Introduction

The horse industry has undergone a rapid growth in recent years and international trade is a structural part of this development. In terms of bilateral trade agreements, movement of horses or equine products after sale falls under the Agreement on the Application of Sanitary and Phytosanitary Measures (SPS) of the World Trade Organization (WTO). Movement of competition or breeding horses, although not considered as trade (12), also falls within the SPS Agreement if a concurrent risk of disease is involved (WTO, personal communication). In terms of commodity value, the horse industry is an economically significant activity; in 1996, in the United States of America (USA), the total value of exchanges was estimated at US$112 billion (1), while in the Netherlands in 1999, a figure of NLG 2.1 billion was calculated (11). The principal groups involved in movement of Equidae across borders are described below.

Performance horses

Competition venues, traditionally located in countries of Europe, North America and Australia have multiplied and are now also found in regions such as Eastern Europe, South America, the Arabian Peninsula, Asia and Africa. Over the course of this development, events on borrowed (local) horses have evolved into competitions with international participation. As a result, the pressure on national Veterinary Authorities to obtain sanitary recognition and support temporary import and subsequent return of competition horses has increased. This trend is reflected in the horseracing industry (Table I) as well as the equestrian disciplines (Tables II and III). Obtaining an approved health status, motivated by a major equestrian event or race, can also benefit trade in other species.

During 1999, the number of racehorses participating in International Federation of Horseracing Authorities (IFHA) events was reported to exceed 350,000. However, the ratio of national to international participants is not recorded.

Based on an average number of seventy-five horses participating per Fédération Equestre Internationale (FEI) event (FEI Veterinary Department, personal communication), the current number of participating horses would be 56,000 annually. Data compiled from FEI veterinary reports indicate that 46.5% of these horses are foreign to the host country for...
individual events; this would illustrate that annually 26,000 horses participating in FEI events are involved in temporary importation and subsequent re-entry to the country of despatch or ongoing transfers to other countries.

Table I
Number of racing events per year

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of host countries</th>
<th>Number of IFHA events</th>
</tr>
</thead>
<tbody>
<tr>
<td>1997</td>
<td>46</td>
<td>359,066</td>
</tr>
<tr>
<td>1998</td>
<td>53</td>
<td>346,246</td>
</tr>
<tr>
<td>1999</td>
<td>49</td>
<td>334,786</td>
</tr>
</tbody>
</table>

Source: International Federation of Horseracing Authorities (IFHA)

‘shuttle’ stallions and frozen semen shipments circumvents the seasonal differences in breeding programmes between the Northern and Southern Hemispheres. To meet the rising standards of competition and breeding horses, professional horse transporters and specific airlines provide structural facilities (e.g. the airlines Lufthansa and KLM transport 4,000 and 5,000 horses per year, respectively), in addition to transport by road.

Sales
In the horseracing industry, the sale of young horses often leads to international movement of the purchased animal. As an example, 25% of trade at the 1997 thoroughbred sales in Kentucky (which reached a turnover of US$500 million) involved overseas buyers (13). Sales of horses are therefore inevitably followed by international transport of these horses to their new owners or trainers.

Slaughter horses
The number of slaughter horses in international movement is generally underestimated. In the European Union (EU) alone, more than 100,000 live horses are imported for slaughter each year (8), while an additional 60,000 tons of horse meat is imported from North America and Australia. Additionally, a small number of live slaughter horses are transported by sea to the EU from South America. The dire conditions under which slaughter horses are often transported by road to their final destination in southern Europe have led to an improved awareness of the horse meat industry. The EU recently set directives for the use of medicines in horses, which consider the possible end-destination of sports horses as meat for human consumption (i.e. rules on maximum residue limits [MRL]). Moreover, it has become clear that not all horses destined for meat production are actually slaughtered. Anecdotal evidence points out that these animals are sometimes used in the recreational sector as riding horses, thereby coming into contact with the local equine population. In this situation, the appropriate health certification or sanitary tests will not have been performed.

Veterinary infrastructure encompassing equestrian events
To enable the organisation of equestrian events or horse races, a synergistic relationship must be established between the organisation responsible for the event, the Veterinary Authorities of the host country and in many cases, umbrella organisations such as the EU or the Office International des Epizooties (OIE). To achieve maximum participation, competition organisations are dependent on a co-operative and lateral approach by the Veterinary Authorities of the receiving country.
Clearly, health organisations will only permit temporary import or transfer of horses if a safety net in the form of transparent traceability is continuously present to prevent disease unexpectedly being introduced or spread during the movement of the animals.

In the course of preparation for equestrian events, the following are essential:

- initial contact with the Veterinary Authorities of the host country
- disease freedom of the country or region of despatch
- movement control of equines at entry points of the country or region
- health certification showing absence of disease for the individual animal
- contact only with equines of similar health status during transport
- preparatory action for re-entry of horses after completion of the event.

During the Olympic Games in Sydney, in 2000, more than 200 horses were flown into Australia, a country with a stringent disease control policy. Incoming horses were required to have been resident in the EU or the USA for sixty days, of which the last fourteen days were under pre-export quarantine (PEQ). Upon arrival, the horses were transported to the competition venue for an additional fourteen days of post-arrival quarantine (PAQ).

The length of the quarantine period was largely based on the disease-free status of Australia with regard to equine influenza. The participating horses were therefore also required to receive additional booster vaccinations.

In regard to equine piroplasmosis, a risk assessment had established that the importation of animals that gave positive results to the indirect fluorescent antibody test (IFAT) presented a relatively low risk. Consequently, these horses, although isolated from the sero-negative participants, were allowed to compete in all three disciplines (i.e. jumping, dressage and eventing).

Additional health certification was required with regard to Borna disease for horses from the EU, as the risk that competition horses would reside in regions where the disease had occurred in the last two years was significant.

An outbreak of West Nile virus infection in the USA could have caused delays in the preparations. However, the ports of departure were not involved in supplementary measures due to the virus.

**Type of movement**

Most health regulatory articles are based on permanent import of animals and animal products. However, a typical characteristic of equine movement is the dual component of temporary and permanent import conditions. Moreover, regulations pertaining to movement of horses and equine products are often complicated by the simultaneous use of horses in the area of breeding and competition. For example, isolation of stallions as semen donors during the collection period can be difficult due to coexisting competition and training schedules. This represents a challenge for the regulatory organisations, as most sanitary requirements stem from permanent import regulations. Slaughter horses are clearly scheduled for a permanent entry into the receiving country, while competition and breeding equines require temporary certification and permission to re-enter the country of despatch or be transported to a third country for ongoing competition. A sequential chain of four or five host countries prior to re-entry into the country of origin is no longer an exception in the case of competition horses. The accompanying certification must be adapted to such a situation and may sometimes deviate from the standard import certification protocol of a country.

**Risk of introduction or spreading of disease**

In general, it is recognised that movement of animals or animal products cannot be undertaken on a ‘zero risk’ basis (9). A compromise must be found between facilitating trade and providing a safety net for the health status of the importing country. If introduction of disease by animal movement occurs, the cause is probably sub-clinically infected or carrier animals and the introduction could perhaps have been prevented by improved control methods, which were either not available or not fully utilised at the time. Table IV lists the documented cases of disease related to movement of Equidae.

African horse sickness is the only OIE List A equine disease included in Table IV; nevertheless the threat of this disease remains an item of discussion in the organisation of events in southern Europe and the Middle East.

Equine viral arteritis can be introduced by equine products such as semen; an outbreak was recently reported in the United Kingdom (14).

Equine influenza has slowly spread among countries with a significant horse industry and, with the exception of several isolated areas or countries, is currently considered to be endemic in most of the equestrian world (Table V). While this
may facilitate matters from a regulatory point of view between most of the trade partners, major problems are posed by the import of horses from endemic regions to, for example, Australia or Hong Kong (10), both of which have a naïve horse population.

Health status versus event organisation

The importing (host) country plays a decisive role in the cascade of administrative events leading to importation, and thereby sets the scene for the requirements which the country of despatch must meet. However, WTO agreements direct that these requirements must be based on scientific input (15), instead of trade protection or political reasoning. An internationally-accepted list of control measures for movement of Equidae must be in place to enable frequent transport to events. A country or zone can achieve recognition of its health status in the following ways:

- freedom from certain diseases will usually be determined by a serological survey and active surveillance system to detect the prevalence of disease. In terms of OIE acceptance, freedom from certain diseases also dictates a non-vaccination policy for the disease
- a veterinary infrastructure must be present, consisting of movement monitoring, standardised testing for certain OIE List A diseases (i.e. African horse sickness) or List B diseases (fourteen other equine diseases) and accompanying certification, to prevent importation of disease
- a list of notifiable equine diseases and measures that can be policed in the case of an outbreak should be in place to eradicate foci of the disease. A programme for successful eradication of a strangles outbreak in a naïve horse population was presented during the 8th Congress for Equine Infectious Diseases (2)
- for certain diseases, the host country will perform a risk analysis to enable a quantification of the risk of introducing disease as a result of importation (e.g. equine piroplasmosis prior to the Sydney Olympic Games).

Recommendations

Veterinary Authorities should depend as much as possible on test results and certification obtained in the country of despatch (i.e. pre-export certification) instead of post-arrival quarantine procedures and testing. The latter can compromise flight recovery (i.e. rehydration and/or eventual treatment for respiratory problems) and ongoing training of the equine athlete. In addition, an upgrading of the laboratory test

<table>
<thead>
<tr>
<th>Disease</th>
<th>Importing country/zone</th>
<th>Year</th>
<th>Reported source</th>
</tr>
</thead>
<tbody>
<tr>
<td>African horse sickness</td>
<td>Spain, Portugal</td>
<td>1987</td>
<td>Imported carrier</td>
</tr>
<tr>
<td>Contagious equine metritis</td>
<td>South Africa</td>
<td>1999</td>
<td>Imported carrier</td>
</tr>
<tr>
<td></td>
<td>United Kingdom, Ireland</td>
<td>1977</td>
<td>Imported carrier</td>
</tr>
<tr>
<td></td>
<td>Australia</td>
<td>1977</td>
<td>Imported carrier</td>
</tr>
<tr>
<td></td>
<td>Brazil</td>
<td>1977</td>
<td>Imported carrier</td>
</tr>
<tr>
<td></td>
<td>United States of America</td>
<td>1978</td>
<td>Imported carrier</td>
</tr>
<tr>
<td></td>
<td>Japan</td>
<td>1980</td>
<td>Imported carrier</td>
</tr>
<tr>
<td></td>
<td>United Kingdom</td>
<td>1996</td>
<td>Imported carrier</td>
</tr>
<tr>
<td>Equine infectious anaemia</td>
<td>United Kingdom</td>
<td>1974</td>
<td>Imported carrier</td>
</tr>
<tr>
<td>Equine viral arteritis</td>
<td>United Kingdom</td>
<td>1993</td>
<td>Imported carrier</td>
</tr>
<tr>
<td></td>
<td>United States of America</td>
<td>1986-1997</td>
<td>Imported carriers/semen</td>
</tr>
<tr>
<td>Venezuelan equine encephalomyelitis</td>
<td>United States of America</td>
<td>1971</td>
<td>Extension of epidemic</td>
</tr>
<tr>
<td>West Nile virus infection</td>
<td>USA</td>
<td>1999</td>
<td>Unknown</td>
</tr>
<tr>
<td></td>
<td>France</td>
<td>2000</td>
<td>Unknown</td>
</tr>
</tbody>
</table>

Table V

Outbreaks of equine influenza as a result of horse movement (5)

<table>
<thead>
<tr>
<th>Virus strain</th>
<th>Importing country</th>
<th>Year</th>
<th>Reported source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equine-2</td>
<td>United Kingdom, Ireland</td>
<td>1979</td>
<td>Continent of Europe</td>
</tr>
<tr>
<td>Equine-2</td>
<td>South Africa</td>
<td>1986</td>
<td>United States of America</td>
</tr>
<tr>
<td>Equine-2</td>
<td>India</td>
<td>1987</td>
<td>France</td>
</tr>
<tr>
<td>Equine-2</td>
<td>Jamaica</td>
<td>1989</td>
<td>United States of America</td>
</tr>
<tr>
<td>Equine-2</td>
<td>Hong Kong</td>
<td>1992</td>
<td>United Kingdom/Ireland</td>
</tr>
<tr>
<td>Equine-2</td>
<td>Dubai</td>
<td>1995/1996</td>
<td>United States of America</td>
</tr>
<tr>
<td>Equine-2</td>
<td>Puerto Rico</td>
<td>1997</td>
<td>United States of America*</td>
</tr>
</tbody>
</table>

* unconfirmed
methodology is urgently required to obtain better standardisation. Test results prior to and after horse transport are not always comparable, which can compromise successful clearance of the horses. The competition organisations are fully aware that multi-lateral co-operation with organisations such as the OIE is required for further development of the sport.

Veterinary supervision during transport and events

Breeding or competition horses destined for movement are mostly animals of significant economic value, and veterinary supervision prior to and after transport, even sometimes during transport, are a crucial element of the overall planning. For FEI events, all horses are subject to an examination upon arrival, performed by a qualified private or official veterinarian, where the identity of the animal is verified and its general health status is controlled. The aim of this examination is to prevent any possible introduction of a contagious disease into the event stables and the examination is therefore performed prior to entrance into the stable complex. Further horse inspections during the remainder of the event serve to evaluate the fitness of the horses to compete, but the horse is nevertheless under veterinary supervision from entry into the host country until departure. Due to the high demands of the sport, the veterinary input is continuous and specialised in equine sciences. In addition to the official Australian Quarantine Veterinarians, between 50 and 100 equine veterinarians were involved during the 2000 Olympic Games in monitoring the equine athletes. These included a Foreign Veterinary Delegate, a Veterinary Commission, Drug Testing Veterinarians, an overall Veterinary Co-ordinator and emergency veterinary clinic staff.

Quarantine

Many countries incorporate a quarantine system, either prior to departure (PEQ) or upon arrival of the horses (PAQ). For top competition horses, whether racehorses or those involved in equestrian disciplines, an extended quarantine procedure is a perturbing factor. These horses reach a high level of fitness through a strictly controlled regime of training, management and feeding, and any infringement of this protocol can greatly affect subsequent performance. Quarantine protocols of over two days require facilities for ongoing training, which are often insufficient or unavailable.

It would be preferable if most importing countries could rely on proper certification for disease freedom in the area of despatch and on test results illustrating the health status of the individual animal.

Additional studies are required to distinguish between sero-positive tests as a result of vaccination and as a result of exposure to a field infection.

Measures for traceability of horses

Apart from the administrative duties of the customs authorities at the port of entry, the competition organisations have a responsibility to provide transparent and comprehensive data on the movements of competition horses, in case a disease outbreak occurs. Hence, a system to traceback animals involved in movement across borders must be operative. Traceability, especially in the case of contagious disease, requires an effective methodology to investigate all the sites on which the horse has recently been resident. Currently, the registration of horse movement is generated (or produced) in a printed or electronic format and is initiated by a reliable identification and registration system. Identification verification of performance horses includes the following:

- ownership data
- pedigree of the horse (studbooks)
- competition entry and results (sports management, betting, transparency)
- disease control and traceability of horse movement (temporary importation of performance horses)
- horse welfare issues
- medication control and the registration of veterinary treatment (sports federations and other regulatory bodies).

Current methods of identification verification and registration

Horse passports

Horse passports are a reliable and non-invasive method of identification and registration. The use of horse passports in the competition sector has a long and well-grounded history. Internationally accepted passports have to meet OIE, FEI and EU criteria. Upon entry for all international events, the horse must be accompanied by an FEI or an approved national passport. Moreover, EU regulations (Council Directives 90/425EEC-90/427EEC and Commission Decision 93/623EEC [3, 4, 5, 6]) currently require all registered horses to have an accompanying passport during transportation (Fig. 1). A primary objective of the document is the identification of the horse via a written description (the narrative) and a diagram, which has been completed by an authorised person (a veterinarian recognised by the National Federation of the country in question) and validated by a competent body (e.g. for FEI events, the National Federation). The identification pages in the passport must be completed in accordance with the FEI Manual on Identification of Horses, 4th edition (7).
A horse passport is designed to provide vital information about the animal. The FEI (Fédération Équestre Internationale) passport includes a variety of details such as the horse’s name, sex, date of birth, and country of birth, among others. Each passport has a unique Microchip number and can be accompanied by other identification methods like a Brandmark. The passport is designed to be easily readable and portable, allowing for quick identification at events and ensuring traceability.

**Fig. 1**
The Fédération Equestre Internationale (FEI) horse passport

Vista markings for horse identification include: sex, colour, markings, whorls, chestnuts, brandmarks and age. The FEI passport has fifty-five slots available for event entry registration. A duplicate passport is provided at marginal cost when the allotted space has been used.
At border crossings or at the entrance to an event venue, identity verification is performed in the presence of the horse and authenticated in the passport by the veterinary official. Incorrect entries in the diagram or narrative are reported to the umbrella organisations (e.g. FEI) and documented in the passport; a fine is issued, if deemed appropriate.

As illustrated in Figure 2, the identity of the horse and other passport data are controlled in combination with the proper health certification during all stages of movement. All events in which the equine athlete participates are recorded and authenticated in the passport, thus enabling traceability of the countries and event venues where the horse has competed. In addition, the horse passport also contains information on the pedigree of the horse, current and previous owners, the vaccination history for equine influenza and other diseases, as well as data on drug testing and health tests performed during movement.

## Current developments

### Microchip technology

Electronic identification or radio frequency identification technology has been tested for identification purposes for over twenty-five years. Three types of devices can be categorised, as follows:

- implantable microchips for permanent application, which are injected or surgically implanted
- microchips deposited in body cavities or orally ingested for temporary application
- electronic devices that can be attached to the exterior of an animal.

The implantable microchips have a limited capacity for data storage, whereas an exterior chip can store large amounts of information (up to 80 Mb). Several national studbooks (e.g. France, Germany, the United Kingdom and the Netherlands) regulate the use of implantable microchip transponders, injected in the neck of the animal, for identification and registration purposes. This identification tool, used in horses since 1985, is currently being studied and may become an important addition to competition entries and the movement control system. At present, the microchip (2 mm x 12 mm) only contains an identification number; however, a further development in the design of an interactive database is technically possible. These data should then be available to the controlling authority via the transponder number and subject to secured access. The transponder reacts to the proximity of a reader by sending out a signal, therefore hand-held readers are required for identification of the horse. Currently, microchips are used as a link between the horse and the detailed information listed in the passport. Although the basic microchip is fraud resistant, some types of transponders have modifiable codes, which can be changed after implantation. These types of microchips are therefore less suitable for permanent identification. Many riders and horse owners are resistant to this means of identification, due to welfare issues or perceived adverse physical reactions to the implantation, with a possible effect on a subsequent competition career. Recent research has indicated that the use of radio wave transponders may replace the current generation of microchips in the near future.

### Other means of identification

The World Breeding Federation for Sports Horses (WBFSH) is in the process of developing a unique equine life number, to be issued by the organisation that first registers the horse and to accompany the animal throughout its life. This number would be issued by the studbook during foal registration. Competition bodies would also have the right to issue these numbers, if previously unregistered horses join the competition arena at a later age. As an example, horses registered by the FEI sometimes only enter the data system at an age of six years. Unfortunately, the life number format does not yet allow for inclusion on the microchip transponder. The WBFSH is of the opinion that only horses with a known pedigree should be given such a number; however, sports federations also register horses if this information is not available.

Attempts have been made to replace the horse passport by a credit-card sized document, containing a photograph of the horse and accompanying electronic information. Although this seems a valuable addition to the current systems for identification and accompanying data collection, the limited availability of computerised hardware at the level of event organisers is still a limitation to practical application. In addition, the question remains as to which officials would have the authority to add information to the database (e.g. booster...
vaccinations or the results of health tests), since falsification of data in the equestrian arena is not an unknown phenomenon.

Analysis of deoxyribonucleic acid (DNA) is sometimes undertaken if the identity of the horse cannot be verified due to absence of a passport or incorrect information in the document. According to the FEI Veterinary Regulations and horseracing rules, the official veterinarian is entitled to take samples for identification control purposes. This type of testing can be performed on samples of blood or hair (preferably with the root). However, DNA testing is only feasible if the DNA data of the horse are already on file or can be compared with the parentage of the horse. In addition, this is a costly means of identification and the involvement of a laboratory is required to produce the DNA profile.

Conclusion

The current number of events and venue locations for equestrian competitions translates into a significant international movement of Equidae. To further promote the development of the sport or breeding programmes, an effective and symbiotic network with organisations such as the OIE is essential. To reinforce this link, the proactive approach of the sports federations, enabling participant traceability, public awareness and securing qualified veterinary supervision, should be an integral part of the health regulatory infrastructure. Although diverse interests of competition organisations and studbooks have prevented a unified approach thus far, identification and registration systems such as horse passports and microchip transponders are operational. Until improved methods are globally available, the passport remains a reliable and non-invasive tool for identification registration with an accessibility independent of the level of equestrianism in the respective countries. Animal health organisations such as the OIE should recognise the role of the performance horse industry and its impact on equine disease control. In doing so, the OIE would emphasise its function of defining standards and assisting communication between countries on matters of disease control.

Traçabilité des équidés : une population en mouvement

F.J.H. Sluyter

Résumé

L’accélération de la vitesse de transport des animaux et l’existence de systèmes de déplacement complexes et imbriqués rendent la population équine extrêmement mobile. La facilité avec laquelle s’effectuent les déplacements internationaux s’accompagne du risque d’introduction et de propagation de maladies, en particulier pour les chevaux de compétition. Le défi majeur aujourd’hui consiste à faciliter les échanges d’équidés tout en préservant le statut sanitaire des pays d’accueil. À ce jour, les autorités de contrôle internationales ont tendance à considérer les risques liés aux déplacements de chevaux comme « relativement faibles », et donc à appliquer des mesures restrictives minimales lors de l’importation des animaux ou de leur retour dans le pays d’origine. Toutefois, plusieurs foyers de maladie contagieuse liés au déplacement de chevaux ont fait ressortir la nécessité de réglementer l’identification des chevaux, d’établir une certification sanitaire appropriée et de garantir la traçabilité des déplacements des équidés.

Mots-clés

Rastreabilidad de los équidos: una población en movimiento

F.J.H. Sluyter

Resumen
La creciente velocidad del transporte de animales y la existencia de complejos e intrincados sistemas de desplazamiento han dado lugar a una población equina en constante movimiento. Esta facilidad para el transporte internacional de caballos influye en el riesgo de penetración o propagación de enfermedades, especialmente entre los caballos de competición deportiva. Facilitar el comercio de équidos y salvaguardar al mismo tiempo la situación sanitaria del país receptor plantea notables problemas. Hasta ahora los organismos normativos internacionales han tendido a considerar que el movimiento de caballos registrados es una actividad de riesgo relativamente ‘bajo’, y por consiguiente a aplicar las medidas menos restrictivas a la importación o el regreso de los animales. Sin embargo, una serie de brotes de enfermedad relacionados con el transporte de caballos ha puesto de manifiesto la necesidad de reglamentar la identificación de estos animales, crear un certificado sanitario adecuado y garantizar la rastreabilidad de esos desplazamientos.

Palabras clave

References


