The Economics of Animal Health and Welfare

PEER REVIEWED

Introduction

There are many definitions of the term 'animal welfare' (Swanson, 1995; Spedding, 2000). For instance: "welfare is normally defined as a state of well-being, in which at least basic needs are met and suffering is minimized" (Spedding, 2000, p.9). This is a simplistic definition, which deals mainly with an animal's physical needs and implies that suffering can only be minimised. This definition does not take into account the idea that animals can be physically fit and mentally unwell (i.e. experiencing boredom, anxiety, fear, etc); it also fails to include positive states of welfare (e.g. happiness, excitement, mental stimulation, etc). When people (scientists and the public alike) think of animal welfare, they find it relatively easy to describe in terms of the absence of negative states, but they find it more difficult to think about positive states. Most people reach general agreement on what animal welfare is, but they find it a little more difficult to say what good welfare is (Duncan, 2002).

Societal and economic pressure for improvements in animal welfare have become an increasingly important driving force for changes in the management of companion, production and wildlife species. This has occurred in parallel with changes in thinking about the way humans interact with animals and has resulted in an improved awareness of welfare of animals under the influence of humans. The changing views of the public's perception of what animals experience, coupled with advances in science and international livestock export requirements, has resulted in significant improvements in animal welfare with changes in government legislation reflecting the increased concern for and awareness of the welfare of animals under the influence of human actions. An important determinant of animal welfare has been the role of animal product supply chains responding to consumer demands, whether it be changes in: production systems (e.g. move from cage-based to free-range poultry layer production systems), development of premium products (e.g. premiums for welfare-friendly certified products), reducing supermarket prices (e.g. intensification of dairy production), or research into alternatives to controversial husbandry practices (e.g. research into non-surgical alternatives to mulesing of Merino lambs). More recently, wildlife and companion animals have received attention with respect to their welfare. For wildlife, badger culling is a significant debate in the UK while for companion animals, attempts to manage the unethical trafficking of pets and spread of disease across Europe have been made by the EU in the form of the Pet Travel Scheme. Closer to home, there is a longer debate about the ethics of purebred pets and their inherited illnesses.

This article sets out to piece together knowledge about the economics of animal health and welfare. We consider animal health and welfare through the lens of key principles of economics (such as supply, demand, pricing, and opportunity cost) using case studies of livestock, companion animals and wildlife. For livestock, we use the example of pleurisy in pigs, for companion animals we consider predicted inherited disease and for wildlife, we discuss the complexities of defining wildlife as pests and the disparate approaches to control programmes.

Livestock

There is no doubt that global pig production will continue to increase due to growing consumer demand for animal protein, the superior feed conversion efficiency of pigs compared to other domesticated species (especially ruminant species) and improvements in husbandry and housing technologies. Therefore, any factor that supresses production must be clearly understood and managed from both production and economic perspectives –diseases are no exception. Notable diseases that inhibit global pig production include: African swine fever, classical swine fever, Aujeszky's disease and porcine reproductive and respiratory syndrome.

Pleurisy in pigs has received attention as a major UK disease that results in carcass losses occurring from trimming of the chest cavity. This disease, and other related respiratory conditions, cause substantial economic losses in the value chain due to increased mortality, morbidity and treatment costs and reduced growth rates, feed conversion efficiency and carcass quality (Holt *et al*., 2011). Garcia-Diez and Coelho (2014) found that 21.2% of 161,001 carcasses included in their sample were condemned because of pleurisy. Respiratory diseases are known to negatively affect indicators of pig welfare (Jäger *et al*., 2012) but from a welfare perspective, pleurisy causes infected pigs to have breathing difficulties and general discomfort when breathing.

Respiratory conditions in pigs have been increasing in Scotland, England and Wales since 2009, with pleurisy being the worst of the respiratory conditions in England and Wales (Eze *et al*., 2015). The UK's British Pig Health Scheme shows that 68% of 3674 batches of slaughtered pigs in the UK were affected with pleurisy (Tucker *et al*., 2009). This research showed the economic impact of pleurisy at both production and processing phases of the value chain. At the production-end, reduced carcass weight (Harley *et al*., 2012; Holt *et al*., 2011) and increased age at slaughter were calculated to cost producers 226p/pig, while at the processing-end reduction in line speed and associated staff costs (i.e. increased inspection and trimming times) were calculated at 29p/pig; these calculations were based on a prevalence rate of 10%. Therefore, if 68% of the 10.5 million pigs slaughtered annually in the UK (AHDB Pork, 2016) are affected by pleurisy and it costs the supply chain 255p/pig then this disease is costing the value chain approximately £18.21 million per annum.

The solution for managing pleurisy in pigs from both health (Holt *et al*., 2011) and welfare perspectives points to farm management. The following management practices were found to increase the odds of pleurisy: 1) no all-in all-out pig flow, 2) rearing of pigs with an age difference of greater than one month in the same airspace and 3) repeated mixing or moving of pigs during the rearing phase (Jäger *et al*., 2012). On the other hand, these husbandry practices decreased the odds of pleurisy: 1) filling wean-to-finish or grower-to-finish systems with piglets from less than three sources compared to farrow-to-finish systems, 2) cleaning and disinfecting of grower and finisher and accommodation between groups, and 3) extended down time of grower and finisher accommodation, respectively, for each additional day of downtime). Despite these findings, research has yet to be conducted on the costs and benefits of these practices to the farm business.

Companion Animals

Greenbaum (2004) discusses the humanisation of pets and the impact this is having on society, in that companion animals have been elevated from being pets to family members, best friends, and "fur babies". Furthermore, there is evidence that single-occupant households and those comprised of couples both tend to substitute pets for children (Euromonitor, 2013). To compound this, it is predicted that the number of couples without children in the UK will increase by 3% by 2018 therefore suggesting scope for increased demand for companion animals. The market for veterinary care in the UK is dominated by the sector dedicated to the care of pets (45.5%) which, according to IBISWorld (2015), is split between households with children (26.1% of the 3.2 billion market) and households without children (19.3% of the 3.2 billion market). In terms of the ability to pay for veterinary care, VetCompass (2016) states that 19% of UK dogs are insured and 7% of UK cats are insured, thereby indicating the potential for growth.

These data explain the increased demand for pets in the UK. For the supply of pets, numerous recent press articles report the rise of commercial breeding establishments (CBEs or 'puppy farms') in the UK and throughout Europe. Dogs purchased from non-commercial breeders are known to be far less likely to experience behavioural disorders than dogs purchased at pet shops (McMillan *et al*., 2013). Work by McMillan *et al*. (2011) showed that a significant number of dogs from CBEs exhibited behavioural abnormalities, but they also found that there were significantly higher rates of health problems of dogs that were pre-owned by CBEs. The health and welfare of companion animals has been compromised to the point that the EU has resorted to policy interventions (the Pet Travel Scheme) to ensure that pets are adequately protected against disease and poor welfare while travelling within Europe.

Despite EU policy and the amount of press dedicated to exposing the negative externalities brought about by CBEs and the demand for pets, there is little convincing evidence that directly points to the rise of purebred animals in society, and research continues on understanding the epidemiology of predictable inherited diseases in purebred pets. However, much is known about predictable inherited diseases of purebred pets and there is a long history of ethical debates about the genetic selection of some traits. McGreevy and Nicholas (1999) and Rooney (2009) discuss the traits that are deliberately bred into dogs to satisfy human preferences, which have negative impacts on animal health and welfare. For example, brain defects in Cocker Spaniels that have been selected for skull shape, fine legs in the Miniature Poodle and Greyhound that are susceptible to fractures, and brachiocepthaly in Boston Terriers and Pugs that lead to a variety of respiratory and skin conditions (Figure 1). There are also conditions that have emerged as unwanted traits, that are either associated with desired traits or as a consequence of pure-breeding. For example: white-coat deafness in cats (Bamber, 1933) and hip dysplasia in German Shepherds (Hedhammar *et al*., 1979).

The prevalence of predictable inherited disorders continues to be sufficiently severe in society that veterinary research into managing inherited conditions thrives (for recent examples, see: Pohl, Roedler and Oechtering, 2016; Packer, Hendricks and Burn, 2015; Roedler, Pohl and Oechtering, 2013). Despite the numerous warnings, demand for purebred pets (particularly dogs) continues to fuel the perpetuation of unethical breeders.

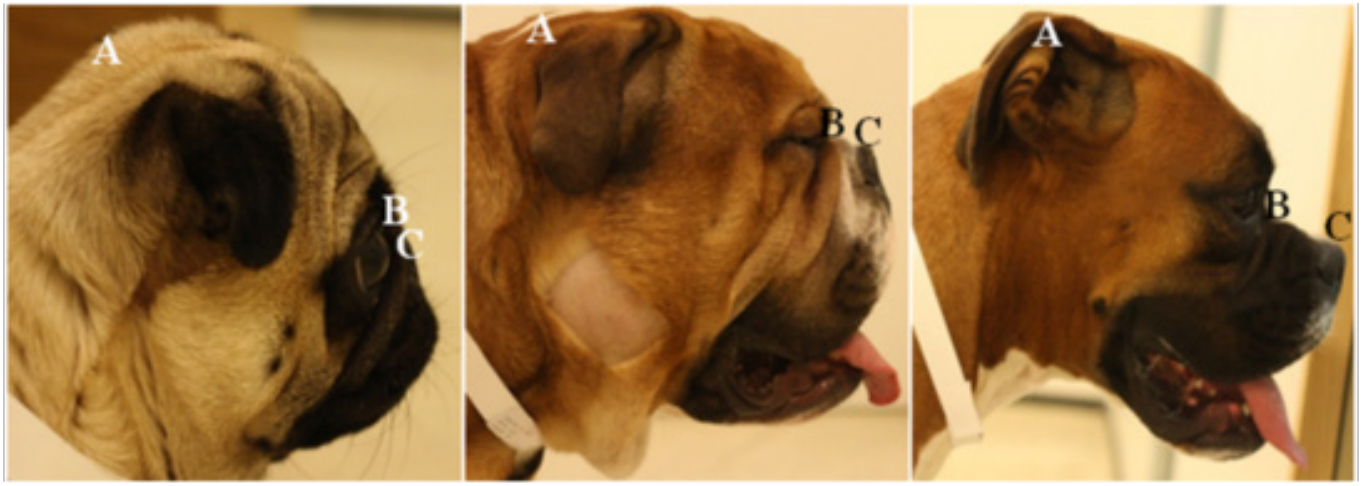

Figure 1: Degrees of brachiocepthaly in different breeds of dogs (i) cranial length (A-B) and (ii) muzzle length (B-C).
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Wildlife

The conflicting pressures of wildlife damaging agricultural and environmental systems, and impacting on public health and the benefits they bring to biodiversity, and even human recreational activities, means that the management of wildlife species is a complex issue. While wildlife can limit agricultural yields in a number of ways, how a wildlife pest is defined depends on social, economic, regulatory, and environmental circumstances. For example, consider the dual role of feral pigs in the California rangelands and how they simultaneously harm both agricultural and natural environments but also provide land owners with lucrative earnings from hunting rights (Zivin, Hueth and Zilberman, 2000).

Significant resources are invested worldwide in the control of wildlife pest species. This control can range from habitat removal, repellents and exclusion methods to lethal control. It is estimated in Southeast Asia that non-indigenous pest species cause annual economic losses of US$33.2 billion (includes invertebrate and plant species) (Nghiem *et al*., 2013), while in the USA it is estimated at over US$66.3 billion (vertebrates only) (Pimentel *et al*., 2005). More specifically it has been estimated that in Australia the European rabbit (Oryctolaus cuniculus) costs the economy between A$600 million and A$1 billion annually (Anon., 2002). This is through direct competition with livestock and damage to the environment. Rabbits are Australia's costliest vertebrate pest species and it is estimated that annually $A20 million is spent on the control of rabbits alone (Cooke *et al*., 2013). The majority of this control of rabbits has been through the use of lethal methods (e.g. toxicants, shooting, traps/snares and introduced diseases).

Despite the impacts that vertebrate pests have on society and the environment and the very real need for their management, their control is a controversial subject, with polarised viewpoints and cultural differences. While the welfare of production, research, teaching and more recently companion animal species have received significant attention (Littin and Mellor, 2005), the welfare of free-living wildlife under the influence of humans in the past has not received the same level of consideration. However, there is now increased public and scientific awareness of the welfare of pest species during control programmes. The control methods (both lethal and non-lethal) when used correctly to manage pest populations generally cause a degree of pain and distress. The level of welfare compromise depends on the method used, but is also influenced by the inherent variability associated with trying to control wild species. For example, target animals can enter traps in unintended ways, animals can be sub-lethally poisoned, secondary poisoning of non-target species, animals can be sub-lethally shot or death may be delayed due to marksmanship, delays in checking traps and snares and even predation of trapped animals can cause welfare compromise. Despite the obvious need for the controlling of some wildlife populations, a body of knowledge has emerged questioning the cost-effectiveness of some wildlife management programmes (Skonhoft *et al*., 2006; Waterfield and Zilberman, 2012) and, in the case of wildlife being valued as a resource, the opportunity costs of such programmes (Zivin, Hueth and Zilberman, 2000).

There is an obvious economic, ecological and human health need for the continued control of vertebrate pest species. However, it is essential that there is continued revaluation of the humaneness and effectiveness of current and newly developed control methods, in conjunction with considering cost-effectiveness and the opportunity costs of control programmes.

Conclusion

This article aimed to present a number of examples that demonstrate the application of economic principles in issues related to animal health and welfare. The livestock industry was presented from the point of view of pig production and the impact that a major disease (pleurisy) has on production and welfare. The welfare issues associated with purebred companion animals in terms of predicted inherited diseases highlight the power of supply and demand in perpetuating welfare-compromising traits in pets. Finally, wildlife species were considered in terms of their prevalence as pests, control methods and the different types of economic analysis that have been conducted to understand the decision-making around cost-effectiveness and opportunity costs. This article examined animal health and welfare issues from an economics perspective. In conclusion, using the examples in this article, there are trade-offs between optimal animal welfare and meeting the needs of modern human society.

An extended version of this article will be available to readers who wish to learn more via this issue in the freely-available special issue: The Economics of Animal Health (2017) Scientific and Technical Review OIE, 36(1): http://www.oie.int/en/publications-and-documentation/scientific-and-technical-review-free-access/list-of-issues/

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