

Economics of production animal health

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Summary

Livestock are a central part of societies across the world. They represent the majority of the terrestrial animal biomass, and are an increasing part of the aquatic biomass. They produce food, clothing and generate traction power. The health and welfare of these animals is critical to the wellbeing of people, either due to the direct impact on farm-level incomes, the availability of livestock products or through the diseases they share with humans. However, achieving adequate education on the economics of livestock production and health is a challenge at the veterinary undergraduate level, in part because the focus of much of the veterinary education in many parts of the world has shifted to companion animal medicine, which is an expanding field.

The paper describes the core economic concepts and tools needed to add value to the 'day one' veterinarian who will be working in the production animal field. It describes the impact of animal diseases and how this can be combined with commonly available economic tools to make assessments of veterinary interventions. The overall recommendation is that the concepts and tools are introduced to undergraduate veterinary training in dedicated classes, and that their use is reinforced during the clinical teaching sessions. Placing economics in a clinical context will increase the relevance to undergraduate veterinarians.

Key words: livestock – animal health – production – economics – education

Introduction

Livestock produce meat, milk and eggs, and generate fibre, hides and traction power, and act as a store of wealth and provide a form of social security. As the collective name suggests – live stock – there is significant investment in the animal itself, an expected return through the generation of livestock products and, with reproduction, the growth of the animal population overall. Livestock include most of the major domesticated species, and overall represent the major proportion of biomass of terrestrial mammals globally and are becoming a significant aspect of aquatic biomass. These animals represent a significant economic activity of 700 million poor people, generate food and clothing for the majority of the global population, and provide a means of investment for millions of others. Maintaining the health and welfare of livestock is a major challenge to the global society and needs to be placed in a political, social and economic context.

Despite the importance of livestock, the veterinary resources dedicated to them are minor compared to companion animals. The latter have become increasingly important

in most societies, particularly those with growing, affluent, urbanised human populations. Most veterinary graduates will become small animal clinicians, albeit many will only act in this role for relatively short periods of their working life with many moving towards managerial, policy or teaching roles (Brown & Silverman, 1999; Knippenberg et al. 2015). Therefore, although it may not be anticipated by veterinary undergraduates in all countries, many will find themselves with careers in industry or public policy roles where a much broader understanding of the societal and economic context of animal health, including livestock health, will be necessary to their success. A challenge in the veterinary curriculum is to provide undergraduate veterinary students with a wider appreciation of the value of animals in society, including livestock.

The paper will, therefore, examine what aspects of the economics of livestock production and health need to be covered in the veterinary undergraduate curriculum in order to give the veterinary student a sufficient understanding of economic concepts and tools, to add value to a 'day one' practicing veterinarian and equip them for diverse roles in their future careers. It will also make comment on how this needs to be delivered in order to maintain the interest of the student and to enthuse them to self-learn in the future.

Economic concepts

The economic concepts which should be taught to undergraduate veterinarians are set out below. A veterinarian who has an understanding of these concepts will be better able to advise livestock owners, by being able to place the individual clinical case within the wider context of the business and society in which livestock are kept. These concepts and tools will also equip veterinarians to work in multidisciplinary teams advising the corporations and major food groups which increasingly control the food supply, or to move into industry or public policy leadership or management roles.

The economics of livestock production and health is not concerned principally with money but with *making rational choices and decisions about the allocation of scarce resources for the achievement of competing goals*. Monetary units are simply used as a yardstick to compare the different resources and goals involved in the decision. The underlying theme is that economics helps to deal with problems of resource scarcity.

When making a choice or decision there must be some sacrifice, the production or consumption of one thing involves the sacrifice of alternatives. This sacrifice of alternatives in production (or consumption) of a good is known as its **opportunity cost**. Decisions concerning the allocation of scarce resources by farmers, agribusiness people, government officials and consumers of livestock products need to assess the costs and benefits of the actions. Where a person makes a decision that generates **the greatest benefit relative to cost** an economist would say that a **rational choice** has been made. Reaching a rational choice on how much of an input to use or how much of a product to consume often involves assessing the **marginal costs** of extra inputs or products versus the **marginal benefits** created.

These concepts need to be placed into a framework of data collection and capture to assess the output from the livestock enterprise and its costs of production, separated into variable and fixed costs. These can be used to assess the: (1) level of **production** – the total output from the livestock enterprise; (2) the **profit** – the difference between the value of the outputs and value of the inputs; and (3) **productivity** – value of outputs divided by the value of inputs. A livestock enterprise that is profitable does not mean that profit has been maximised, so estimating profitability alone is only a partial economic assessment. Productivity measurement allows a more nuanced assessment of whether an enterprise is performing well and allows comparisons between enterprises and farms.

Whilst it is not anticipated that estimating profit and productivity would be carried out routinely by a veterinarian, graduate veterinarians who understand the basic trade-offs being made within a livestock enterprise (and wider society) will be better able to support farmers in decision-making around animal health losses and investments (described in more detail in the next section) and work collaboratively with other farm business advisors.

Economic impact of livestock diseases

Veterinarians need to appreciate that animal disease impacts have two sources of economic cost, namely losses and expenditures (McInerney et al, 1992). Some animal disease and health problems cause dramatic impacts, such as animal deaths and rapid reductions in weight or production of milk or eggs. These losses will generate a demand for help from animal health professionals and there will be expenditure in medicines and vaccines in order to manage the problem. For every unit of money spent on these animal health services and products the animal owner will expect at least an equal return in terms of losses they avoid. Other losses may also be incurred that are less obvious, but no less important. For example some diseases impact negatively on fertility in animals leading to less young being produced each year and with a negative impact in milk production. In addition a poor fertility level will mean that greater numbers of breeding animals will be needed for every unit of meat, milk or eggs produced implying a reduction in productivity of the overall system. These more subtle changes due to disease are less frequently reported by farmers and require more careful data collection and analysis to determine if there is a need to respond to disease presence with control measures.

Disease presence in an animal population can also limit the animal keepers' ability to access markets, where disease freedom is required. Finally the presence of disease and the lack of possible technologies to manage the problems it creates can mean that livestock owners choose livestock breeds and livestock production technologies that first minimise variation in production, by minimising disease risk, before optimising production in terms of productivity gains. This complex web of livestock

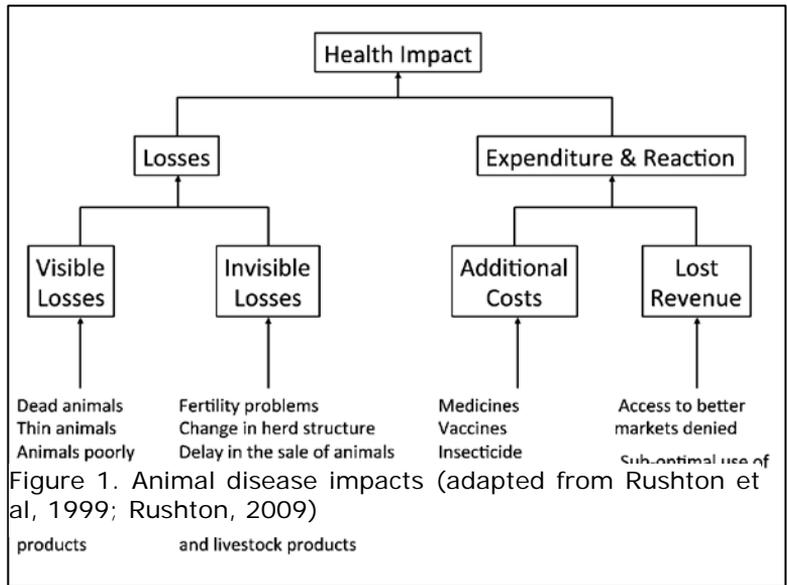


Figure 1. Animal disease impacts (adapted from Rushton et al, 1999; Rushton, 2009)

disease losses, with a range of human reactions in terms of animal health interventions, market changes and technology choices, make up the overall impact of animal disease (see Figure 1). Information structured in this way provides an assessment of the strengths and weaknesses of the current practices of disease management and provides a basis to discuss change at either farm level or at a government or livestock industry policy level.

Assessing change

When assessing change in healthcare delivered to livestock, there is the application of the economic concept of *marginal costs and benefits* described above. The economic tools that relate to this concept are partial budget and cost benefit analyses.

Partial budget analysis should be used when assessing veterinary interventions that have short term changes. There is a need to separate additional costs into (1) new costs and (2) lost revenue; and additional benefits into (3) costs saved and (4) new benefits. Lost revenue relates to opportunities lost due to the health status or healthcare change and corresponds to *opportunity cost*. New benefits are often related to greater numbers of animals and more livestock product, which needs to recognize that extra resources are required in terms of feed and labour.

For changes that require large investments, such as improvements in housing to reduce pneumonia, the additional costs and benefits will occur in different years and this requires the future costs and benefits to be converted to a present value through a process known as discounting. Discounting requires a rate, which many confuse with the bank interest rate for borrowing. In an economic analysis the rate should represent the best alternative use of money for the person or organization making the investment, or the *opportunity cost* of capital. The resulting comparison of the net present value of costs

and benefits is commonly known as a **cost-benefit analysis** and it generates three metrics: (1) net present value; (2) benefit cost ratio and (3) internal rate of return. These metrics all have strengths and weaknesses and should be combined to aid decision making with a client.

The partial budget and cost benefit analysis provide an assessment of the **economic profitability** and estimate the **net value** of a veterinary intervention. Before a decision is made to implement a veterinary intervention the livestock owner should be encouraged to carry out a **financial feasibility**, where the origin of money required for the investment needs to be considered along with the repayment conditions. Where there is risk and uncertainty there should also be the consideration of combining the partial budget or cost benefit analysis with a **decision tree analysis**. All these methods are covered in the NEAT (2016) teaching notes and can be found in Chapter 7 of Rushton (2009).

Conclusions

The paper has covered critical core economic concepts and tools that provide a framework for understanding the costs and benefits of a livestock enterprise. It has examined how to assess the economic impact of an animal disease and how to use this as a baseline to assess a veterinary intervention for a livestock production system with the use of a set of tools. These concepts and tools need to be taught in dedicated classes in the veterinary curriculum (see NEAT, 2016 for teaching materials) and reinforced during clinical teaching. The clinical context is key to ensuring impact and relevance to the undergraduate veterinarian. A critical target audience of these economic concepts and tools therefore has to be the clinical teachers in the veterinary faculties, so that the application of the methods can be embedded into the clinical teaching. Teaching economics in isolation is likely to alienate students from the subject and cause them to question its relevance. At the same time it is particularly important to raise their awareness of veterinary career paths, which may not be anticipated by the undergraduate, but which will demand a broader understanding of the economic and social context of livestock health to achieve success.

Economics skills overall provide a veterinarian with an improved ability to communicate with their clients, covering all aspects of the veterinarian's roles from animal health policy maker, small animal clinician to farm-level advisor to livestock farmers. In short, economics adds value to the practising veterinarian, making them better equipped to compete in the rural job market.

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References

Brown, J.P.; Silverman, J.D. (1999) The Current and Future Market for Veterinarians and Veterinary Medical Services in the United States. JAVMA 215:2 pp 161-183

Knippenberg, R.; Dicks, M.R.; Bain, B.; Dow, M. (2015) Estimating the financial return on a veterinary education JAVMA 246:4 pp 422-424

McInerney, J. P. Howe, K. S. Schepers, J.A. (1992) A framework for the economic analysis of disease in farm livestock. Preventive Veterinary Medicine.13: 2, 137-154.

NEAT (2016) <http://www.neat-network.eu/resources/teaching> accessed June 2016

Rushton, J. (2009) The Economics of Animal Health and Production. CABI, UK 364 pages

Rushton, J.; Thornton, P. and Otte, M.J. (1999) *Methods of Economic Impact Assessment*. In "The economics of animal disease control" OIE Revue Scientifique et Technique Vol 18 (2) pp 315-338.
