The circumstances surrounding the outbreak and spread of equine influenza in South Africa

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Summary
Equine-2 influenza A virus (H3N8) infection first occurred among naïve horses in South Africa in December 1986. The virus was introduced following the importation of six horses from the United States of America. While the release of in-contact horses from quarantine three days after the arrival of these six horses played a role in the rapid spread of the disease in South Africa, other outbreaks of disease were associated with viral introduction by personnel or contaminated instruments. The control measures and implications of the introduction of equine influenza to South Africa are also discussed.

Keywords

Introduction
Despite the widespread use of inactivated equine influenza vaccine since the 1960s, the incidence of disease attributable to equine-2 influenza A virus (H3N8) has increased (4). Equine-2 influenza has become enzootic among equine populations of North America, Europe and Scandinavia (4) and epizootics have been reported by South Africa in 1986 (6), India in 1987, the People’s Republic of China in 1989 (4) and Hong Kong in 1992 (5). This paper describes in detail the circumstances surrounding the outbreak of equine-2 influenza virus among horses in South Africa which started in December 1986, and the subsequent spread and control of the outbreak.

Introduction of disease
A shipment of six horses (identified as D1 to D6) was admitted to the State Quarantine Station at Johannesburg International Airport on 5 December 1986. The horses originated from Kentucky, United States of America (USA). In accordance with the requirements of the import permit issued by the Directorate of Veterinary Services, Republic of South Africa, the horses were isolated for 30 days prior to departure from the USA. The horses left the pre-export isolation facility on 1 December 1986 and were transported by road to Canada prior to being flown to South Africa, via France. The horses reportedly did not come into contact with other horses while in transit between the USA and South Africa. Coughing was noted in one of the six horses (horse D6), while in Paris. On arrival in Johannesburg, this horse was listless and was still found to be coughing. The horse was examined by a private practitioner who attributed the cough and serous nasal discharge to the change in climate and the long journey. The horse was not suspected to be suffering from equine influenza. On 8 December 1986, horse D4 was also found to be listless and coughing and horse D1 was found to have severe nasal discharge. Both horses were treated for respiratory infections.

In the four-week period prior to the arrival of these horses in South Africa, horses had been admitted into the quarantine station on 9, 12 and 19 November. The horses in these three intakes are identified as A1 to A3, B1 to B3 and C1 to C3, respectively. Following the arrival of the horses from the USA, horses were admitted to the quarantine station on 7 and 10 December. These horses are identified as E1, F1 and F2. The horses were housed in individual stables, as shown in Figure 1. Information on the previous equine influenza
Fig. 1
Plan of the layout of the large animal section of the State Quarantine Station at Johannesburg International Airport where the horses were housed prior to, or at the time of, the outbreak of equine influenza in South Africa in December 1986
There were a total of 28 horse stables (identified as 1 to 28), of which 18 were occupied (individual horses identified as A1 to F2) and 10 unoccupied (indicated by ‘No’)

The vaccination history of these horses is provided in Table I. It should be noted that at the time of these imports, the import permits did not require vaccination against equine influenza.

### Spread of the disease

Horses A1 and A2 were released from quarantine on 8 December 1986. After leaving the quarantine station, six other horses were loaded on the same truck in the Johannesburg area. One of the horses was loaded at the Turffontein Racecourse. The truck then travelled to Cape Town and the horses were offloaded at De Doorns, Ceres, Robertson, Durbanville, Milnerton and Phillippi (Fig. 2). The driver of the vehicle reported that horse A2 was coughing and listless during the journey to Cape Town. The last horse was offloaded at approximately 18h00 on 9 December 1986. Outbreaks of influenza subsequently occurred at all of the premises where horses were offloaded. These outbreaks were noted to have started between 11 and 15 December 1986.

In the morning of 9 December 1986, the attending veterinarian examined horses D1, D4 and D6. While at the

### Table I
Summary showing the identification numbers of the horses in quarantine, origin, dates of arrival in South Africa and release from quarantine and dates of previous vaccinations against equine influenza

<table>
<thead>
<tr>
<th>Horse ID</th>
<th>Stable number</th>
<th>Origin</th>
<th>Arrival date</th>
<th>Release date</th>
<th>Dates of previous influenza vaccinations</th>
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<tr>
<td>A1</td>
<td>7</td>
<td>Europe</td>
<td>08.11.86</td>
<td>08.12.86</td>
<td>27.07.86 + 21.08.86</td>
</tr>
<tr>
<td>A2</td>
<td>8</td>
<td>Europe</td>
<td>08.11.86</td>
<td>08.12.86</td>
<td>04.03.85 + 12.10.86</td>
</tr>
<tr>
<td>A3</td>
<td>9</td>
<td>Europe</td>
<td>08.11.86</td>
<td>10.12.86</td>
<td></td>
</tr>
<tr>
<td>B1</td>
<td>10</td>
<td>USA</td>
<td>12.11.86</td>
<td>11.12.86</td>
<td>16.05.86</td>
</tr>
<tr>
<td>B2</td>
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<td>USA</td>
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<td>16.05.86</td>
</tr>
<tr>
<td>B3</td>
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</tr>
<tr>
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<td>08.04.86</td>
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</tr>
<tr>
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<td>Europe</td>
<td>19.11.86</td>
<td>15.09.86 + 11.10.86</td>
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<tr>
<td>C3</td>
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<td>15.05.86</td>
<td></td>
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<td>23.09.86</td>
<td></td>
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<tr>
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<td>17.06.86</td>
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<td>09.05.86</td>
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</tr>
<tr>
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<td>23.09.86</td>
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<tr>
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<td>05.12.86</td>
<td>17.01.86</td>
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<td>E1</td>
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<td>05.09.86</td>
<td></td>
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<tr>
<td>E2</td>
<td>H1</td>
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<td>07.12.86</td>
<td></td>
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<tr>
<td>E3</td>
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<tr>
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<tr>
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<td>H3</td>
<td>Europe</td>
<td>10.12.86</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

ID: identification
quarantine station, he received a call to attend to a horse in training at the Turffontein Racecourse. The veterinarian went directly from the quarantine station to the Turffontein Racecourse to attend to a horse in the care of Trainer A (Fig. 3). Horse D6 belonged to a patron of Trainer A. Trainer A went to the quarantine station at approximately 14h00 on 9 December 1986 to examine the horse on behalf of his patron. Following this visit, Trainer A returned directly to his stables at the Turffontein Racecourse (Fig. 3). On 10 December 1986, one of the horses in the stables belonging to Trainer A was observed to be listless and to have a severe cough. The attending veterinarian diagnosed a respiratory viral infection. A further 4 horses presented similar symptoms on 11 December and all 53 horses belonging to Trainer A showed similar symptoms on 12 December 1986.

Horse A3 was released from quarantine on 10 December 1986 and was transported to a stud farm in KwaZulu-Natal. No clinical signs indicative of equine influenza were observed on this farm. Horses B1, B2 and B3 were released from quarantine on 11 December 1986 and were transported to the stables belonging to Trainer B at the Turffontein Racecourse (Fig. 3). Approximately 320 of the 450 horses in training at the Turffontein Racecourse showed clinical signs indicative of equine influenza on 15 December 1986. On 12 December 1986, nasopharyngeal swabs were collected from a number of the affected horses in the yard belonging to Trainer A at Turffontein and were submitted to the Veterinary Research Institute in Onderstepoort. Based on the severity of clinical signs and the rapidity of spread amongst horses, a presumptive diagnosis of equine influenza was made.

Laboratory diagnosis

Immediately after collection, the nasopharyngeal swabs were placed in approximately 10 ml of transport medium and transported on ice directly to the laboratory. Medium was expressed from the swab using sterile forceps and 0.2 ml of the fluid was inoculated into 10-day-old embryonated chicken eggs. The remaining swab material and fluid was frozen at −70°C. The eggs were incubated at 35°C for 48 h and the allantoic fluids harvested and tested for haemagglutination activity in microtitre plates. On 17 December 1986, the Veterinary Research Institute in Onderstepoort, confirmed the isolation of influenza A/equine-2 virus (B.J. Erasmus, 1986, unpublished data).
Emergency response and control procedures

As equine influenza was exotic to South Africa, the disease was classified as a 'controlled disease' in terms of the Animal Diseases Act (1). Over 50% of the horses in training stables at Turffontein (Johannesburg) and Milnerton (Cape Town) were showing clinical signs of respiratory disease by noon on 12 December 1986. A presumptive diagnosis of equine influenza was made. The Director of Veterinary Services therefore convened an emergency meeting with representatives of the Jockey Club of Southern Africa in the afternoon of 12 December 1986. During this meeting, it was decided that the Jockey Club of Southern Africa should cancel race meetings scheduled in Johannesburg and Cape Town on Saturday 13 December and that no horses would be allowed to move between training establishments in these regions. It was also recommended that the movement of people, including veterinarians, between training stables should be limited as far as possible. It was also decided that a Joint Management Committee (JMC) consisting of representatives of the Directorate of Veterinary Services and the Jockey Club of Southern Africa should be responsible for the management of the disease outbreak. As the Jockey Club of Southern Africa could implement decisions of this Committee with immediate effect, without having to rely upon promulgation of regulations under the Animal Diseases Act, this was used to expedite the implementation of emergency control measures.

The JMC decided that a vaccination programme should be instituted as soon as possible. By Monday 15 December it had become evident that the disease outbreak had spread to horses outside the jurisdiction of the Jockey Club of Southern Africa. The Directorate of Veterinary Services thus issued a press statement declaring that it was likely that an outbreak of equine influenza had occurred and that horses at a number of different places in the country were affected. The Directorate indicated that movement of horses should be avoided and that all equestrian events should be cancelled. Unfortunately, some equestrian sporting bodies did not heed this request. The JMC was also extended to include representatives of other equestrian disciplines. On 15 December 1986, the Directorate of Veterinary Services issued a permit for the import of influenza vaccine registered for use in other countries. The first batch of this vaccine was made available on 17 March 1987. This vaccine was later modified to a bivalent vaccine by inclusion of an influenza equi-1 antigen and the first batch was released on 9 June 1987.

In accordance with the recommendations of the JMC, the Jockey Club of Southern Africa issued a notice on 18 December 1986 cancelling race meetings in all provinces except KwaZulu-Natal until further notice. This notice also introduced a rule requiring that all registered Thoroughbreds should receive a primary and secondary vaccination against equine influenza and that no horse could move from a stable where there had been a case of equine influenza for at least 21 days after the last symptoms were observed. The South African National Equestrian Federation also cancelled all events and introduced a rule whereby horses were barred from attending a show until at least 42 days after receiving a primary and secondary vaccination against equine influenza.

The general policy of the Directorate of Veterinary Services on post-arrival quarantine for animals was that quarantine should occur on an all-in all-out basis. Due to extreme pressure from importers, this was not strictly adhered to in the case of horses at the time of the outbreak. On the recommendation of the JMC, it was decided that post-arrival quarantine of horses should also be performed on a strict all-in all-out basis. The revised policy also excluded the entry of visitors to the quarantine station, mandated that all personnel, including veterinarians attending to horses in quarantine, wear protective clothing and shoes and that any equipment used on horses in quarantine should be thoroughly disinfected.

Movement of horses from South Africa to neighbouring countries (Namibia, Lesotho, Swaziland, Botswana, Mozambique and Zimbabwe) was restricted. South Africa also modified import requirements so that all horses imported into South Africa were required to be vaccinated against equine influenza at least 30 days and not more that 60 days before despatch to South Africa.

The Veterinary Research Institute in Onderstepoort commenced work on the local production of an inactivated equine influenza vaccine using the Johannesburg/86 isolate. The first batch of this vaccine was made available on 17 March 1987. This vaccine was later modified to a bivalent vaccine by inclusion of an influenza equi-1 antigen and the first batch was released on 9 June 1987.

Regulations were published in the Government Gazette on 12 February 1987 describing specific control measures for equine influenza in terms of the Animal Diseases Act (1). These regulations became effective on 2 March 1987 and included compulsory vaccination of all horses, donkeys and mules.

Numerous outbreaks of equine influenza were reported throughout South Africa during the first six months of 1987. In the latter part of May 1987, an outbreak of equine influenza was reported in Lesotho. An outbreak was also reported following the National Endurance Riding Championships held at Fauresmith from 14 to 16 July 1987. Horses from Namibia, Botswana and Lesotho competed in this event. On 4 August 1987, an outbreak of equine influenza was also reported in Namibia that affected approximately 1,000 horses in districts close to the border with Botswana. The last case of equine influenza that was confirmed by the Veterinary...
Research Institute in Onderstepoort occurred in September 1987. Subsequently, there has been no clinical or epidemiological evidence to indicate that equine influenza has occurred in South Africa.

Discussion

The 1986 South African outbreak of equine influenza occurred as a result of the liberal post-arrival quarantine policy applied to horses at the time. The spread of influenza to Cape Town (a distance of 1,600 km), back to Welkom and subsequently to KwaZulu-Natal, Johannesburg and Port Elizabeth can be attributed directly to the release of two horses from quarantine within three days of the arrival of a new group of horses from the USA. While the truck transporting the horses to Cape Town did stop at the Turffontein Racecourse, no horse was offloaded from the truck at Turffontein and therefore one has to question whether this was the primary source of virus for the outbreak at Turffontein (Fig. 3). The veterinarian attending to the horses in quarantine and the trainer who owned the stable in which the outbreak first occurred both came into contact with horses that were probably infected with equine influenza immediately before going to the stables in which the outbreak commenced on 9 December 1986. Thus, it is probable that one of these two people introduced the virus into the stables. This highlights the role that people and contaminated equipment can play in the spread of highly contagious viral infections and indicates that quarantine policies should be designed to minimise the risk associated with this mode of transmission as far as possible.

The introduction of a second group of horses from the quarantine station to stables belonging to a different trainer at the Turffontein Racecourse on 11 December 1986 (Fig. 3) probably served as a secondary source of virus at Turffontein. While there was no direct contact between any of the horses transported from Johannesburg to Cape Town and the horses in the Western Province Show Jumping team, these horses were infected with equine influenza following transport in the same vehicle. The faeces and soiled bedding were removed and new bedding was put in the vehicle but the vehicle was neither cleaned nor disinfected. The infection of the second group of horses shows that following environmental contamination, equine influenza virus can remain infectious for a period in excess of 12 h. This also highlights the need to properly clean and disinfect vehicles that have been used to transport horses that may have been shedding highly infectious viruses, such as equine influenza.

The constitution of a Joint Management Committee consisting of representatives of the Directorate of Veterinary Services and of equestrian sporting bodies is believed to have played a major role in rapidly controlling the effects of the outbreak. Reliance upon immediate voluntary instigation of control measures by equestrian sporting bodies themselves, as opposed to sole reliance upon measures promulgated by the Competent Veterinary Authorities, is also believed to have played an important role in reducing the impact of the disease. It should be noted that the self-imposition of quarantine measures played an important role in preventing outbreaks of equine influenza in a number of establishments housing a large number of horses. This included Summerveld, Ashburton and Clairwood Training Centres in KwaZulu-Natal that housed approximately 1,000, 400 and 300 horses, respectively, and the Randjesfontein Training Centre near Johannesburg that housed approximately 750 horses.

The outbreak of equine influenza that occurred in the naive horse population of South Africa had an extremely rapid and widespread impact. This impact included extensive losses in State revenue due to the cancellation of race meetings, with the subsequent loss of tax revenue from bets. All the feature races during the racing season in the Western Cape and a number of the Highveld feature races were cancelled. The normal racing schedule was resumed in May and a number of extra meetings were held. In 1987, the National Yearling Sales were delayed from March to May. A number of other major equestrian events were either cancelled or rescheduled. The cost of veterinary treatment of horses infected with influenza was also significant and, in addition, owners had to bear the cost of compulsory vaccination of all horses, donkeys and mules. Initially, there was major concern about the long-term effects of infection on subsequent athletic performance. The fact that the first three horses in the 1987 Rothmans July Handicap (the premier horse race in South Africa) had all shown severe acute equine influenza during December 1986 demonstrated that the long-term effects of infection were minimal in these individuals.

In addition, it was shown that zebra (Zebra burchelli) were susceptible to experimental infection with equine influenza (2). During the outbreak, great concern was expressed about the potential effects that equine influenza could have on the large population of zebra (approximately 50,000) that could not practically be vaccinated against the disease. Fortunately, there appear to have been very few, if any, outbreaks of influenza in zebra and the effects of the disease appear to have been negligible in these animals. Recent studies have also shown that sera collected from zebra throughout South Africa have no antibody against equine influenza (2, 3) which lends support to the contention that equine influenza no longer occurs in South Africa.

As no outbreaks of equine influenza had been confirmed since 1987, the Directorate of Veterinary Services modified the regulations under the Animal Diseases Act (1) in 1990 and no longer required that all horses, donkeys and mules should be vaccinated against equine influenza every six months. The Jockey Club of Southern Africa and a number of other equestrian organisations, including the South African National Equestrian Federation, have maintained their rules...
requiring horses under their jurisdiction to be vaccinated every six months. In view of the increased international movement of horses, these organisations believe that it is in the interests of their constituents to immunise their horses against equine influenza, with the hope that should the disease be reintroduced into South Africa the impact of the infection would be minimised.

The reintroduction of a more conservative all-in all-out quarantine policy for horses and the limiting of access to horses in quarantine, along with specific vaccination requirements, have prevented the reintroduction of equine influenza into South Africa. The conservative nature of these measures appears to be justified as the risks associated with introduction of equine influenza into partially immune (5) or naïve horse populations are unacceptably high.

Circonstances entourant l’apparition et la propagation de la grippe équine en Afrique du Sud

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Résumé
En Afrique du Sud, l’infection par le virus A Equi-2 de la grippe équine (H3N8) s’est déclarée, pour la première fois, en décembre 1986, chez des chevaux qui n’avaient jamais été en contact avec cet agent pathogène. Le virus a été introduit après l’importation de six chevaux des États-Unis d’Amérique. La sortie de quarantaine de chevaux ayant été en contact avec ces équidés infectés, trois jours seulement après l’arrivée de ces derniers, a joué un rôle dans la propagation rapide de la maladie en Afrique du Sud ; d’autres foyers ont été associés à l’introduction du virus par du personnel ou des instruments contaminés. Les auteurs décrivent les mesures de prophylaxie adoptées et exposent les conséquences de l’introduction de la grippe équine en Afrique du Sud.

Mots-clés

Circunstancias que rodearon el brote de gripe equina en Sudáfrica y su ulterior propagación

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Resumen
En diciembre de 1986 se produjo en Sudáfrica la primera infección por el virus A Equi-2 (H3N8) de la gripe equina entre caballos que no habían estado en contacto con ese agente patógeno anteriormente. El virus se introdujo a resultados de la importación de seis caballos de Estados Unidos de América. Aunque en la rápida propagación de la enfermedad en Sudáfrica influyó el hecho de que, tres días después de la llegada de esos seis caballos, otros animales que habían estado en
contacto con ellos abandonaran las dependencias de cuarentena, se produjeron también otros brotes de enfermedad ligados a la introducción del virus a través de trabajadores o de instrumental contaminado. Los autores examinan las medidas de control adoptadas y las consecuencias que tuvo la introducción de gripe equina en Sudáfrica.

**Palabras clave**
Caballlos – Gestión de emergencias – Influenza – Sudáfrica – Virus de la gripe equina.

**References**


