Economics for assisting policy-makers to take decisions about new and endemic diseases

T.E. Carpenter

EpiCentre, Institute of Veterinary, Animal and Biomedical Sciences, College of Sciences, Massey University, Palmerston North 4442, New Zealand
E-mail: t.e.carpenter@massey.ac.nz

Summary
Animal health policy-makers are frequently faced with making decisions concerning the control and exclusion of diseases in livestock and wildlife populations. Economics is one of the tools they have to aid their decision-making. It can enable them to make objective decisions based on the expected costs and benefits of their policy. In addition, economics can help them determine both the distribution impact and the indirect impact of their decisions. However, economics is only one of many tools available to policy-makers, who also need to consider non-economic outcomes in their decision-making process. While there are sophisticated epidemic and economic (epinomic) models that are available to help evaluate complex problems, these models typically require extensive data and well-trained analysts to run and interpret their results. In addition, effective communication between analysts and policy-makers is important to ensure that results are clearly conveyed to the policy-makers. This may be facilitated by early and continued discussions between these two potentially disparate groups. If successfully performed and communicated, economic analyses may present valuable information to policy-makers, enabling them to not only better understand the economic implications of their policy, but also to communicate the policy to relevant stakeholders, further ensuring their likelihood of participating in the planned policy and hence increasing its likelihood of success.

Keywords

Introduction
Animal health policy-makers are frequently faced with making decisions concerning the introduction, spread and control of diseases in animal and human populations. The criteria upon which they base their decisions are multiple, but may include welfare (both human and animal) and economics (ranging from the individual animal up to the international level). Ramsey et al. (1) identified the important role of economic analysis in determining the benefits of animal health programmes. A recent report by the Food and Agriculture Organization of the United Nations (FAO) (2) highlighted the importance of economics in aiding policy-makers to identify how best to deal with the limited resources they have available to restrict or control animal diseases.

Along with the introduction of new diseases emerging from wildlife populations, an increase in global trade and travel has led to an increase in the number of livestock disease epidemics occurring around the world. In addition, once these diseases are introduced into a population, they spread more rapidly due to increased animal movements. As a result of these factors, the economic impact of livestock diseases and their associated controls is becoming more costly to producers and consumers alike, and can even be devastating for the poorest households, which can least afford such losses (3).

Realising the importance of economics, governments have used epidemic and economic (epinomic) analyses to inform animal disease control policy. Unfortunately, until recently, these studies were not subject to peer review and were often not well distributed. Nearly 45 years ago, a non-peer-reviewed study (4) on swine fever eradication, possibly the first ever cost–benefit study on agricultural disease control, was conducted in Great Britain. One of the first, if not the first, peer-reviewed papers influencing animal health policy-making was prepared for the Ministry of Agriculture, Fisheries and Food in the United Kingdom (UK) at the
request of the Committee of Inquiry into Foot-and-Mouth Disease (FMD). This resulted in a study that considered two control policies: traditional slaughter and vaccination (5). The conclusion of the study was that the slaughter policy was the more acceptable of the two, based on ‘any realistic set of assumptions’. This early analysis likely played a role in shaping the UK policy response to the subsequent FMD incursion nearly 30 years later, in 2001.

In the present paper, the focus is on diseases in livestock and how economic analyses can be used by policy-makers in designing disease control and eradication programmes. Examples are categorised as endemic and new (exotic) diseases to better illustrate the complexity of factors that must be considered in making animal health policies.

Endemic versus exotic diseases

As noted in a report of the FAO (3), endemic diseases tend to be tolerated more in developing countries, which are more reliant on traditional agricultural systems, than in developed countries, in spite of the burden these diseases place on producers and consumers alike. Furthermore, developing countries are more constrained by limited resources, which means that animal health policy decisions have a disproportionately harder impact on poorer livestock owners. Countries that are more industrialised, including those with more intensive livestock production systems, manage endemic livestock diseases more efficiently and focus more on policies affecting the international trade of livestock and livestock products.

One distinction between new and endemic diseases has to do with surveillance activities. Decisions regarding surveillance of endemic diseases should keep in mind the purpose of the activity. For example, is the purpose to identify the prevalence of disease or antibodies, reflecting either a level of exposure or a level of protection due to a vaccination programme? Is the purpose to determine the farm, national or regional level of infection, which may further guide decisions about the disease control or trading programmes that should be undertaken? For instance, in New Zealand, the purpose of surveillance is to support the country’s aim of eradicating bovine tuberculosis (bTB) from livestock (cattle and deer). However, given there is an endemic wildlife vector (brushtail possums, Trichosurus vulpecula) responsible for infecting deer, beef and dairy herds, TBfree New Zealand Ltd (prior to 2013 known as the Animal Health Board) is responsible for developing and implementing bTB control strategies that focus on the possum (6). A major focus of the bTB control programme in New Zealand is identifying areas of high risk for bTB infection in possums and subsequently carrying out more frequent herd testing in those high-risk areas. The policy to reduce risk levels in livestock is based on the cost associated with more testing balanced against the economic impact of reduced testing, which could delay the detection of bTB infection in a latently infected herd. As is typical with an eradication programme, once the incidence and prevalence of the disease are reduced to a very low level, it becomes incrementally more costly to remove infected individuals or herds and, at the same time, there may be a loss of interest among stakeholders (i.e. livestock producers, and even consumers who may have concerns about environmental contamination associated with a wildlife disease control programme).

One of the most economically important diseases concerning animal health policy-makers worldwide is FMD, which is also a disease that is viewed as both endemic and new, depending on the country. Regardless of the epidemiologic status of the disease, policy-makers are highly influenced by the economics of FMD when making decisions concerning it. For instance, in an FMD-endemic country, control policies are dependent on the endemic level of FMD, both in the country and in neighbouring countries. If FMD is highly endemic in a country, control policies are concerned with how the disease can best be managed, given the financial constraints on the Veterinary Services, and the myriad of other diseases that also need to be managed. On the other hand, if FMD is sporadically endemic, and a short-term eradication is viewed as feasible, the focus of a policy-maker is increasingly on neighbouring countries and stringent border controls.

In FMD-free countries, such as Australia, the United States of America (USA), and New Zealand, policy-making is very much influenced by the potential economic impact of the disease if it were to enter the country. In addition to considering the direct costs associated with the introduction of FMD, e.g. costs of disease control and surveillance, as well as lost production associated with FMD-related culling, the major economic impact would be lost export markets. While these countries have either never or not recently experienced FMD, estimates of the economic impact have been made using epinomic modelling to better inform policy-makers. Recent estimates of the potential impact of FMD, if it were introduced into Australia, predict losses of between US $51 and US $54 billion for a large outbreak (7). In the USA, economic losses were estimated to be between US $7 and US $69 billion, if limited to California alone (8, 9), or US $14 billion if the outbreak were similar in magnitude to that which occurred in the UK in 2001 (10). It should be noted that the relative impact in Australia, which had a gross domestic product of US $1.56 trillion (11) when these impacts were calculated (similar to that of the UK but approximately one-tenth that of the USA), is much higher than in either the USA or the UK.

These epinomic models have also been used to evaluate alternative control/eradication strategies, e.g. vaccination
versus stamping out. The importance of maintaining an active export market, both in terms of economics but also employment, may create a balancing problem, where an animal health policy-maker may be viewing a decision in terms of how best to apportion limited resources, i.e. how much to allocate to identifying the introduction of a new disease and how much to eradicating it once it has entered. It may or may not be in the purview of an animal health policy-maker to also consider the trade impact of their decision, however, their policy may affect another policy-maker's decision. For example, a Minister of Agriculture may focus on controlling endemic diseases at the cost of a weakened surveillance programme. The result of this could be the introduction of an exotic disease, which could eliminate exports to certain markets and be of paramount concern to a Minister of Trade.

Human health economics and policy-making

Economic analyses of human health issues to inform policy-making may provide insight into how better to inform policy-makers on animal health issues. While research on animal health economics is limited, several journals and books have been published on the topic of human health economics, including the European Journal of Health Economics, which was first published in 1992. Drummond et al. (12) stressed the need to make decision-makers more aware of human health economic studies and also to help them understand the methodology used and results obtained. Sloan and Grabowski (13) discussed the rising pressures in the industrialised world to constrain expenditures on human health services, which affect decision-making in both the private and public sectors. No doubt there is a similar issue for animal health services.

Economics in the human health arena has been used in setting policy in the face of a limited budget. For example, in 1989, the state of Oregon used cost–benefit analysis to decide how best to allocate Medicaid funds (14). It decided to reduce the number of services it covered in order to provide Medicaid to everyone earning less than the federal poverty level (FPL) (an increase from the previous year, when only people earning less than 67% of the FPL had their costs covered). To decide which services should be the priority, it consulted both medical professionals and consumers to determine i) the medical benefits that would be derived from a particular intervention and ii) the value that consumers placed on those interventions. Decisions about animal health spending could be made in a similar way. Governments in developing countries could look at the subsistence level of a producer when deciding whether or not to provide funding for a particular preventive measure.

In addition, just as medical professionals and consumers were included in the decision process in Oregon, both producers and veterinarians could be consulted to ensure input from all stakeholders in animal health decisions. Lessons learned from the Oregon example and numerous others should be studied to better inform similar work in the area of animal health.

Improving communication among veterinarians, epidemiologists, economists and policy-makers

The application of economics to animal health in the industrialised world is uncommon and sporadic, and has even been described as ‘experimental’ (15). This is due, at least in part, to the complexity of economic analyses and the need for the analyst to ensure that policy-makers can understand both the methods and the results. Furthermore, economic analyses of animal health issues are dependent on a prior epidemiologic analysis; however, it is not sufficient to conduct epidemiologic and economic analyses separately. Moreover, even if these analyses are conducted jointly, it is important for assumptions, methods and results to be communicated among all the disciplines involved if there is any hope of conveying findings to relevant policy-makers. As pointed out in an FAO report (2), while economics has an important role in policy and strategy planning for transboundary animal diseases, national animal health programmes do not always include economists. Whether this is due to an inability (or lack of desire) to understand another discipline, be it veterinary medicine, economics or epidemiology, it is important that different disciplines work closely together. Only through such close collaborations can the nuances of the different disciplines be understood and final outcomes, including epidemiologic and economic outcomes, be communicated. Once this is accomplished, the next step of communicating the results to a policy-maker becomes more feasible. Without it, the analyst is faced with the insecurity of not understanding the underpinnings of the ‘foreign’ discipline. This subsequent insecurity or uncertainty is then conveyed to policy-makers, making them less sure about the findings upon which they have to base their policy decisions and communicate with stakeholders.

In 1993, Coyle (16) proposed a four-stage model to better report the impact of economic evaluation results for human health, which included the dissemination of research to decision-makers, followed by the recognition, understanding and utilisation of this research by decision-
makers. To increase the likelihood of the successful communication of this research, he recommended that decision-makers be more involved in requesting the research and that economists disseminate their findings widely to the relevant decision-makers in a timely fashion. He concluded that social science research has not made much of an impact on healthcare decision-making, which appears to also be true today in animal health policy-making.

If research is to have a greater influence on policy-making, policy-makers must make clear to analysts what sort of information they need (17); in turn, analysts must make their work more understandable to policy-makers, even if that means sacrificing technical details. However, sometimes it is necessary to convey detailed results that go beyond what a policy-maker is expecting. For example, a policy-maker may ask for a recommendation about a disease control action, with the expectation of hearing that stamping out is preferred to vaccination, or that, on average, the expected benefit of stamping out is US $3 billion over a period of five years. What they may not expect to hear is that there is uncertainty associated with these activities. For instance, the conclusion of an economic analysis may be that, while the expected benefit may be US $3 billion, there is also a 10% probability that stamping out may produce a negative net benefit compared with vaccination. Hence, there is potentially a need to better educate the policy-maker regarding the uncertainty of an analysis. While this may be more complicated than an expected outcome, it may be a necessity when formulating policy.

For communication between the analyst and policy-maker to be successful, it is important that the latter is made aware of the results. Clearly, while this may be accomplished by reporting directly to the policy-maker, this may not be feasible in all cases. Instead, the analyst may feel they can communicate successfully with a policy-maker by publishing their results in a peer-reviewed journal. However, due to lack of time or a belief that they will not understand, it is likely that policy-makers will not read the technical literature, underscoring the need for the analyst to make the extra effort to communicate with the policy-maker in ways that may be unconventional for analysts.

**Economic and non-economic objectives of policy-making**

While the economic impact of a policy decision is typically important, it is not the only criterion a policy-maker relies upon (17). This is especially true in countries where a large portion of the human population is dependent on livestock for their livelihoods and where livestock play multiple roles in the lives of the poor (18). Therefore, policy decisions are based on political and technical information as well as information on associated resource limitations and risk. In addition, policy decisions should take into account national social and economic agendas, as well as competing national priorities (1). Sloan and Grabowski (15) discussed the need for countries to have integrated animal and human health programmes, which would be based on common objectives across sectors. In this way, countries could effectively develop policy to support their intervention.

Ashley and Carney (19) discuss the use of the sustainable livelihoods approach when considering project objectives, i.e. setting objectives that will help reduce poverty rather than aiming only for purely economic outcomes. It is a way to help the poor make improvements against poverty indicators and has been used for several livestock development projects at the policy level and is definitely appropriate for animal health policy assessments. Another criterion considered by policy-makers is the extent to which a policy enables a country to become self-sufficient or even to become an exporter of a good, including livestock and livestock products.

Multi-criteria decision analysis (MCDA) is an approach used to compare alternative actions in terms of multiple, and sometimes competing, outcomes such as welfare, environmental and economic outcomes. MCDA has been used in veterinary medicine to evaluate control strategies against classical swine fever (CSF) in Europe (20), prioritise climate-change-associated emerging and re-emerging diseases in humans and animals in Canada (21), and evaluate FMD control strategies in the Asia–Oceania region (unpublished data). In the climate study paper, one of the three outcomes measured was the economic impact, which included costs for control, to industry, and relating to healthcare. Other outcomes measured were social and environmental impacts. In the CSF and FMD studies, the outcomes were epidemiologic, socio-environmental, and economic. By using methods such as MDCA, a policy-maker can combine economic outcomes with other outcomes to more efficiently formulate policy.

Even when evaluating economic outcomes only, there may not be a consistent single criterion that a policy-maker is basing decisions upon. For instance, in benefit–cost analysis, two criteria are commonly used to assess the economic value of a project, namely, net present value (NPV) and benefit–cost ratio (B/C). When considering whether or not a particular project will have a positive outcome, the results of these two assessment methods will concur, but when comparing the merits of two positive alternatives they will not always agree on which is the preferable alternative. Assessments which use NPV as the criterion tend to indicate that larger projects are preferable, even if they have a low B/C ratio, because they typically have a high NPV due to the massive investment they require. On the other hand, an
evaluation that uses the B/C ratio as the assessment criterion is likely to consider a smaller project as the preferable option, because although they usually have a relatively modest NPV, their B/C ratio is high. This is a potential conundrum for the policy-maker, as a project can have a high NPV or a high B/C ratio, but not both. They must decide which mix of projects will produce a favourable outcome, given budget and other resource constraints.

Distribution analysis

Due to the global nature of trade of livestock and livestock products, policy-makers must consider the impacts of policies on global markets as well as on national and regional economies. For instance, it was estimated that losses to the USA due to lost beef exports as a result of BSE-related restrictions were US $11 billion, with $9.4 billion in lost exports to Japan and the Republic of Korea alone. However, this does not account for the benefit to consumers in the USA arising from lower prices as domestic supplies increased (22).

Furthermore, policy-making at the national level must also consider the impact on other sectors, such as sport and tourism, and on other stakeholders, such as agricultural marketing boards, food wholesalers, and industries and organisations supplying goods and services to agriculture (15). Looking even more closely at a single stakeholder, e.g. the livestock producer, any consideration of the economic impact of animal health policy should focus on the producer's economic status. This is especially important in developing countries, where subsistence farming and endemic diseases are more common. As discussed in an FAO report (3), as well as considering the overall impact of a policy on human and animal health, policy-makers should consider how these impacts are distributed and should also consider the distribution of incentives and compensation. It is, therefore, important for policy-makers to focus more closely on smallholders, whose incomes and even livelihoods heavily depend on the health of their animals, instead of the aggregated economic impact of a policy recommendation.

While a disease control/eradication programme may prove beneficial for a given sector, e.g. beef cattle, it may have a negative impact on alternative meat sectors, as the price of other meats, such as poultry, may drop as the result of increased beef production. However, both increased beef production and cheaper alternatives to beef are of benefit to the consumer. This is true unless the programme results in the opening of an export market for beef, as this will decrease the domestic supply, causing increased demand for poultry and a rise in poultry prices, thus benefiting poultry producers while costing consumers of both beef and poultry. It is in situations like these, which add complexity to policy-making, that decisions have the potential to be controversial, requiring policy-makers to have a solid understanding of markets in order to make informed choices. Furthermore, caution should be taken when grouping either producers or consumers together. For instance, when considering producer benefit, e.g. producer surplus, one should ensure that a policy does not only benefit large producers, but also the small or subsistence-level producer. Similar care should be taken when interpreting consumer benefits, to ensure that benefits are not being accrued by the wealthy at the expense of those at or below the poverty line.

Conclusions

Economics is one tool that may be used by policy-makers when designing or revising animal health programmes, at the local, national, regional, or global level. However, due to the complex nature of economic analyses, it is important that policy-makers, economists, and epidemiologists communicate throughout the analyses, to ensure expected outputs are produced and results clearly communicated. In this way, a policy-maker may use economic impacts as one of the outputs used in combination with non-economic outputs to better formulate a policy.
Le rôle de l’économie pour aider les responsables politiques à prendre des décisions en matière de maladies émergentes et endémiques

T.E. Carpenter

RÉSUMÉ
Les responsables des politiques de santé animale sont souvent confrontés à la nécessité de prendre des décisions au sujet de la lutte à mener contre les maladies animales affectant les populations domestiques et sauvages ou de leur éradication. L’économie est l’un des outils d’aide à la décision à leur disposition. L’économie peut les aider à prendre des décisions objectives basées sur les coûts et les avantages attendus des politiques envisagées. Elle peut aussi les aider à déterminer l’impact de leurs décisions en termes de portée et d’effets indirects. Néanmoins, l’économie n’est qu’un des nombreux outils disponibles et les décideurs doivent également intégrer les résultats non économiques lors de leur processus décisionnel. Un certain nombre de modèles épidémiques et économiques (« épinomiques ») sophistiqués permettent d’évaluer des problèmes complexes ; ils nécessitent cependant un volume considérable de données ainsi que des analystes qualifiés pour les mettre en œuvre et en interpréter les résultats. En outre, une communication efficace doit être mise en place entre les analystes et les décideurs afin de s’assurer que les résultats obtenus sont rapportés à ces derniers dans un langage clair. Ceci peut être facilité par des échanges précoces et permanents entre ces deux groupes potentiellement hétérogènes. Des analyses économiques bien réalisées et faisant l’objet d’une bonne communication fournissent aux décideurs des informations de qualité grâce auxquelles ils peuvent appréhender plus clairement les conséquences économiques de leurs politiques, mais aussi expliquer ces politiques aux principales parties prenantes, ce qui accroît la probabilité de les faire adhérer aux mesures planifiées et améliore d’autant les chances de succès.

Mots-clés

Economía para ayudar a los planificadores de políticas a adoptar decisiones sobre enfermedades nuevas o endémicas

T.E. Carpenter

Resumen
Los planificadores de políticas zoonotéricas se ven con frecuencia en la tesitura de adoptar decisiones acerca del control y la exclusión de enfermedades en poblaciones de ganado o de animales salvajes. La economía es una de las herramientas en las que pueden apoyarse para ello, pues les ayuda a tomar decisiones objetivas basándose en los costos y beneficios previstos de determinada política. Además, la economía puede serles útil para determinar tanto el impacto distributivo como el impacto indirecto de sus decisiones. Sin embargo, la economía es solo una de las muchas herramientas de que disponen los planificadores, que en su proceso decisorio también deben tener en cuenta
References


