The application of economics in animal health programmes: a practical guide

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Summary

Economic analysis is a valuable technique in the planning and management of animal health programmes at the national policy level and at the level of individual livestock enterprises. Considerable experience has now been accumulated in the adaptation of methods of economics to address decisions on disease control issues. Different methods are appropriate for endemic diseases, for diseases which occur intermittently as local outbreaks, and for diseases which have the potential to cause an epidemic. A guide to the selection of the most suitable method is provided. The information required for analysis at individual herd level is much simpler than that required for national policy decisions and funding decisions by international agencies; an outline of the requirements for each level of analysis is provided. Issues surrounding the degree of risk of different choices are examined, and the application of decision analysis to higher-risk choices is introduced. Ways in which difficulties and hazards can be overcome are suggested for those unfamiliar with the techniques. Finally, procedures to provide confidence in the results of evaluations through sensitivity analysis are explained.

Keywords


The contribution of economics to animal health

Economics is concerned with the allocation of scarce resources to competing uses, thereby providing the greatest benefit to society. The resource to be allocated is commonly money, but other limiting resources (labour, land, etc.) can also be considered. The 'benefit' can be interpreted in a number of ways, depending on the particular circumstances to which economic principles are applied. Both animal and human welfare benefit from the improvement of animal health. The benefits to animal welfare cannot be readily translated into economic terms, but the benefits to human welfare can be expressed to a large degree in economic terms, hence the merits of alternative activities can be compared. Most of the economic benefit can be expressed in monetary terms (e.g. more animal products available for sale, a higher price per unit of product, lower production costs), but some elements cannot be valued so easily in monetary terms (e.g. reduced risk of human infection with zoonoses, increased work capacity of animals in crop production and transport, increased availability of animals for cultural purposes). However, methods can be found to consider most of the major benefits from disease control within an economic evaluation, although some items cannot readily be given a monetary value.

In animal health economics, the relative merits of different approaches to improving the health of an animal population are evaluated in order to make the best decisions on the allocation of disease control resources. The focus of the evaluation is on the 'marginal' or additional benefit of intensifying disease control by a small degree, until an economically optimal control strategy is identified. This point is reached when the increased benefit achieved by a further small increase in disease control effort is exactly balanced by the costs of achieving that improvement — up to that point, additional investment has produced a positive net economic benefit.

Economic analysis is not a form of financial accounting; the main concern in economics is to rank alternative disease control measures in order of the merit of each alternative, hence to make the best decision, and not to calculate the exact monetary value. Thus, although imperfect data is often used...
in many analyses, this does not necessarily reduce the value of the results. In economics, the risks of an investment are also investigated, and risk evaluation is an important component of animal health economics.

Effects of disease on animal productivity and performance

Diseases have a cascade of effects on the productivity of affected animals. Morris has described the nature of these effects as far as is currently known (9); these are summarised in Figure 1. The principal direct effect of most diseases is on protein metabolism, with ancillary effects on mineral, vitamin and energy metabolism. As a consequence, animals convert feed less efficiently into useful products. In addition, feed intake tends to be reduced in many disease states, further exacerbating the impact of the disease. The underlying explanation for the impact of disease on productive efficiency is that nutrients are used up by the defensive response of the body to disease agents, and especially by the regeneration process which is required after an animal has been affected by a disease. These two body responses divert protein and other nutrients into the response to disease, rather than marketable products, and this 'nutrient leakage' is never recovered, even after the animal returns to normal health. Moreover, for many diseases, animals may continue to suffer productivity depression for a long period after the disease has been successfully treated.

By affecting nutrient utilisation, diseases reduce the productivity of animals, often in ways which extend beyond the specific pathological effects of the disease. The best recognised effect of disease is the premature death of animals, but this is commonly over-emphasised as a part of the total disease impact. In considering the overall effect of diseases in animal populations, increased mortality represents only a small proportion of the total effects of many diseases; other consequences are often much more serious. For example, reduced yield of meat, milk, eggs or wool causes much more significant economic impacts for many diseases than deaths from the disease, yet livestock owners focus attention disproportionately on losses through death because these are obvious. Even more subtle are effects on the quality of products, which have been documented in various studies (9). These range from reduced nutritional value of milk to the less attractive taste of meat, and from poorer manufacturing characteristics of milk to weaker fibre structure in wool. In countries where animals are used for crop preparation and other tasks, disease which renders animals unable to work may also have a severe impact on crop productivity and transport of crops to markets.

At herd level, diseases (not only those which directly affect reproduction) commonly reduce fertility and fecundity, thereby impairing herd output and replacement potential. Diseases have also been shown to lower the accuracy with which animals of superior genetic merit can be identified in a herd, thereby reducing the potential rate of genetic gain. Finally, diseases can reduce productive life both through mortality and premature culling. All three of these effects combine to increase involuntary herd turnover, leaving less scope for planned genetic improvement and adversely affecting the age structure and hence productivity of the herd. Each individual disease causes some (and in some cases all) of the effects described, and almost all have severe effects on overall productive efficiency of animals, causing a far less efficient conversion of available feed into marketable products.

Evidence from a wide variety of studies over the last thirty years has shown that because of the substantial effects of diseases on productivity and the relatively low cost of control measures, the net economic benefit obtained from controlling animal diseases is very high, commonly in the range 200% to 1,500% return on invested funds (9). Investments in other activities are considered unusually profitable if a yield on invested funds of over 20% is obtained. Clearly, disease control can be exceptionally profitable, and hence a very beneficial method of improving the productivity of animals, and the economic well-being of the owners. In addition, disease control provides substantial benefits to animal welfare (2, 15), and represents an important element of a valid programme of animal welfare measures.

General approach to conducting economic analyses

An extensive body of published examples of analyses in animal health economics is now available; these can act as models, covering almost all of the types of evaluation issues likely to be faced by analysts. The eight Proceedings of the International Society for Veterinary Epidemiology and Economics from 1976 to 1997 also provide a valuable overview of the development of techniques within the discipline.

Those new to the techniques often fear making errors in analyses (which will be detected by experts with differing backgrounds from their own), and also fear using the terminology of the field incorrectly. However, ample examples of analyses are now available to use as models in each of the different types of disease control problems. Illustrations of each of the analytical methods and issues described below can be obtained from standard references such as the book edited by Dijkhuizen and Morris (1), and the accompanying papers in this volume. An understanding of economic terminology and its use is also necessary, at least on key points. The concepts underlying economic analysis are quite simple and straightforward in reality, and while various traps exist which need to be avoided in constructing an
Fig. 1
The cascade of effects of disease on animal productivity
an analysis, following earlier published examples by experienced analysts will avoid most of these. A number of the hazards are discussed below, and advice is given on how to avoid these hazards.

Another common misconception is that the data available will be inadequate to construct an analysis on the particular issue of interest. However, a literature search covering the full spectrum of published work on the disease will almost always reveal a surprising quantity and depth of relevant information—often in papers which are concerned with quite different issues, but incidentally contain material useful to the economic analyst. Where no data can be found concerning a critical point, the next option is to make reasonable assumptions about the likely value of the variable, and then to test within the analysis to determine whether the validity of conclusions reached in the study are likely to be susceptible to variation in the value, within the expected range—a process called sensitivity analysis. For many such variables which have never been measured, the outcome of the analysis is found to be quite insensitive to the value in question, and a sensible ‘guesstimate’ is adequate for inclusion in the final analysis. In cases where a more precisely measured estimate is required, a specific study can be designed to provide the answer, and in many such cases, critical epidemiological data are also lacking. Thus, these values can be jointly measured in an appropriate investigation. However data are gathered, it is essential to document the source of the data in a report of an economic impact study, thereby providing a pedigree for even informal ‘guesstimates’.

### Choice of analytical method

Five common methods of economic analysis are applied in the evaluation of animal health issues. These are outlined below, and are dealt with in greater detail in other papers in this volume (3, 7, 13, 14). The methods are as follows:

a) Partial budget: this is used for within-herd analyses, where costs and benefits both accrue within a single year, and only the items changed by the proposed action need to be considered in the analysis.

b) Enterprise analysis: evaluation of the effects of disease control on the entire livestock enterprise, not only on the items which change; this creates more analytical difficulties than partial budgeting.

c) Cost-benefit analysis (CBA): this is used for analysis of communal activity, where the actions of one livestock owner have ramifications for the welfare of others; this is typically used to examine industry or national programmes.

d) Decision analysis: this method is selected for evaluating issues where the probability of particular outcomes is used to weight the economic consequences should that outcome occur. Risk analysis, as used in import decisions, is an example of decision analysis, although commonly the assessment of the consequences has been somewhat neglected and effort concentrated on the probability issues (although the World Trade Organization Sanitary and Phytosanitary Agreement expects the consequences to be evaluated).

e) System modelling: this method is used in cases where the issue is sufficiently complex and the economic implications of an erroneous decision are substantial. An epidemiological/economic model of the issue can be developed, and used to conduct a more comprehensive evaluation that considers more closely the nature of the problem, and interactions among various effects.

### Categories of disease for analysis

Three major categories of disease can be identified which require different types of analysis. Diseases which occur in most or all livestock herds in a country or zone and cause some economic impact each year (e.g. parasitism, Johne’s disease, mastitis) are the simplest to deal with, requiring a partial budgeting approach at herd level and a simple CBA at national level. Diseases which affect only some herds in any given year and which have an uncertain pattern of occurrence (clostridial diseases, haemorrhagic septicaemia, bloat, Newcastle disease) require that both the impact and the probability of an outbreak be considered, which can be achieved using decision analysis or a more complex form of CBA. Where a disease is not present in an area or is present only at a very low level due to control (e.g. rinderpest, foot and mouth disease, rabies), the analysis must give greater weight to the risk of introduction or recrudescence, and analysis will use decision analysis, but may use a more cautious decision criterion than the usual one of maximising expected economic benefit, to protect against high impact in the event of an outbreak. When required due to the biological complexity of the issues in any of these three types of diseases, a comprehensive epidemiological evaluation method, such as modelling, may be used in conjunction with the economic analysis to improve the precision of the conclusions reached. Broadly, the three categories outlined equate to endemic, sporadic and epidemic diseases.

Table I outlines the suitability of each of the five analytical approaches, from different perspectives.

### Approaches for different levels of decision-making

Each potential use and user of economic analysis has different requirements involving various levels of complexity of analysis.
Table I
Suitability of various methods of economic analysis for animal health issues
(Scale: 1 = poor; 5 = ideal)

<table>
<thead>
<tr>
<th>Value</th>
<th>Partial budget</th>
<th>Enterprise analysis</th>
<th>Cost-benefit analysis</th>
<th>Decision analysis</th>
<th>System modelling</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use method for disease:</td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>- endemic</td>
<td>5</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>- sporadic</td>
<td>3</td>
<td>2</td>
<td>5</td>
<td>5</td>
<td>3</td>
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<tr>
<td>- epidemic</td>
<td>1</td>
<td>1</td>
<td>4</td>
<td>5</td>
<td>4</td>
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<tr>
<td>Usefulness of method for:</td>
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<tr>
<td>- single herd</td>
<td>5</td>
<td>3</td>
<td>1</td>
<td>3</td>
<td>3</td>
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<tr>
<td>- industry</td>
<td>2</td>
<td>1</td>
<td>5</td>
<td>4</td>
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<tr>
<td>- country</td>
<td>1</td>
<td>1</td>
<td>5</td>
<td>5</td>
<td>4</td>
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<tr>
<td>Useability:</td>
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<td></td>
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<tr>
<td>- ease of use</td>
<td>5</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>2</td>
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<tr>
<td>- ease of explanation</td>
<td>5</td>
<td>1</td>
<td>5</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>- adjust to new data</td>
<td>5</td>
<td>2</td>
<td>4</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>- extrapolate to new environment</td>
<td>4</td>
<td>1</td>
<td>4</td>
<td>4</td>
<td>4</td>
</tr>
</tbody>
</table>

Where an analysis is being conducted to guide the decisions of individual livestock owners, the focus will be the actual or potential economic impact of the disease on the productivity and economic return from the herd, and protection of the herd against the entry of additional diseases. The analysis will usually focus principally on productivity gains and the costs of possible interventions. Prices of additional quantities of output from the herd can reasonably be assumed to remain unaffected by the actions of the individual. Risk of adverse effects of action (or inaction) are important issues, which will affect the choices of many owners – especially those for whom an erroneous decision could have serious implications for family or economic viability.

If the analysis covers all herds in an area of the country or the entire industry of the country, then CBA provides a structured answer, and can incorporate probabilities of various outcomes and risk of adverse effects in the analysis. If the output levels of many producers will be affected by the programme, then consideration must be given to the depressing effect of this increased output on product prices, and adjustments made for this effect. Under these conditions, a substantial proportion of the economic benefits of the control programme may accrue to consumers (through lower prices), and producers will retain only part of the gains in which they have invested. This partitioning of benefits can be accommodated within the analysis, and it is economically appropriate that costs be allocated according to this transfer of benefits, an aspect which is often not acknowledged by policy makers.

Related industries which supply goods and services to livestock producers, or which process products from them, may also be substantially affected by a disease control programme, and these effects should be considered in the analysis.

Where a disease is of national importance, or is the subject of a nationally managed disease control programme, then the analysis must consider alternative investment of scarce national resources, and begin to compare animal health with alternative national development priorities, considering also the risk to human health if this is a relevant factor. Issues such as the impact of a particular potential animal health programme on export opportunities (or conversely, the flexibility to import rather than expand local production, without compromising animal health status) need to be considered. Differential effects of disease control programmes on different groups within the society, including the opportunity to use a disease control programme to enhance the opportunities of disadvantaged groups within the society, will require consideration. Impacts of proposals on the environment and wildlife may also be important. Some of these issues are not easily quantifiable, but methods can be found to incorporate these variables in the analysis.

At the national level, external effects (or externalities) can become very important. External effects occur where the actions of one individual affect, in some substantial way, the economic well-being of others, with the latter unable to easily influence the result. For example, a farmer who fails to vaccinate his or her cattle may place an entire district at risk; such externalities are very common complications of disease control decisions.
National analyses need to examine issues from the viewpoint of the consumer as well as the producer, and recognise that in some cases these two groups have conflicting preferences, while in other cases the groups have complementary needs.

At the national level, research priorities need to be identified taking into account the relative importance of various diseases, possible options available for their control, and the probabilities of research success within a given time period. Such assessments need to take a longer-term strategic view of livestock industries, and not make decisions purely on short-term assessment of possible courses of action. In some cases, animal disease may inhibit the development potential of an area or a livestock industry, perhaps by limiting exports or making the industry uneconomic in a particular area. Success in controlling a major disease often creates new opportunities, which in many cases extend beyond disease to include structural enhancement of the industry.

Such issues are of even greater importance when international investment in a livestock industry is under consideration. In such cases, the development strategy for livestock may be only one part of an investment strategy. Animal disease may represent an impediment to investing in livestock in comparison with an investment in transport infrastructure for example, where biological uncertainty is not a consideration. Those who undertake national and international investment decisions commonly have an extremely limited understanding of the biological foundations underlying their fairly mechanistic assessment of the merits of development strategies. Thus, considerable responsibility lies with animal health economists. They should ensure that animal health issues are neither overstated to eliminate an otherwise attractive investment from consideration, nor understated to the point of neglect, so that success is undermined by disease impacts.

Methods of performing the analysis

Most of the simpler forms of analysis are now performed using an electronic spreadsheet such as Microsoft Excel® (10); to perform an analysis by hand is now rare. All of the analytical functions required are provided in the spreadsheet (e.g. discounting and calculating net present value). Multiple sheets in a spreadsheet book can be used with ease to represent different components of the analysis (e.g. different regions or industries), and then combined in a summary front sheet and set of built-in graphs. Changing one value in the spreadsheet can then lead to recalculation of all of the outcome estimates. If the analysis is to take into account risk considerations, by using statistical distributions in place of single values, then an add-on program, such as @RISK (11), can be used to insert such functions into the spreadsheet directly. Although a spreadsheet can be developed easily for a particular analysis, numerous spreadsheet templates for particular types of analyses are available; these can be used with minimal design effort, or can be adapted to a somewhat different need.

For some common problems, specific software programs have been developed to conduct the analysis, and can be used for suitable cases – such as linear programming and dynamic programming (4, 5). Disease models which incorporate industry structure and economic components have been developed for some problems, and may provide an ideal answer to some analytical tasks (6, 8). This approach has been used recently for analyses of classical swine fever in the Netherlands.

Development of an analysis lay-out

The lay-out should first be developed with suitable headings under the different categories of the analysis, commencing with benefits at the level of one or more individual example farms. Issues beyond the farm gate can be added where appropriate, once the within-farm situation has been analysed. It is not essential to include all items. Only those which are likely to be important enough to influence the outcome of the analysis should be used. Inclusion of costs is usually straightforward for individual farms, but is typically more difficult beyond the farm gate because, for example, attributing the costs of various components of veterinary service operations to a particular disease control activity can be problematical. However, a range of examples has now been published which can be drawn on as models. Any analysis deals only in the implications of future actions, thus costs which are already 'fixed' and irreversible can be excluded.

Selection of an analytical approach

Animal health economics has an adequate range of analytical tools to apply to any decision problem, and care should be taken to choose one which will meet the particular need without being excessively complex. Before selecting an analytical method, the objectives of the economic study must be documented clearly, in order to clarify what answers are required, and hence which of the available techniques will best meet the need. As in statistical analysis, at least one appropriate method exists to solve virtually any problem, and in most cases, one particular technique will match the task exactly.
from the analysis, greatly simplifying the data requirements in most short-term decisions, although this is not the case for long-term strategies.

Table II lists the items which may be appropriate to consider for inclusion at each of the levels of analysis.

<table>
<thead>
<tr>
<th>Individual herd</th>
<th>Animal industry</th>
<th>Country</th>
</tr>
</thead>
<tbody>
<tr>
<td>Herd benefits</td>
<td>Communal benefits</td>
<td>Inter-industry effects</td>
</tr>
<tr>
<td>Herd costs</td>
<td>Communal costs</td>
<td>Human health effects</td>
</tr>
<tr>
<td>Probability of occurrence</td>
<td>Probability of occurrence</td>
<td>Environmental effects</td>
</tr>
<tr>
<td>Supply/price effects</td>
<td>Effect on input suppliers</td>
<td>Wildlife effects</td>
</tr>
<tr>
<td>Effect on output processors</td>
<td>Effect on service providers</td>
<td>Social equity effects</td>
</tr>
<tr>
<td>Effect on future evolution of industry structure</td>
<td>Development investment effects</td>
<td></td>
</tr>
</tbody>
</table>

Tips for estimation of benefits and costs

Inexperienced analysts are often initially overwhelmed by the number of unknown values which require estimation for the analysis. However, standard figures, termed 'rules of thumb', are used very extensively, and figures for an amazing range of items can be found either in 'pocket references' of such figures, which are available in many countries, or by seeking such data from specialists in the subject in question. This saves considerable effort, while ensuring that estimates used for common items are not open to challenge.

Another common economic technique is to value items at 'opportunity cost' – the cost of a lost opportunity. If a farmer fails to control a disease, then animals may be culled prematurely, before reaching full productive potential. Estimating the cost of rearing extra replacements may be very difficult, but opportunity cost calculation can be used to demonstrate that the farmer who controls the disease has surplus young stock for sale at high prices, while the farmer who does not undertake control has only cull animals for sale (which have a much lower value), and hence suffers an opportunity cost of foregoing the higher prices. This approach can be used in many contexts. Some items, if not used for the intended purpose, have no market value. If such an item (for example, surplus pasture available because of high mortality in a cattle herd due to a disease) is available, then the item is effectively free because it has zero opportunity cost, as it cannot be used for another purpose. The most difficult cost item to estimate is the value of time spent by the farmer on disease control activities, given that alternative farm activities could be undertaken in this time. A common solution is to value the time of the farmer at the cost of hiring temporary labour, although in some cases this may underestimate the true value of the effort devoted to an activity by the farmer.

Where no adequate data can be obtained to estimate an item for analysis, the first step is to make a 'guesstimate' of a reasonable value for the item. Part of the initial analysis will then involve testing the level of sensitivity of the conclusions to inaccuracies in the estimate. Often, data items for which no rules of thumb exist are of minor importance and errors will have little impact, but if the variable is found to be important, the value will have to be estimated by field data collection.

Traps in constructing analyses

A common trap is to conduct the analysis in terms of the estimation of the 'cost of disease', which is, in fact, of no relevance to decisions on how to control the disease (12). All calculations should consider the benefits of control rather than the cost of disease, because the former is the basis on which the decision should be made, and the calculations will conform to accepted economic principles if this approach is adopted. Another common trap is to 'double-count' benefits or costs, by including a single item in two or more different ways, not realising that this is the same element of the analysis. Experience usually overcomes this fault.

Gathering field data

For any analysis, a preliminary analysis is always possible in order to structure the analysis and identify where the difficulties lie. This will highlight data deficiencies, and solutions can be sought. Commonly, most of the missing data items will be available, if sought from other organisations which, in many cases, have collected the data for some unrelated purpose. Other data will be available in the published literature, often as a minor part of a paper which is primarily concerned with other aspects of the disease. Where accurate estimates of data items are found to be essential but unavailable, the data will have to be gathered directly for the study. However, collection of epidemiological and economic data is often best undertaken jointly, so that answers to both types of questions can be gathered in a single study.

Completing the structure of the analysis

Once all the available data have been compiled, the data can be inserted into the analytical framework, and a preliminary analysis performed. The focus should be comparison of
The guiding principle of economic analysis

Economics is built around the concept of the production function – the declining economic response to each extra unit of any given resource, until it is uneconomic to add more.

Thus, decisions should be based around the ‘marginal’ or additional effect of further investment in a resource such as control of a specific disease. The overall guiding principle of economics (the principle of equimarginal returns) is to allocate funds progressively, moving resources to wherever the return on the next invested dollar is highest, and away from the current activity which yields the lowest return on investment. Disease control yields very high returns and deserves additional investment in most livestock enterprises. Within disease control programmes, efforts should be balanced across those diseases of highest economic priority, in order to maximise the benefit of the portfolio of investments; efforts should not be focused on a single control approach, or a single disease.

Application de l'économie aux programmes zoosanitaires : un guide pratique

R.S. Morris

Résumé

L'analyse économique est un outil important pour la planification et la gestion des programmes zoosanitaires, tant au niveau national qu'au niveau de l'élevage. On dispose désormais d'une longue expérience en matière d'adaptation des méthodes économiques aux décisions intéressant la prophylaxie. Différentes méthodes existent pour lutter contre les enzooties, les maladies à foyers sporadiques et cycliques ou les maladies qui peuvent devenir épizootiques. L'auteur propose un guide pratique pour le choix de la méthode la plus appropriée. L'information requise pour une analyse au niveau du troupeau est beaucoup plus simple que celle nécessaire aux décisions de politique nationale ou aux décisions qui engagent un financement international. L'auteur précise les besoins correspondant à chaque niveau d'analyse. Il aborde, par ailleurs, les questions relatives au degré de risque inhérent à chaque choix et donne un aperçu de l'application de l'analyse décisionnelle aux choix à haut risque. Il fait également quelques suggestions pour aider les personnes peu familières de ces techniques à surmonter certaines difficultés et à maîtriser certains risques, ainsi
que pour renforcer la fiabilité des évaluations par l’analyse de la sensibilité des résultats.

Mots-clés

Guía práctica para la aplicación de la economía a programas de sanidad animal

R.S. Morris

Resumen
El análisis económico es una técnica valiosa para elaborar y gestionar programas de sanidad animal, aplicable tanto al ámbito nacional como al de una sola empresa ganadera. Se ha ido acumulando una notable experiencia sobre cómo adaptar los métodos de la economía a la adopción de decisiones en materia de control sanitario. Las enfermedades endémicas, las de aparición intermitente en forma de brotes locales y las que encierran el potencial de causar epidemias exigen métodos distintos y adecuados a sus especificidades. El autor ofrece, en este sentido, orientaciones para seleccionar el método más conveniente. La información necesaria para el análisis en el caso de un rebaño es mucho más sencilla que la requerida para adoptar decisiones de ámbito nacional u orientar la asignación de fondos de organismos internacionales. El autor expone a grandes rasgos la información necesaria para cada nivel de análisis. También examina el nivel de riesgo asociado a distintas alternativas, y explica cómo aplicar el análisis de decisiones a las alternativas de alto riesgo. Por último formula una serie de recomendaciones para salvar las dificultades y riesgos que presentan esas técnicas para el profano, y evoca la posibilidad de recurrir al análisis de sensibilidad para ponderar la confianza que ofrecen los resultados de las evaluaciones.

Palabras clave

References


