Methods for the economic evaluation of animal diseases

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Abstract: Economic analyses for prevention and control of animal diseases are rare. A general approach for measuring the effects of animal diseases is still missing but needed. To address this gap, an overview of existing methods for the evaluation of animal diseases and the determination of their strengths and weaknesses is presented.

1 Introduction

There is an increasing demand for economic analyses for the prevention and control of animal diseases by the European Union [EU06] and the science community [RU09, Dr13]. However, despite its undoubted importance, such analyses have hardly been the subject of scientific investigations [MC96; RU09] due to insufficient data and the lack of general methods to capture the economic effects of animal diseases e.g. spillover-effects on other food branches. The aim of this paper is on the one hand to present different economic methods, which could be used for the economic evaluation of animal diseases and their associated prevention-intervention measures. On the other hand, we work out the strengths and the weaknesses of these methods for the economic evaluation of animal diseases. In order to capture the current state of knowledge about different economic methods for the evaluation of the prevention-intervention measurements of animal diseases, information from the literature was collected using the scientific databases ScienceDirect™, PubMed™; ISI Web of Knowledge™, and Google Scholar™.

2 Results

Costs in the veterinary field can be distinguished, either in costs for prevention e.g. costs for monitoring- or surveillance programs in order to intervene before an enormous economic damage occurs - or intervention measures e.g. costs for culling of animals in

order to mitigate the spread of animal diseases. Costs for intervention measures, in contrast to the costs for preventive measures, can vary widely [HI11], depending on the epidemiological development (dependent e.g. on the basic reproduction number (R_0)).

Due to the limited resources in the public sector the question about the effectiveness[1] and efficiency[2] of certain prevention- and intervention measures is increasingly raised [Dr13; St06]. In this context, two economic methods are available in order to compute the efficiency of prevention- and intervention measures [HO11]:

1) Cost-benefit-analysis and
2) Cost-effectiveness-analysis

As part of a cost-benefit analysis, all cost -and benefit effects are expressed in monetary units. In this context, all benefits over the time are divided by all costs (benefit-cost ratio) and the ratio to each other illustrates how much benefits are generated at costs of one Euro [Ve11]. A discount factor (1+r) is used to convert future costs or benefits of animal diseases into present values [HÄ11]. With other words, discounting is a "time-homogenization-method". However, after [Ve11] the cost-benefit ratio (BCR) represents a good indicator for the return of investments and hence an indicator for the efficiency of preventive- and intervention measures. Beside the monetary costs and benefits there are many parameters, especially benefit parameters, which cannot be quantified in monetary value (intangible) because there is no market for these parameters [BHP13]. Consequently a price determination is not possible. One solution is to transform intangible benefits into tangible benefits, which can be expressed in monetary units by comparing the costs of prevention-and intervention measures with the losses avoided when these measures are applied [HO11; Hä12]. This transformations are used e.g. in the recent study by [Hä12] in order to compute the benefit of bluetongue surveillance programs in the Switzerland. However, often the transformation from intangible to tangible costs and benefits is not possible. In this context, a cost-effectiveness analysis can be used in order to demonstrate the degree of achievable effectiveness of preventive- or intervention measures in relation to their costs. This can be done, by dividing the costs of preventive- or intervention measures and their effectiveness in non-monetary units [HÄ11]. For instance, the effectiveness of surveillance programs can be assessed through expert opinions[3], which can be translated into a points system (1 = very low effectiveness to 5 = very high effectiveness). In general, this approach for the measurement of effectiveness represents only a proxy for an economic benefit [HÄ11]. Further economic methods that existed in the context of prevention and control of animal diseases are:

3) Linear programming and
4) Partial budgeting

Linear programming is a method for solving optimization problems. This algebra technique is designed for finding the minimum or maximum of a linear function ($f(x_n)$)

[1] Effectiveness describes, if the intended objectives of surveillance have been achieved [Dr13].
[2] Efficiency indicates, if the objectives have been realized in efficient manner [Dr13].
[3] This technique was used in the study by [VA05] in order to measure the effectiveness of the implementation of control measures for improving the food safety in the dairy industry.

of variables ($a_n x_n$) by taking into account a set of constraints e.g. $f(x_n) \leq b$ [HN86 in VA05].

Table 1: The strengths and the weaknesses of the methods for the economic evaluation of animal diseases

Method	Strengths	Weaknesses
Cost-benefit-analysis	Different preventive- or intervention measures can be compared directly because costs/benefits are expressed in monetary units	Intangible costs and benefits can not be considered directly
Cost-effectiveness analysis	An aid in order to consider parameters in the assessment, which are monetarily difficult to assess	Subjective nature of the assessment with respect to the effectiveness of measures;
Linear programming	Can be used in the veterinary area to identify the least cost set of preventive- or intervention measures with the constraint that a certain level of animal disease control is achieved	Can only be used if there is a guarantee that the variables are independent from each other
Partial budgeting	Estimates the direct effects of the change in consideration of supply and demand behaviour on market; Focuses attention on the issues that are of interest [MA99];	No clear time horizon can be specified [MA99]; No comparison can be made with alternative investments [MA99];

In general, partial budgeting is a technique, which focuses on the variable costs. This means that only costs that are affected by the proposed intervention are considered [MA99]. In other words, partial budgeting is used as a technique to estimate the economic consequences from some changes, e.g. in trade policies on the market or in production process, which implies that a baseline is needed in order to measure the changes [VA05]. For further description and application of this method, see [MA99; HD97]. It should be mentioned here, that further methods (e.g. economic surplus analysis, policy analysis matrix or multi market models, social accounting matrix or cost-minimization-analysis) for the economic evaluation of animal health and preventive- or intervention measures can be found in the studies by [RWM05] and [WBP12].

3 Conclusion

Different assessment methods for the evaluation of animal diseases are available whereby each method has strengths and weaknesses. The choice of the method depends on the research question, the quality of the data as well as the scope of the economic approach.

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