

# The spread of zoonoses and other infectious diseases through the international trade of animals and animal products

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## Summary

For trade purposes, ever increasing quantities of food animals and animal products that are transported more rapidly than ever before are contributing to the spread of zoonoses and are creating threats on a permanent basis. Most countries in south-eastern Europe, the Mediterranean and the Middle East are increasing imports of food animals and meat and products of animal origin. They can become potential sources of zoonotic and other infectious diseases if controls are not performed under the most effective conditions. Developing countries with their organisational weakness are particularly vulnerable to fraudulent international trade practices of animals and animal products. To prevent such risks, the World Trade Organization, the World Organisation for Animal Health and their member countries support the measures stipulated in the Sanitary and Phytosanitary Agreement which targets the liberalisation of trade in animals and animal products under specific conditions while protecting public health and national economies. Vigilance must be exercised and appropriate inspection made at points of entry by veterinary and other authorities to ensure the strict implementation of international and national regulations. National legislation, appropriate infra-structures and the respect of international regulations can become barriers to avoid animal trade, contributing to the spread of zoonotic and other infectious diseases.

## Keywords

Animal, Disease, Health, Infection, Legislation, Public health, Trade, Zoonoses.

## La diffusione delle zoonosi e di altre malattie infettive attraverso il commercio internazionale di animali e dei loro prodotti

### Riassunto

*Il trasporto di animali e dei loro prodotti a fini commerciali, in quantità e velocità sempre crescente, contribuisce alla diffusione delle zoonosi e rappresenta una minaccia permanente. La maggior parte dei paesi del Sud-Est Europeo, del Mediterraneo, del Medio Oriente sta aumentando le importazioni di animali vivi da reddito, nonché di carne e prodotti di origine animale. In mancanza di controlli efficienti queste importazioni possono diventare fonti potenziali di diffusione di zoonosi e di altre malattie infettive. I paesi in via di sviluppo a causa delle loro debolezze strutturali sono particolarmente vulnerabili a eventuali frodi nel commercio di animali e dei loro prodotti. Per prevenire tali rischi l'Organizzazione Mondiale del Commercio, l'Organizzazione Mondiale della Sanità Animale (OIE) e i loro paesi membri hanno adottato Accordi Sanitari e Fitosanitari allo scopo di liberalizzare il commercio degli animali e dei loro prodotti mediante regolamenti specifici per la protezione della sanità pubblica e delle economie nazionali. E' necessario assicurare la vigilanza e l'adozione di adeguate misure di ispezione alle*

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*frontiere da parte dei veterinari e delle competenti autorità, al fine di garantire una rigorosa osservanza dei regolamenti nazionali ed internazionali. La legislazione nazionale, infrastrutture adeguate e il rispetto dei regolamenti internazionali possono diventare una barriera per evitare che il commercio animale possa contribuire alla diffusione delle zoonosi e di altre malattie infettive.*

#### **Parole chiave**

Animale, Commercio, Infezione, Legislazione, Malattia, Sanità, Sanità pubblica, Zoonosi.

## **Introduction**

People have always depended on animals for food, transport, labour and for companionship. However, these animals may be a source of viral, bacterial and parasitic diseases, some of which are transmissible to humans and vice versa. Only the most common zoonoses are referred to here.

For centuries and in many countries, these diseases that have reservoirs in domestic and wild animals, have imposed, and are still imposing, a very heavy social and economic burden.

The significance of these diseases is growing continuously and their impact is being felt increasingly by many countries, especially the developing ones. There is no doubt that besides human suffering, morbidity and mortality, they hamper agricultural production, they decrease the availability of food and create barriers to international trade (2, 10, 16).

The Food and Agriculture Organization (FAO) of the United Nations estimates that zoonotic diseases contribute significantly to the loss of over 30 million tons of milk annually. This loss contributes to malnutrition and to reduced resistance, especially among children and elderly people (10, 13).

The great changes of the last decades include massive movements of populations and animals, thereby opening of new areas for badly needed food production and markets for food animals and their products. The permanently increasing quantities and speed of transportation of these commodities have contributed to make zoonoses and other

infectious animal diseases much more important problems and permanent threats. Moreover, these diseases have moved from traditionally endemic rural areas to invade entire geographic regions and, in some cases, to become worldwide problems (3, 6, 10, 17).

Emerging zoonotic or potentially zoonotic problems are clearly not rare events, due to the increasing human population, the related environmental changes and urbanisation, as well as due to the ever increasing international trade of animals. Therefore, the spread and occurrence of these diseases should be expected in any part of the world. The severe acute respiratory syndrome (SARS) epidemic that occurred four years ago and the avian influenza pandemic threat are two very characteristic examples.

It is well known that the shipment of animals from one country to another is included among the most common ways for the spread of zoonoses and other infectious diseases. However, in the past, this problem had not attained the degree of severity that it does today. Travel time was normally longer than the incubation period for most infectious diseases and zoonoses and animals were likely to become ill during transportation. If they died, they were thrown overboard, if sick on arrival they were likely to be refused entry. With the advent of faster means of transport and the discovery of diseases with exceptionally long incubation periods, the advantages of slower transportation were lost. Today, travel time is often shorter than the duration of most incubation periods. Most air transport from any country of the world to any other is measured in hours and the speed of modern ships has markedly reduced the duration of sea travel to just a few days only or sometimes to several hours, depending of course on the distance (4, 5, 6, 7, 10, 16).

## **International trade of live animals and animal products**

Most countries of the south and Eastern Europe, the Mediterranean, and those of the Arabian Peninsula are becoming greater importers of animals, meat and products of

animal origin, despite efforts to reach self-sufficiency in animal proteins.

The bulk of the trade, in both live animals and meat, is conducted between these countries, neighbouring countries and sometimes even very distant countries. Regarding Europe, the trade flow of live animals and meat, mainly bovine and swine, is directed from countries in the north-west countries to those in the south-east. For the countries of the Middle East, traditional exporting markets are from the Sudan, Somalia, Turkey and Pakistan. Additionally, a flow of animals and meat arrives from countries outside from the Middle East, mainly from Australia, New Zealand and countries in South America (8, 11, 14, 22, 25).

Trade in live animals in this part of the world is much more voluminous than trade in meat. Preference for live animal trade to that of meat is due to various reasons, such as local traditions for the slaughter of live animals for consumption, religious festivals that require the sacrifice of small ruminants. However, there is sometimes a lack of infrastructures such as roads, vehicles and chilling/freezing capacity to ensure the refrigeration chain for slaughtered carcasses, etc. (8, 11, 14, 22, 25).

Tables I and II illustrate this situation based on data reported for 1994.

Trade in such large numbers of animals and animal products, frequently performed in conditions that are not entirely satisfactory for health purposes, including inadequate controls at the port of entry in a country, can rapidly become the potential source of zoonotic and other infectious diseases.

## The spread of zoonoses and other infectious diseases through international trade

The history of zoonotic and other infectious animal diseases that have spread through trade is rich in examples. A few of those that have occurred in the recent decades are listed in Table III. They can be explained briefly as follows:

1. The introduction of foot and mouth disease from South America to the United

Kingdom in 1967 caused 2 364 outbreaks resulting in the loss of 430 000 animals.

2. Newcastle disease was reintroduced into Finland after its elimination in 1996.
3. Brucellosis was reintroduced into the cattle population of the Czech Republic in 1972 following the importation of 1 000 heifers from a neighbouring country that is supposedly 'brucellosis-free'. Before distribution to different farms, the animals were kept in quarantine up to the first calving. During this period, various laboratory tests were performed with negative results. However, despite these preventive measures the disease appeared at a later stage in many farms infecting thousands of animals and several people.\*
4. The introduction of bovine brucellosis through imports was recorded in Malaysia in 1990, in the Netherlands in 1991 and in the United States in 1997 with several cases in humans.

Table I  
Trade in small ruminant meat in the Middle East in 1994  
(metric tons)

Country	Imports	Exports
Bahrain	1 289	NA
Cyprus	1 460	19
Egypt	1 260	1 056
Iran	15 000	NA
Iraq	NA	NA
Palestine	430	NA
Jordan	13 402	20
Kuwait	4 603	15
Lebanon	150	NA
Libya	300	16
Oman	8 043	2 900
Qatar	2 500	2 000
Saudi Arabia	38 153	1 650
Sudan	NA	NA
Syria	1 500	NA
Turkey	NA	8 436
United Arab Emirates	2 100	5 000
Total	88 090	21 112

NA not available

Source: Food and Agriculture Organization Trade Yearbook, 1994 and Rapoport and Shimshony (22)

Table II  
Trade in live small ruminants in the Middle East in 1994 (metric tons)

Country	Imports	Exports
Bahrain	401 584	NA
Cyprus	NA	398
Egypt*	8 000	4 284
Iran	1 000	570 000
Iraq	NA	2 500
Palestine	3 500	NA
Jordan	566 835	409 645
Kuwait	2 527 456	12 064
Lebanon	500 000	100 000
Libya	20 000	NA
Oman	727 607	227 413
Qatar	550 000	45 000
Saudi Arabia	5 921 884	44 539
Sudan	NA	380 000
Syria	900 000	1 065 000
Turkey	4 834	1 708 374
United Arab Emirates	1 760 000	180 000
Total	13 892 700	4 749 217
Total meat (in metric tons)	277 854	94 984

NA not available

\* The General Organisation of Veterinary Services (Egypt) reports figures for 1994 as follows: imports: 30 000 head and exports: 3 156 head

Source: Food and Agriculture Organization Trade Yearbook, 1994 and Rapoport and Shimshony (22)

5. Ovine and caprine brucellosis was imported to Palestine, Malaysia and Bahrain in 1982, 1994 and 1995, respectively.
6. The introduction of the New World Screwworm due to *Cochliomya hominivorax* from South America to Libya in 1987 and its reintroduction to the United States in 1997 after eradication in 1987.
7. Cholera that had devastated countries of Asia and Africa for years, was introduced into the western hemisphere for the first time in 1991, making it another example of an infectious disease spread through trade routes.
8. Foot and mouth disease was reintroduced into Italy from Croatia in 1993 after its eradication in 1989.

9. Rift Valley fever, introduced into Saudi Arabia and Yemen in September 2000, causing 1 328 cases among humans, with 166 deaths and 882 cases with 124 deaths respectively, is another example of the impact of uncontrolled trade.

10. The reintroduction of foot and mouth disease into the United Kingdom in February 2001 causing 2 030 laboratory defined cases in 1 720 bovine premises also infecting swine, sheep and goats.

The few examples mentioned above reflect the severity of situations that can be created by live animal and meat trade in both countries and continents.

It is known that the introduction or reintroduction of zoonotic and other infectious diseases in a country cannot easily be avoided in the absence of efficient infrastructures and surveillance systems that require not only massive effort but also considerable resources. The causes are different and can be considered as follows:

### Exporting countries

There are different possibilities that need to be taken into account. For example, in developing countries, inefficiency of veterinary and other responsible authorities might lead to exports of animals of unclear health status or of meat and other products of doubtful quality. Other factors that contribute to the spread of disease include:

- disregard of effective legislation and the regular implementation of those regulations (at national and international levels) in regard to the spread of zoonoses and other infectious animal diseases
- the lack or absence of reliable notification to international organisations (especially to the World Organisation for Animal Health [*Office International des Épizooties*: OIE]) of the incidence of zoonotic and other infectious diseases in their livestock
- falsifying animal health certificates and other fraudulent activities (10, 12, 15,17,19).

This situation results in unfair trade practices, although contracts between states or business deals, guarantee the supply of healthy animals and safe animal products.

Table III  
Examples of zoonoses and other infectious diseases introduced through international trade

Disease	Country	Year
Foot and mouth disease	United Kingdom	1967
	Togo	1994
Newcastle disease (reintroduction)	Finland	1996
	Singapore	1996
Echinococcosis/hydatidosis	Switzerland	1994
	Sweden	1994
	Oman	1995
Bovine brucellosis	Czech Republic	1972
	United Arab Emirates	1990
	Malaysia (Sarawak)	1990
	Netherlands-Jordan	1991
	United States	1997
New World Screwworm <i>Cochliomyia hominivorax</i>	Libya	1987
New World Screwworm <i>C. hominivorax</i>	United States	1997
Bovine tuberculosis	Yemen	1982
	Namibia-Morocco	1983
	Netherlands	1991
	Jordan	1996
Bovine cysticercosis	Yemen-Macau	1982
<i>Brucella melitensis</i> infection	Palestine	1982
	Malaysia (Peninsula)	1994
	Bahrain	1995
Swine cysticercosis	Hong Kong-Macau	1996
Psittacosis/ornithosis	Switzerland-Belgium	1982
	France	1983
Fasciolosis	Yemen	1982
	Sweden	1983
	United Arab Emirates	1991
Erysipelas	Liberia-Macau	1991
Cholera	Western hemisphere	1991
Foot and mouth disease	Italy	1993
Rift Valley fever	Saudi Arabia	2000
	Yemen	2000
Foot and mouth disease	United Kingdom	2001

Source: Animal Health Yearbooks of the Food and Agriculture Organization/ and *World Animal Health* of the World Organisation for Animal Health (*Office International des Epizooties*: OIE)

In almost all cases, exporters are aware of the quality status of their commodities if downgraded and if animals to be shipped are of at least questionable health status. However, the responsibility of the authorities who are expected to perform strict controls, is sometimes inadequate.

### Importing countries

Developed countries, however well organised and efficient they may be in regard to their veterinary and other control authorities, can experience unexpected factors or human mistakes and there have even been cases of corruption on some occasions, and

consequently they cannot prevent the importation of zoonotic or other infectious diseases. Moreover, there are more reasons for developing countries, with known structural deficiencies, to be very weak in providing reliable epidemiological information on the situation that exists in the exporting country prior to the signing of a trade agreement. On some occasions, due to the inefficiency of the competent authorities, such agreements do not clearly specify the terms which should provide protection to the importing country from the transfer of any potential infectious diseases and some even fail to refer to penalties that would apply (12, 14, 15, 19).



In most developing countries, the veterinary inspection is not applied with specific and strict regulations at the port of entry of the imports. There may be partial efficiency and completion of certain tasks. There are no adequate quarantine facilities in the ports of entry and laboratory support for diagnostic purposes may be particularly weak (1, 2, 12, 15).

Additional factors are human indifference and errors due to inexperience or even corruption and fraud. In such conditions, the falsification of identity and health certificates can pass unnoticed.

All of the above factors can contribute to the ineffective protection of importing countries, especially developing countries, from the fraudulent international trade of animals and animal products. They operate as factors which can facilitate the introduction and spread of zoonoses and other infectious diseases in these countries.

## **Public health hazards from trade in live animals and meat products**

For many years, the study by international organisations of the links between animal and human pathology remained limited to a few severe zoonoses that were generally transmitted by contact (such as anthrax, rabies, glanders, etc.) and only a few zoonoses of food origin (for example brucellosis, listeriosis, trichinellosis, salmonellosis, etc.). However, over the years several events changed this approach (6, 9, 10, 11, 12, 18, 21).

There are a number of microbial organisms, such as *Salmonella*, *Campylobacter*, *Escherichia coli* strain 0157:H7, *Toxoplasma gondii* and others, that are present in the gastrointestinal tract of livestock and that have little or no effect on animal health but are pathogenic for humans. During slaughter or processing, these agents may be deposited on meat products and may be transported to the plates of consumers who may then become infected (6, 9, 10, 11, 12, 21).

There is a multitude of cases when meat or meat products, in such quality conditions, have been stopped at the ports of entry of a country or, regrettably, that have been allowed entrance, have been distributed and then reached the consumer's plate with varying consequences, depending on the incident. Therefore, animal health, and the safety of meat and meat products should necessarily remain a priority objective for livestock producers, food processors, veterinarians and health authorities.

Trading animals that do not represent a risk of transmitting zoonoses or other infectious diseases is not an easy task due to complexity and cost. Therefore, in order to cope with this important problem, health and veterinary authorities of previous generations were inclined to selective trade prohibition, using a 'zero risk' option. However, nowadays the relative isolation offered by that era has now been lost, even in island nations. The irreversible social, political and economic pressures for free trade that have emerged in recent decades are a reality (6, 9, 11, 13, 19).

Fortunately, these pressures are accompanied by technological developments which were unknown a generation ago. These technological advances, if used appropriately, can facilitate the evaluation of risks associated with animal trade and the management of these risks.

However, computers, the internet and modern diagnostic aids are not the answer to all the problems that the international trade of animals and their products is creating. Only bilateral and multilateral trust, built upon credible experience, can facilitate a greater understanding and transparency on which free trade can be based, while the exchange of reliable information will strengthen that trust.

## **The World Trade Organization and the international trade of animals and animal products**

The ever increasing international trade of animals and animal products that carry the potential risks of transporting and spreading

zoonotic and other infectious animal diseases across countries and even continents, led, among many other reasons, to the establishment of the World Trade Organization (WTO) and regional trade agreements, such as the 'Sanitary and phytosanitary measures' (known as the 'SPS agreement') (4, 14, 24).

Through the application of this agreement, the WTO, in collaboration with other international organisations and member countries, promises to extend the liberalisation of trade, without increasing the risk to public, animal or plant health (4, 16, 23, 24, 26).

The main objective of the SPS agreement is to establish science-based principles that promote a transparent and safe system for agricultural trade internationally. The guiding principles of this SPS agreement which are the harmonisation of rules, risk assessment and equivalence, provide a rational framework for the application of food safety measures on an international basis. In this way, the protection of consumer health can be improved and confidence in exported products strengthened (4, 23, 24, 26).

To comply with the principles of the SPS agreement, while promoting the scientifically based protection of animal and public health, all countries (developed and developing) must review their regulatory systems and make the necessary amendments.

It is difficult to predict which countries will benefit most from this new reliable trade environment. In the short term, countries with reliable animal health infrastructures will benefit from added advantages stipulated by international trade rules.

Rather than waiting for the WTO to resolve problems and disputes, countries should focus their efforts on the enforcement of preventive measures, i.e. strengthening animal health control infrastructures, establishing and adhering to international animal health standards, ensuring transparency in the animal health situation and notification of regulatory changes. Such measures could lead to

increased trust between trade partners and could contribute to the protection of animal and public health.

However, these 'tools' used on their own cannot achieve this target. Livestock producers, veterinarians in animal health and food safety risk assessment and risk management, state regulatory and control authorities and traders are among the partners that imperatively need to be actively involved in the process. These important factors in exporting and importing countries can only provide the essential infrastructure which may benefit from the technical collaboration offered by international organisations. Without including the trading countries in this process, the economic and social development as well as public health will remain at permanent risk (18, 20, 22, 23, 25).

## Conclusions

All countries are now exposed to the introduction of exotic epidemic diseases and, therefore, to the spread of infections including zoonoses. Early disease detection systems, the development and/or strengthening of diagnostic capacity and the consolidation of field veterinary services are all of highest importance. Moreover, among the most urgently needed requirements are improvements in the epidemiological surveillance of animal health and zoonoses, the timely communication of reliable information and the co-ordination of all important activities to be undertaken either by the public health and/or the animal health sectors. It is important that this be achieved within countries, i.e. between central services and district units, as well as between countries, particularly in the same region, while collaboration with and notification to international organisations should become a routine practice. Achieving these targets is crucial to prevent the spread of infectious diseases, particularly zoonotic diseases, across geographic regions, countries and even continents.

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