculated by dividing the annual operating costs of the network by the overall score obtained after evaluation.

Calculation of the 'cost per point' proposed improvement theoretically requires a fresh evaluation of the operation of the network after the improvements have been implemented.

In this study, we simulated, with the coordinators' help, the effect of implementing the improvements corresponding to the potential for improvement estimated for each critical point, thus allowing an evaluation score to be determined for the 'improved' network.

## 2.3. Evaluation applied to epidemiological surveillance networks

The evaluation method was then applied to three operational epidemiological surveillance networks: the RENESA epidemiological surveillance network for salmonella and mycoplasma contamination in French poultry production units and hatcheries subjected to official screening [5], the French Foot and Mouth Disease Epidemiology Network [9] and the REPIMAT epidemiological surveillance network for major diseases in Chad [10].

For each network, the technical evaluation resulted in a score being awarded out of a maximum of 100 points. Only RENESA and the French Foot and Mouth Disease Epidemiology Network underwent the complete procedure, including evaluation of the annual operating costs, formulation of improvement proposals, estimation of the cost of improvements, simulated evaluation of the improved network and the determination of 'cost per point' ratios.

## 3. RESULTS

### 3.1. Evaluation grid design

Application of the HACCP method to various epidemiological surveillance networks enabled us to develop a list of critical points with identical criteria for all the networks tested (*table II*).

### 3.2. Results of the expert consultation

Two rounds of consultations were required for the experts to reach a consensus on the two evaluation grids shown in *table II*. For the sake of convenience, both grids are included in the same table.

*Table I* gives the overall scores (mean score for each question) attributed by the experts at the end of the first and second consultations. Two of the experts did not complete the questionnaire on the evaluation grid relating to surveillance networks for exotic diseases on the grounds that they had no experience of diseases of this type.

**Table II.** Quantitative evaluation grid for epidemiological surveillance networks.

Critical point	Criteria important for evaluation	Enzootic disease	Serious exotic or rare disease
		Score	Score
Aims		<b>15</b>	<b>15</b>
Sampling		<b>20</b>	<b>20</b>
	<i>Surveillance for clinically suspected cases</i>		
	Regulation covering notifiable diseases		3 (6) <sup>a</sup>
	Proportion of cases declared		7 (14) <sup>a</sup>
	Accuracy (if sample)	5 (10) <sup>a</sup>	
	Precision (if sample)	5 (10) <sup>a</sup>	
	<i>Surveillance for infected cases</i>		
	Accuracy	5 (10) <sup>a</sup>	5
	Precision	5 (10) <sup>a</sup>	5
Coordination and awareness		<b>15</b>	<b>15</b>
	<i>Awareness of field workers</i>		
	Awareness training	2	4
	Maintenance of awareness	2	4
	Evaluation of level of awareness	1	3
	<i>Coordination of the network</i>		
	Coordination methods	5	2
	Suitable provision of staff hours	5	2
Environmental factors		<b>0</b>	<b>4</b>
	Surveillance of susceptible wildlife		2
	Surveillance of vectors		2
Techniques used for screening and diagnosis		<b>20</b>	<b>20</b>
	Screening or diagnosis in the field	4 (0) <sup>b</sup>	4 (0) <sup>b</sup>
	Sampling	4 (8) <sup>b</sup>	4 (8) <sup>b</sup>
	Laboratory techniques	4	4
	Reagents used	4	4
	Laboratories	4	4
Collection and circulation of data		<b>10</b>	<b>10</b>
	Standardisation of field observers' work	5	5
	Quality and rapidity of data circulation	5	5
Data processing and analysis		<b>10</b>	<b>10</b>
	Quality of processing	5	5
	Scientific validation	5	5
Dissemination of information		<b>10</b>	<b>6</b>
	Quality of disseminated information	5	3
	Frequency and scope of dissemination	5	3
	<b>Total</b>	<b>100</b>	<b>100</b>

<sup>a</sup> The figures in parentheses apply if surveillance includes only clinical signs or infection.<sup>b</sup> The figure in parentheses applies when no field tools are used.

For surveillance networks for enzootic diseases, the mean overall score of all the experts increased by over one point between the first and second rounds of consultation. For the proposals on the evaluation of surveillance networks for exotic diseases, the increase between the two rounds of consultation was less marked (0.24 points).

The experts submitted various proposals on adjustments to the relative weighting given to each of the critical points and on the list of evaluation criteria. These proposals were taken into account in the evaluation grids sent to them for the second round of consultation.

The evaluation grids resulting from the second round were subsequently modified slightly after they had been tested on three epidemiological surveillance networks.

### 3.3. Application of the evaluation method

#### 3.3.1. RENESA network

At the end of the quantitative evaluation, the RENESA network obtained an overall score of 69/100 (*table III*). Three critical

points appeared to be less well managed than the others: sampling, techniques used for screening and diagnosis (especially standardisation of sampling and laboratory techniques) and collection and circulation of data (particularly standardisation of field observers' work).

The annual cost of operating the RENESA network, as evaluated in 1996, was 201 016 FF.

Improvements were proposed on sampling, techniques used for screening, diagnosis and collection and circulation of data.

Following a simulation of the implementation of the proposed improvements, the overall score for the network was found to have improved by 11.5 points, increasing to 80.5/100.

The theoretical 'cost per point' of improvement gain resulting from implementation of the proposed measures was found to be highly variable from one measure to another. The points gained by extending the network were the most costly. However, it should be noted that the points that could be gained as a result of standardising testing would not have to be financed by RENESA itself.

**Table III.** Evaluation scores of three epidemiological surveillance networks: RENESA, the Foot and Mouth Disease Epidemiology Network and REPIMAT

Critical points	RENESA	Foot and Mouth Disease	REPIMAT
Aims	13/15	12/15	6.5/15
Sampling	11.5/20	16/20	8/20
Coordination and awareness	12.5/15	10/15	8/15
Environmental factors	–	3/4	–
Techniques used for screening and diagnosis	9.5/20	15/20	11/20
Collection and circulation of data	5/10	5/10	6.5/10
Data processing and analysis	9/10	8/10	4/10
Dissemination of information	8.5/10	1/6	8/10
Total	69/100	70/100	52/100

### 3.3.2. *The French Foot and Mouth Disease Epidemiovigilance Network*

As shown in *table III*, at the end of the quantitative evaluation the Foot and Mouth Disease Epidemiovigilance Network obtained a global score of 70/100. Two critical points were found to be less well managed than the others: collection and circulation of data and dissemination of information.

The annual cost of operating the Foot and Mouth Disease Epidemiovigilance Network was estimated to be 2 397 856 FF, including tax.

Suggestions were made to help improve the management of collection and circulation of data and the dissemination of information.

A simulation of the implementation of these improvements indicated that the global score for the network could be improved by six points to 76/100.

The 'cost per point' of implementing the suggested improvements was low and almost identical, thus arguing in favour of simultaneously introducing them.

### 3.3.3. *The REPIMAT network*

The evaluation procedure applied to the REPIMAT network was confined to a quantitative technical evaluation and the formulation of proposals for improvements. The potential cost of implementing these improvements could not be estimated in the limited time available for study completion. At the end of the evaluation, REPIMAT obtained a global score of 52/100 (*table III*). Three critical points were found to be less well managed than the others: sampling, techniques used for screening and diagnosis (especially sampling arrangements) and data processing. Proposals were made for improving the management of these critical points.

## 4. DISCUSSION

Applying the developed evaluation method to several epidemiological surveillance networks allowed us to test its effectiveness and potential scope.

### 4.1. Initiating the evaluation procedure

Evaluating an epidemiological surveillance network requires the active collaboration of its coordinators. They have access to all the basic technical and financial information needed to carry out the technical evaluation and determine the network's operating costs.

For the purposes of our study, we obtained the participation of the coordinators of the three networks (RENESA, French Epidemiovigilance Network for Foot and Mouth Disease and REPIMAT) for the entire evaluation procedure. For RENESA and the French Epidemiovigilance Network for Foot and Mouth Disease, their participation also involved the simulations that evaluated the operational quality of the 'improved' network [6, 13].

The advantage of this approach is to obtain a maximum amount of information, and thus be in a position to formulate proposals for improving the network that are both realistic and acceptable.

The method does, however, present a risk of reducing the evaluation objectivity, because it may be difficult for some coordinators to accept that certain critical points could be more effectively managed. If the procedure is conducted in a constructive manner and clearly aimed at helping to improve the network and if a good climate of confidence can be established with the coordinating team during the information collecting phase, the element of subjectivity can be greatly reduced.

For the three networks that we evaluated, the importance of improving efficiency was paramount and we did not encounter any

reluctance on the part of coordinators to acknowledge the weakness of any particular critical point identified during the evaluation.

#### **4.2. Implementing the qualitative technical evaluation**

The first phase of the quantitative technical evaluation involved collecting the information needed to complete the questionnaire.

The information collection phase proved to be lengthy and rather complicated (for both the RENESA network and the Foot and Mouth Disease Network an additional survey had to be carried out; the REPIMAT network was continuously monitored for approximately 6 days). If we had not been able to collect data in this manner, it would still have been possible to conduct the evaluations, but their accuracy and objectivity would undoubtedly have suffered as a result.

In addition, some data are difficult to collect, for example the proposition of not notified cases is difficult to obtain from some networks.

#### **4.3. Implementing the quantitative technical evaluation**

The most debatable feature of our evaluation tool is the scoring system. It is clearly impossible to avoid a degree of arbitrariness in: 1) the maximum score assigned to the various critical points; and 2) the score given at the end of the quantitative evaluation.

1) The score for each critical point (and thus its relative weighting) was decided in consultation with epidemiological surveillance experts in France and other countries. Given the difficulty in deciding exactly what constitutes an expert in the field of epidemiological surveillance, our selection of experts was inevitably somewhat arbitrary.

Furthermore, this method of validation cannot guarantee that the scores finally selected are well founded, but simply allowed us to obtain the consensual views of epidemiological surveillance experts concerning our proposals. However, in the absence of a more rigorous scientific approach, the expert's opinion remains the only means of limiting the individual subjectivity of the evaluation designer.

The Delphi method constituted the most effective means of organising the expert consultation, reducing the risk of experts being influenced by the other consulted experts (the consultation was conducted anonymously) and diminishing the individual subjectivity of the experts (seeking a consensus by limiting the most divergent views).

Therefore, even though their validity can be questioned while an element of subjectivity inevitably remains, the scores assigned to the various critical points at the end of the consultation can be considered acceptable.

2) Assigning a score at the end of the qualitative evaluation proved to be the most 'delicate' part of the entire evaluation owing to its subjectivity.

This subjectivity has two components: the 'scorer effect', relating to the individual appreciation by each scorer, and the choices made in the scoring guide.

The scoring guide was developed to reduce the arbitrary decisions of the scorer and to standardise scoring. However, the scoring instructions given in the guide are also somewhat arbitrary (they are based on the competence of experts and not on any scientific procedure).

Another difficulty arises from the degree of precision in the guide. The more specific the instructions the less likely they are to apply to all possible situations.

Scoring guides therefore have to be sufficiently precise and unequivocal, so as to limit the 'scorer effect', without being too

specific, in order to cover the wide variety of situations encountered in epidemiological surveillance networks. This dilemma is difficult to resolve. The guide is therefore a compromise: for some topics the scoring method is very precise while for others the scorer is allowed greater flexibility in interpreting the instructions.

To test the extent of the scorer effect, the same information on two of the three networks was given to six independent scorers. A comparison of the results of their evaluation showed a maximum inter-scorer variability of 5 % overall for the quantitative evaluation. This result was considered satisfactory.

However, if you wish to compare networks between themselves, you need to ask a panel of scorers to include the subjectivity of some of the questions.

#### **4.4. Implementing the estimation of costs**

Network coordinators do not always have access to all the necessary information for estimating costs and in some cases additional investigations will have to be carried out, as in the case of the RENESA network and the Foot and Mouth Disease Epidemiology Network. As with information collection for the technical evaluation, this procedure can be time consuming and may extend over a fairly lengthy period.

The degree of precision of the collected information can vary quite considerably (as with the Foot and Mouth Disease Epidemiology Network) depending on whether costs are estimated or calculated.

#### **4.5. Improvement proposals**

Improvement proposals are made on the basis of the results of the quantitative evaluation.

While it would be theoretically desirable to propose measures to improve the management of all critical points, in practice it seems logical to propose changes only for those critical points that obtained the lowest scores during the evaluation. However, the score is clearly not the only criterion that has to be taken into account. The proposed improvements must be technically feasible (i.e. capable of being implemented by the coordinating team) and acceptable to the decision makers.

#### **4.6. Use of the ratios**

In order to integrate the economic aspect, which is vital for rational decision making, we used a ratio that combines the chosen criterion of effectiveness (the number of points gained after implementation of the proposed improvement) and the cost of implementation. This ratio was devised specifically for this study even though it is not totally original in concept (in calculations involving cost effectiveness or cost utility, similar approaches are frequently employed).

The 'cost per point' ratio has the advantage of being simple to calculate and to use. Highly eloquent, its measures offer the best return with an easily identified 'cost per point' close to the initial 'cost per point' of the network. Nevertheless, the 'cost per point' of the network at the time of the evaluation depends entirely on the annual cost of running the network. It would therefore be impossible to use this method as a means of comparing different networks.

Overall, we have been able to demonstrate that the evaluation method proposed in this study is a valid tool for use in improving the functioning of epidemiological surveillance networks for infectious animal diseases.

The procedure has so far been tested on only three networks. It therefore needs to be applied to other networks in France and

elsewhere, to test whether it can also be used to evaluate and improve networks that operate in a very different manner from those selected for the present study. In particular, it would be interesting to apply the method to surveillance networks for a variety of chemical or bacteriological contaminants in food.

The results of such a test conducted on a far wider scale should allow further improvements to be made, which constitutes a first step in improving the reliability of epidemiological information produced by epidemiological surveillance networks.

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