

## ANIMAL HEALTH SYSTEMS AND STATUS -

### ARE THEY TRADE BARRIERS OR MECHANISMS TO IMPROVE GLOBAL ANIMAL DISEASE CONTROL?

*By Jonathan Rushton,*

*CEVEP,*

*Casilla 10474,*

*La Paz, Bolivia.*

*Email [rushtonjonathan@yahoo.com](mailto:rushtonjonathan@yahoo.com)*

#### **SUMMARY**

The paper discusses the origins and history of sanitary agreements from an early stage of animal disease spread through to the vast improvements in transboundary disease control, which have taken place first in developed countries and more recently in countries with potential to export livestock products. These improvements have created pressure to establish rules on animal health disease status and more recently on the quality of animal health services. These rules are part of the SPS agreement. However, there has been a divergence in the quality of animal health systems and status over the last 30 years, with three groups of countries identified. In the one group are developed countries who have a high capacity for the control and eradication of transboundary disease, and relatively good abilities in the control of livestock product trade. Another group of countries are mainly developing countries who have a high potential to export livestock products, and have recently eradicated important transboundary diseases. However, their surveillance and emergency response systems are variable. A third group consist of developing countries who have poor control over animal disease and little or no capacity for livestock product export. The different in human and technical capacities in these groups of countries imply that livestock product trade negotiations are carried out on an uneven playing field. There is need to further clarify the SPS agreement in order to help developing countries improve their animal health systems and status so that international markets opportunities are fully exploited. It also recommended that the least developed countries are given strong technical assistance in the development of their veterinary services to ensure that poor rural people in these countries have every opportunity to use livestock as means of poverty reduction. Improvements in international animal health regulations will be an effective mechanism to protect previous investments in animal disease control and the expansion of animal disease free regions.

**Keywords:** Animal Health, Trade

#### **INTRODUCTION**

Concerns about the introduction and spread of animal disease through the imports of livestock and livestock products provide powerful arguments for the need for regulations on international trade. This paper examines whether international rules on livestock disease and animal health systems are part of barriers to trade or are methods to protect investments in animal health status. An initial section examines the origins and history of the sanitary agreements, followed by a section that examines the negative and positive impacts of the SPS agreement. A discussion identifies conclusions and potential solutions to problems.

## ORIGINS AND HISTORY OF SANITARY AGREEMENTS

The spread of animal disease through the movement of livestock and livestock products has a long history. Table 1 presents some examples of animal disease spread over time.

**Table 1. Important animal disease spread that is related to trade.**

Disease	When	Movement	Comments
Trypanosomiasis	19 <sup>th</sup> century (Luckins, 1999)	Cattle from Africa to Latin America	Establishment of trypanosomiasis in Latin America, where trypanosomes have adapted and used biting flies to maintain and spread their population (Quispe et al, 2003).
	In the last 10 to 15 years	Cattle from Brazil to Bolivia <sup>1</sup> and Central America <sup>2</sup>	Examples of price differences and technology improvements leading to movement of animals from other parts of South America to Bolivia and Central America respectively
Rinderpest	1891	Movement of cattle from Europe to Africa	The appearance of rinderpest in Africa killed thousands of cattle and is sometimes reported as having an important impact in development. It is only recently that the disease has been brought under control in Africa and there is now a possibility of eradicating this disease from this continent.
Tuberculosis	Late 1800 early 1900	Cattle movement from Denmark to the UK	During the tuberculosis eradication programmes in Denmark, positive cattle were sold and exported to the UK. This increased the already high levels of tuberculosis in the cattle population. In the early 1900s bovine tuberculosis was one of the major causes of infant mortality in the UK due to the consumption of tuberculosis contaminated milk and milk products.
Foot-and-mouth disease	1960s	Meat with bone movement from Argentina to the UK	It is suspected that bone infected with FMD was fed to pigs in England. An epidemic began that lasted 6 months and involved a stamping out programme that slaughtered 180,668 cattle, 77,592 sheep and 98,526 pigs (Whitlock, 1968)
	2001	Unidentified source	Pigs were fed leftovers from a restaurant contaminated with FMD. The disease then spread from pigs to a neighbouring sheep flock. Sheep movement within the UK produced a massive epidemic that lasted for 12 months, involved a stamping out programme that slaughtered 792,864 cattle, 4,930,029 sheep and 431,651 pigs and cost billions of dollars (Rushton et al. 2002; Thompson et al. 2002).
BSE	1980s and 90s	Export of meat and bone meal from the UK	Worldwide outbreaks of BSE have been strongly related to the patterns of exports of UK meat and bone meal.
HPAI	1990s and 00s	Export of poultry and poultry products in South-East Asia	There are arguments about the importance of migratory birds or trade in the spread of avian influenza. However, Japan and South Korea quickly controlled the disease and maintained freedom when they stopped imports of fresh, uncooked poultry products.

The use of animal disease presence as a trade barrier is also not a new phenomena. For example European countries, with the support of their pig producers, banned the imports of American pork in the 1880s because of rumours that the meat was infested with trichinosis. According to Gignilliat (1961) this was a godsend for European protectionists.

<sup>1</sup> Based on field evidence from Bolivia

<sup>2</sup> Based on anecdotal evidence of veterinarians based in Central America

However, the patterns of indiscriminate spread of diseases began to change in the 1960s and 1970s as European, North American countries and Japan began to make serious inroads into the control of range of both transboundary and endemic diseases<sup>3</sup>. This was achieved through significant investments in human skills and the implementation of much more rigorous and organised programmes that used epidemiology and economics research to assist in decision-making. Towards the end of the 80s many of these developed countries had begun to be free from the major transboundary diseases and were beginning to make assessments of how to protect themselves from potential re-entries or re-emergence of disease. In addition to this group of countries were Australia and New Zealand, who were largely free of many of the transboundary diseases and had important livestock industries that exported livestock products throughout the world. The strategies employed in prevention of transboundary disease have been different, the USA has adopted a pro-active role in working with potential exporting countries in maintaining control of food chains through its international arm APHIS. Much of this activity has been concentrated in neighbouring countries in particular Mexico, Central America and the Caribbean. Australia and New Zealand have made investments in protecting their borders from incoming livestock and livestock products. Europe, while playing a role in setting rules, has perhaps not been as active in disease prevention actions.

This period of change in animal health systems and status also coincided with a greater interest in non-tariff barriers that were discussed and included in the Tokyo Round (1973-79) of GATT in an attempt to reduce the use of technical issues as trade barriers (Irwin, 2002). In this Round countries imposing domestic taxes and regulations had to adhere to the standard of “national treatment”, which is another form of non-discrimination by which domestic and imported goods should face the same regulatory standards. Therefore, governments were prevented from setting one standard for domestic products and then imposing a more stringent standard for similar imported products (Irwin, 2002). Whilst the intentions of this round were aimed at reducing the impact of technical barriers to trade there success was limited as a majority of GATT members did not sign the codes and there were gaps in the coverage of the rules, for example the agricultural sector and developing countries were exempt from the GATT regulations.

Before the Uruguay Round there was strong expansion in world trade, which also included trade in livestock and livestock products (Ataman Aksoy, 2005), and there was a long-standing debate or argument on the use of hormones in beef production. The latter had led to the European Union banning US beef products from its market on food safety grounds even though there was no clear scientific evidence to support this decision. This problem led the USA to seek clarification of the rules on health and safety regulations during the Uruguay round and resulted in the Agreement on the Application of Sanitary and Phytosanitary Measures (SPS). This agreement provides that trade-related sanitary measures should be based on scientific evidence or be based on international standards (if they exist). It was also stated that sanitary measures should be non-discriminatory and not be more trade-restrictive than required to achieve the appropriate level of sanitary protection. The agreement also was strong on the need for consistency in the protection of health risks and that animal health barriers should not be discriminatory or a disguised restriction on international trade (WTO, 1999).

At the time of the SPS agreement the developed countries had been moving towards a set of international standards through Codex Alimentarius for food safety and the OIE on animal health and zoonoses. These two organisations became important actors in the livestock and livestock product trade disputes with the signing of the SPS agreement. The overall goal was to emphasise the need for standards that ensure food safety and the prevention of animal diseases, and the

---

<sup>3</sup> It is recognised that some diseases were controlled well before this period (see Fisher, 1980), however major breakthroughs were mainly made in the period suggested.

limitation of countries abilities to use animal health issues as protectionist devices (Friis Jensen, 2002).

These advances in the setting of international standards on animal health and food safety with the agreement on compliance were accompanied with a divergence in animal health systems and status in different countries (Jaffee & Henson, 2005). Three groups are beginning to emerge that have very different needs from the SPS agreement:

1. Countries that are free from the majority of transboundary diseases, that have a reasonably strong surveillance systems and relatively high capacity in terms of human, logistic and financial resource to stamp out transboundary disease re-emergence. These correspond to the developed countries with some possible exception of Chile. Their livestock systems are mainly found in intensive units with high capital investments, production systems that are vulnerable to small changes in demand and output. These countries are also important importers of livestock products, and if other trade barriers were removed, would be attractive markets for group 2 countries.
2. Countries that have recently declared disease free status of the major transboundary diseases and have surveillance systems based on vaccination campaigns. Their abilities to control and eradicate the re-emergence of transboundary diseases are variable. These countries are found in the Southern Cone of South America, Mexico and potentially South Africa and Thailand. They are exporters of livestock products and in some cases are aggressively searching for new markets (Economist, 2005).
3. Countries that have poor control over livestock diseases and have weak animal health systems. They have low levels of general investment in livestock systems, with most of the animals in extensive systems. Some of these countries are importers of livestock products and most have very little capacity to export livestock products.

Liberalisation and clearer rules on technical trade barriers that relate to animal health have helped to increase trade in livestock products (Delgado et al, 2001), although this slowed towards the end of 90s (Ataman Aksoy, 2005). The relaxing of tax laws on agricultural exports from Brazil combined with a greater serious and international representation of the public veterinary survives from this country has led to a strong increase in livestock exports from this country over the last 5 years (Economist, 2005; Rodrigues, 2003).

In more recent times Byron Nelson identifies three important trends in global livestock production and trade:

- The growth in demand for livestock products in developing countries and the meeting of that demand mainly through intensive pig and poultry systems, but also milk production. This is the livestock revolution (Delgado et al, 1999).
- An ever-increasing trend for food safety in developing countries.
- A development in international law that incorporates food safety issues.

## **IMPLICATIONS OF ANIMAL HEALTH SYSTEMS AND STATUS ON LIVESTOCK AND LIVESTOCK PRODUCT TRADE**

### **Negatives**

A balance between consumer welfare and adequate protection of public and private investments in animal health control, livestock and livestock production systems is difficult to achieve. As the head of the Australian quarantine services states (Landos, not dated) "If you are a grower whose whole livelihood may be threatened by a sanitary or phytosanitary access decision, you are likely to only be interested in a zero risk approach compared to a consumer who may enjoy perhaps a

new variety of cheaper price of an import.” There is also concern that lobbying can easily take out of all proportion risks in food safety and environmental issues (see Box 1).

**Box 1. BSE in Canada and USA – an over reaction?**

In May 2003 the Canadian government reported the detection of a single case of bovine spongiform encephalopathy in a national cattle population of nearly 13.5 million animals (FAO, 2006). This led to 40 countries banning the import of large range of live animals and livestock products from Canada. Mitura and De Piéto (2004) estimated that the impact of the international livestock trade ban was significant for Canada. In 2003, Canadian farm cash receipts from cattle and calves were estimated at \$5.2 billion, a sharp drop of \$2.5 billion (33%) from 2002. At farm-level it was estimated that on average a family farm with an unincorporated beef unit would have lost US\$20,000. The more wide-ranging impact of the trade ban was the movement of cattle from Mexico to the USA to fill the demand for store cattle that would have come from Canada. While this has created a positive impact for cattle producers in Mexico, it has meant that beef prices in Mexico have risen affecting Mexican consumers, and that the USA is potentially importing animals from areas with low tuberculosis status (Ayala et al. 2005).

Later in 2003 the USA also declared the discovery of a single animal with BSE (out of an estimated cattle population of 96 million, FAO, 2006) which led to 53 countries banning the imports of American beef. Coffey et al (2005) estimated that the losses associated with this trade ban were between US\$3.2 to 4.7 billion. These authors also estimated that BSE has had considerable costs in terms of increased needs for surveillance at farm and slaughterhouse level.

The reaction of the world to these reported cases of BSE seems to have been an over reaction given that both Canada and USA had in place BSE surveillance systems, and had controlled the use of meat and bone meal in cattle diets (European Medicines Agency, 2004). In addition, there has been a slow improvement in the knowledge of the risks of BSE to human health. Experiences in the UK, which has the human population at greatest risk to BSE, would appear to indicate that human cases are now falling, and that risks are much lower than feared.

On an international level the use of BSE cases in Canada and USA as a trade barrier can only have a negative impact on disease reporting in the future. Livestock exporting countries, whose economies have far less ability to absorb rapid changes in export demand for livestock products, are unlikely to report minor levels of animal disease where there is a risk of exaggerated and rapid trade bans. The objective of increased transparency with the SPS agreement would therefore be placed in jeopardy.

Landos (not dated) also expresses concerns that in small countries, even developed ones such as Australia, the number of scientists in specialist areas is not always sufficiently strong and deep to deal with issues that arise from the SPS agreement. In a much more straightforward example Box 2 provides details on how the world has responding slowly to the risk of trade in disseminating this disease, in part because of a lack of capacity in the countries worse affected

**Box 2. The spread of avian influenza in the South East Asia and more recently in Africa – a lack of effective control of trade in live birds and fresh poultry products?**

Avian influenza has been present in Asia since the 90s (Van Konkelenberg, 2005), but it only reached a situation of serious proportions after it entered South East Asia in 2003 (Ruston et al, 2005). The reasons for its rapid spread in this area have not been fully explained and there has been much discussion on trade or migratory birds have been the important issue in the international spread of the disease. However, it would appear that trade had a major role in the entry of the disease to Japan and South Korea, countries who dealt rapidly with initial outbreaks and subsequently banned live poultry and fresh poultry product imports from China and Thailand.

Other countries have not been so effective in controlling movement of poultry and poultry products and have had tremendous difficulties in bringing the avian influenza under control. The recent experiences with the appearance of avian influenza in Nigeria due to the importation of poultry from Asia demonstrate that while the developed countries have relatively effective mechanisms in applying controls on livestock and livestock product trade due to the presence of transboundary diseases, developing countries are some way behind. Where zoonotic diseases are involved and this places the populations of importing countries at risk, and also has negative impacts on their livestock producers.

The international response to the limitations of affected countries in controlling avian influenza, and the low capacity to control movement from these affected regions to other developing countries has been relatively slow. In general the developed countries have not supported interventions quickly enough (Rushton et al, 2005a; Forthcoming). Contrast this with how quickly the Netherlands detected, controlled and eradicated H7 avian influenza in 2003. The outbreak lasted for a very short period. In addition within a year the outbreak and its control had been studied by a group of national scientists who examined whether the most effective means of control had been used and also the implications to human health (Elbers et al, 2004; Koopmans et al. 2004; Stegeman et al. 2004; Witt et al, 2004; Thomas et al. 2005)

Perry et al (2005) also identify the difficulties of developing countries to comply to the regulations with a glaring gap between the current international trade regulations and the capacity and ability of many developing countries to comply with these regulations. A negative to these authors is that rules are set by developed countries, with developing countries having very little influence. These rules are generally complex and open to different interpretations (Perry et al. 2005), which can also cause problems between developed countries. As Irwin (2002) says writing rules such as SPS is not going to end livestock trade disputes. The negotiation of the rules is a useful way of finding common ground. However countries will have different assessments of risk trade-offs involved in any given regulation. A good example, would be the United States and European Union perceptions of risk with regards food safety (Perkidis et al. 2001). In Europe, the food is under suspicion until proven safe, whereas in the United States, the food is acceptable until proven harmful.

Complicated regulations will be difficult for many developing countries to comply with and therefore imply a restriction on trade and access to markets (Byron Nelson, 2005) leading to the exclusion of such countries (Leslie & Upton, 1999). If the transactions costs of being involved in international trade of livestock products are too high then many countries will be excluded. In the end this can hurt both potential exporting countries who have livestock producers with markets limited to national consumers and less demanding countries<sup>4</sup> and consumers in importing countries who pay more for their food and have smaller range of products. What is clear is that while the SPS Agreement does have specific provisions for these potential exporting countries assistance is very limited and as a general rule not well focussed (Landos, not dated).

### Positives

There are, however, a number of very strong positive aspects coming out of the increase in international trade in livestock products and greater standardisation in rules for that trade. For example the SPS agreement has been successfully used to allow uncooked Argentinean beef to USA after 80 years of exclusion (based on areas of Argentina being free of FMD) and the Australians are now allowed to buy cooked poultry meat. In each of these cases the trade restrictions were based on a questionable issue of public health (Irwin, 2002).

---

<sup>4</sup> Therefore likely to be countries who will pay less for the product.

Rushton et al (forthcoming) that the SPS agreement has been an important component of the advances in the fight against transboundary diseases, which in some cases is leading to the possibility of worldwide eradications. Through the general process a number of countries have been brought into an international animal health system through trade leading to an expansion of:

- Expansion of animal disease systems that are more effective in the detection and control of diseases – benefits at farm-level and in livelihood security
- Expansion of livestock processing norms – benefits in food hygiene and safety (Byron Nelson, 2005)
- Improvement in the animal health status in these countries

Greater trade and clearer regulations can also help to improve animal production and processing systems (Byron Nelson, 2005) if appropriate technical assistance is provided. This has an impact of ensuring that national and international consumers get better quality products at more reasonable prices. However, Perry et al (2005) report that the success stories of developing countries exporting livestock and livestock products have been led by the private sector and have succeeded despite the lack of support of national governments.

## DISCUSSION

A view that the animal health systems and status are used as trade barriers is true in some cases, but is too narrow. Sanitary agreements can also be seen as a key strategy in the eradication of transboundary diseases as they bring collective action of developed countries on international disease control, and through trade draw in developing countries with potential and interests in livestock and livestock product exports. However, some countries will be left out as they have little capacity to invest in better animal health services and little incentive to do so because of their lack of capacity to export. Developed countries need to offer support to the latter countries in improving veterinary services. This would be a win-win strategy as better animal disease status reduces costs and risks of livestock production, improves world animal disease status and reduces risks of animal disease spread from such countries to free zones.

Byron Nelson (2005) suggests that the problems that developing countries face with the sanitary agreements can be addressed positively so that governments of these countries act in the interests of their own poor livestock producers. He recommends that the developing country governments:

- Greater coordination of national ministries, organisations and private individuals involved in setting national policy agendas for food safety.
- Improved quality and quantity of delegations to international organisations
- The formation of alliances with countries that have similar problems.
- The lobbying for technical assistance to comply with international regulations, both public and private.

The major challenge is to work to improve and update the SPS agreement. In general many authors are in agreement that the clarification of the trade regulations that relate to animal health, which took place in the Uruguay Round, was flawed but positive (Byron Nelson, 2005; Perry et al., 2005; Irwin, 2002). What needs to be improved is support for countries who are not well incorporated into the international livestock and livestock product trading systems. For these countries there is need to support and develop animal health services that address the needs of extensive livestock systems kept on communal lands – be they cattle, sheep, goats, pigs or poultry. These production systems are where there are major challenges in the control and eradication of transboundary diseases. There also has to be continued support and incentives to countries that export livestock products, but have variable surveillance and emergency response capacities.

## ACKNOWLEDGEMENTS

I would like to thank my wife and colleague Rommy Viscarra for searching for information and reviewing the first draft of the document. I would also like to thank the organisers of the symposium, Tim Josling, Monika Hartmann, Thomas Heckelei, Bettina Rudloff, Tom Wahl and Harald von Witzke, for inviting me to submit and present a paper, and Birgit Klein for her efficient administration.

## REFERENCES

- Ataman Aksoy, M. 2005. The Evolution of Agricultural Trade Flows. In Ataman Aksoy, M. & Beghin, J.C. (Editors) Global Agricultural Trade and Developing Countries. The World Bank, Washington DC, USA. pp 17-35.
- Byron Nelson, M. 2005. International Rules, Food Safety and the Poor Developing Country Livestock Producer. Pro-Livestock Policy Policy Initiative Working Paper No. 25. FAO, Rome, Italy. 41 pages
- Coffey, B., Mintert, J., Fox, S., Schroeder, T. & Valentin, L. 2005. Economic impact of BSE on the US beef industry: Product Value Losses, Regulatory Costs and Consumer Reactions. Kansas State University, Kansas, USA.
- Delgado, C., Rosegrant, M., Steinfeld, H., Ehui, S. and Courbois, C. 1999. Livestock to 2020. The Next Food Revolution. Food, Agriculture and the Environment Discussion Paper 28. IFPRI, Washington DC, USA. 72 pages
- Economist 2005. Special Report Brazilian Agriculture. The harnessing of nature's bounty. The Economist November 5<sup>th</sup> 2005. Pages 95, 96 and 98.
- Elbers A.R., Fabri T.H., de Vries T.S., de Wit J.J., Pijpers A. & Koch G. 2004. The highly pathogenic avian influenza A (H7N7) virus epidemic in The Netherlands in 2003--lessons learned from the first five outbreaks. Avian Dis. 48 (3) pp 691-705.
- EMA (European Medicines Agency) 2004. First cases of BSE in USA and Canada: Risk Assessment of ruminant materials originated from USA and Canada. EMA, London, UK.
- FAOSTAT 2006. <http://apps.fao.org> Date accessed: 10 May, 2006.
- Fisher, J. R. 1980. The economic effects of cattle disease in Britain and its containment, 1850-1900. Agricultural History. 54: 2, 278-294.
- Friis Jensen, M. 2002. Reviewing the SPS Agreement: A Developing Country Perspective. Working paper from the Royal Veterinary and Agricultural University, Denmark.
- Gignilliat, J.L. (1961) Pigs, Politics and Protection: The European Boycott of American Pork. Agricultural History 35 pp 3-24
- Jaffee, S.M. & Henson, S. 2005. Agro-Food Exports from Developing Countries: The Challenges Posed by Standards. In Ataman Aksoy, M. & Beghin, J.C. (Editors) Global Agricultural Trade and Developing Countries. The World Bank, Washington DC, USA. pp 91-114.
- Irwin, D.A. (2002) Free Trade Under Fire. Princeton University Press, New Jersey, USA. pages 257
- Koopmans M., Wilbrink B., Conyn M., Natrop G., van der Nat H., Vennema H., Meijer A., van Steenberg J., Fouchier R., Osterhaus A. & Bosman A. 2004. Transmission of H7N7 avian influenza A virus to human beings during a large outbreak in commercial poultry farms in the Netherlands. Lancet. 363(9409) pp 582-3
- Landos, J. not dated. Where is the SPS going. Australian Quarantine & Inspection Resources, Canberra, Australia.

- Leslie, J. & Upton, M. 1999. The economic implications of greater global trade in livestock and livestock products. *Rev. sci. Tech. Off. Int. Epiz* 18(2) pp 440-457
- Luckins, A.G. 1999. Epidemiology of non-tsetse-transmitted trypanosomiasis - *Trypanosoma evansi* in perspective. *ICTPV Newsletter* No. 1 September 1999
- Mitura, V. & Di Piétro, L. 2004. Canada's beef cattle sector and the impact of BSE on farm family income 2000-2003. *Agriculture and Rural Working Paper Series Working Paper No. 69*. Canada Statistics, Agricultural Division, Ottawa, Canada.
- Perkidis, N., Kerr, W.A. & Hobbs, J.E. 2001. Reforming the WTO to Defuse Potential Trade conflicts in Genetically Modified Goods. *The World Economy* 24 pp 379-398
- Perry, B., Nin Pratt, A., Sones, K. & Stevens, C. 2005. An appropriate level of risk: Balancing the need for safe livestock products with fair market access for the poor. *Pro-Livestock Policy Policy Initiative Working Paper No. 23*. FAO, Rome, Italy. 53 pages
- Quispe P., Chávez A., Casas E., Trigueros A. & Suárez F. 2003. Prevalencia de *Trypanosoma vivax* en bovinos de cuatro distritos de la provincia de Coronel Portillo, Ucayali. *Rev. investig. vet. Perú*, jul./dic. 2003, vol.14, no.2, p.161-165.
- Rodrigues, G.V. 2003. Mercado Internacional de produtos de origem animal. Presentation at the XV Congresso Brasileiro de Reprodução Animal, Porto Seguro, Brazil. August 2003.
- Rushton, J. 2004. *Appropriate mechanisms for animal health knowledge transfer and their importance in animal disease risk management*. A paper presented at Brazilian-UK Meeting "Technology Transfer new horizons in agribusiness development" 6-8 December 2004. British Council, Brasilia, Brazil.
- Rushton, J., McLeod, A. & Lubroth, J. (In Press) *Managing transboundary animal disease*. World Livestock, FAO, Rome, Italy.
- Rushton, J., Taylor, N., Wilmshire, T., Shaw A.P.M. & James, A.D. 2002. *Economic analysis of vaccination strategies for foot and mouth disease in the UK*. A study commissioned by the Royal Society, London, UK. PAN Livestock Services and VEERU, University of Reading, UK. 95 pages
- Rushton, J., Viscarra, R.E., Guerne Bleiche, E. and McLeod, A. 2005. Impact of avian influenza outbreaks in the poultry sectors of five South East Asian countries (Cambodia, Indonesia, Lao PDR, Thailand, Viet Nam) outbreak costs, responses and potential long term control. *World Journal Poultry Science*. 61 (3) pp 491-514
- Stegeman A, Bouma A, Elbers AR, de Jong MC, Nodelijk G, de Klerk F, Koch G, & Boven M. van 2004. Avian influenza A virus (H7N7) epidemic in The Netherlands in 2003: course of the epidemic and effectiveness of control measures. *J Infect Dis*. 190 (12) pp 2088-95
- Thomas M.E., Bouma A., Ekker H.M., onken A.J., Stegeman J.A. & Nielen M. 2005. Risk factors for the introduction of high pathogenicity Avian Influenza virus into poultry farms during the epidemic in the Netherlands in 2003. *Prev Vet Med*. 69(1-2) pp 1-11
- Thompson, D.; Muriel, P.; Russell, D.; Osborne, P.; Bromley, A.; Rowland, M.; Creigh-Tyte, S.; Brown, C. 2002. Economic costs of the foot and mouth disease outbreak in the United Kingdom in 2001. *Rev. sci. Off. Int. Epiz*. 21 (3) pp 675-688
- Van Konkelenberg, R. 2005. The Costs and Benefits of Regulatory Control Applied to Wet Markets to Prevent/Control Avian Influenza in Hong Kong. Report for WHO.
- Whitlock, R. 1968. *The Great Cattle Plague*. John Baker, 5 Royal Opera Arcade, Pall Mall, London, UK. Pp 111.
- Wit J.J. de, Koch G., Fabri T.H. & Elbers A.R. 2004. A cross-sectional serological survey of the Dutch commercial poultry population for the presence of low pathogenic avian influenza virus infections. *Avian Pathol*. 33 (6) pp 565-70

WTO 1999. The Legal Texts: The Results of the Uruguay Round of Multilateral Trade Negotiations.  
Cambridge University Press, New York.