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COMMENTARY

IN THIS ISSUE

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LLOYD'S

Lloyd's—An international insurance market for bloodstock and other specialist insurance.

The COVID-19 pandemic has heightened the awareness of the horse industry regarding the potential introduction and spread of foreign animal diseases (FAD). The human pandemic highlights the importance of early detection, laboratory utilization of high capacity, validated diagnostic testing, and coordinated implementation of a disease response plan. How would the national and international community respond to a pandemic of equine infectious disease?

The threat of an FAD entering the U.S. is a top concern of regulatory animal health officials. These officials are responsible for implementing mitigation measures to prevent introduction of a highly contagious or vector-borne disease agent. Risk reduction includes pre-import testing and post-import quarantine as well as testing of live animals and animal products to ensure that diseases with the potential to become widely disseminated do not enter the country. FAD may be introduced by an asymptomatic carrier, contaminated equipment, or an infected vector or reservoir host. Should an FAD enter the country, private practitioners and equine owners would provide critical surveillance and hopefully its early detection. Any individual suspecting an FAD should immediately report the case to a local regulatory authority.

Once reported, an FAD diagnostician will visit the premises within 24 hours of notification to perform an onsite investigation, examine affected animals, obtain appropriate samples for laboratory testing, quarantine the animals and/or premises, and implement disease control measures. If diagnostic testing at the Foreign Animal Disease Laboratory on Plum Island, NY, confirms an FAD, then regulatory officials will implement movement restrictions and disease eradication measures.

Unlike an outbreak of an endemic disease, such as strangles or equine influenza, all members of the equine industry across the country would be impacted by an FAD outbreak. Confirmation of an FAD results in activation of a national response plan with coordination of state and federal animal health officials. With detection of an FAD, countries can prohibit entry of equids from the affected country and domestic movement of horses is restricted. Restrictions may extend to equine affiliated entities such as nutritionists, farriers, equine dentists, and feed and hay suppliers.

The ultimate outcome following the introduction of an FAD depends on the response of regulatory officials in concert with the equine industry. Preparedness, prompt response, and collaboration are key to success. Unfortunately, domestic equine disease outbreaks in recent years have shown the equine industry is underprepared due mainly to limited implementation of biosecurity measures and insufficient use of diagnostic testing. Furthermore, limited resources at national and local levels to address equine disease issues result in the inability to focus on the development and training involved in a national equine FAD response plan. Lastly, segmentation of different sectors of the equine industry leads to challenges in communication and collaboration and slows the response to an FAD.

The equine industry has a unique opportunity to learn from the current human pandemic and enhance equine FAD preparedness and response. Equine stakeholders can reach out to local and national regulatory authorities to prioritize the development of an equine FAD response plan, which focuses on business continuity while protecting the health of the nation's equine population.

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INTERNATIONAL

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The International Collating Centre, Newmarket, United Kingdom, and other sources reported the following disease outbreaks.

The Republic of South Africa (RSA), the Kingdom of Eswatini (SZ), and Thailand reported outbreaks of African horse sickness (AHS). AHS was confirmed in all nine provinces in the RSA, with the majority of cases in Gauteng Province. A single case was recorded in SZ. Outbreaks of AHS continued in Thailand, with multiple cases confirmed in 11 provinces.

Estonia, France, Germany, the Netherlands, the UK, and the USA reported outbreaks of equine influenza ranging from one (Estonia), two (Germany), three (UK), four (France and the Netherlands), to at least five in many states (USA), where the disease is endemic. Although diagnosed primarily in unvaccinated or partially vaccinated horses, isolated cases were also seen in vaccinated animals.

Strangles is considered endemic in most countries with outbreaks reported from Belgium (one), France (seven), the Netherlands (16), Switzerland (four), and the USA (38 outbreaks in 17 states).

Equine herpesvirus 1 (EHV-1) related diseases are believed endemic in most countries and were confirmed by Belgium, Canada, France, Germany, Ireland, Japan, the Netherlands, the UK and the USA. Respiratory disease outbreaks were recorded by Belgium (two), France (two), Ireland (eight), Japan (one), the Netherlands (one), the UK (two) and the USA (one). EHV-1 abortion was reported by France (two outbreaks, single cases), Germany (one case), Japan (three outbreaks, one or two cases apiece), the Netherlands (two outbreaks, one involving two cases and a case of neonatal mortality, and another, a single case), the UK (three outbreaks, one involving multiple cases of respiratory disease, one neonatal mortality and three of neurologic disease; a second, involving three cases of neonatal mortality; and a third, a case of neonatal mortality). EHV-1 neurologic disease was confirmed by Canada (three outbreaks, one involved three cases; another, a single case; and a third, five cases with three having to be euthanized), and the USA (11 outbreaks in eight states, the majority were single cases).

Numerous countries reported equine herpesvirus 4 (EHV-4) respiratory disease; outbreaks ranged from one (Belgium, Switzerland), four (Ireland), five (the Netherlands), to eight (France). France also reported a case of EHV-4 abortion.

Single cases of equine infectious anemia were recorded by Canada, Germany, and Hungary. The USA recorded three outbreaks, each involved one or two cases.

Equine piroplasmosis cases were reported by the RSA (where the disease is endemic) and New Zealand (a single case in an imported mare).

The USA recorded four cases of Tyzzer's disease caused by *Clostridium piliforme* and also two cases of equine parvovirus associated hepatitis.

The UK detected *Taylorella equigenitalis* in an imported stallion.

Equine coital exanthema (equine herpesvirus 3 infection) was diagnosed by France (one case) and the USA (three cases).

Belgium reported a case of leptospiral abortion and two cases of abortion caused by *Streptococcus zooepidemicus*.

Nocardioform placentitis/abortion was diagnosed by the USA, with 24 cases confirmed in Kentucky and 27 in Pennsylvania. *Amycolatopsis* spp. were implicated in the majority of cases.

The USA reported 13 cases of salmonellosis, the majority involving Serogroup B isolates.

Rotavirus diarrhea in foals was diagnosed by France (14 outbreaks, mostly single cases of infection) and the USA (78 cases, most involving 60-90 day old foals). A subset of 67 cases comprised 31 of the G3 genotype, 21 of the G14 genotype and 15 involving both genotypes.

Clostridium perfringens was reported in 12 foals and *Clostridium difficile* in seven foals by the USA.

The USA confirmed two fatal cases of Eastern equine encephalomyelitis in Florida and two cases of West Nile encephalitis, one in California and the other in Florida; one was euthanized.

A total of 71 cases of equine encephalosis were confirmed in seven provinces of the RSA.

The USA confirmed re-emergence of vesicular stomatitis in New Mexico in mid-April. The disease was subsequently confirmed in Arizona, Texas, Kansas, and Nebraska. Of 107 affected premises,

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103 were equine only premises and four cattle premises. The Indiana serotype was involved in all but seven premises in Texas where the New Jersey serotype was implicated.

Outbreaks of *Rhodococcus equi* associated diseases were reported by the USA. The number of recorded outbreaks is not considered reflective of the true incidence of the disease.

African Horse Sickness: Potential Threat for Disease-free Countries

A major outbreak of African horse sickness (AHS) in Thailand earlier this year was a timely reminder for animal health officials, veterinarians, and members of the horse industry of the vulnerability of equine populations to this disease. Of all known equine infectious diseases, AHS is the single most important in terms of devastating losses in naïve horses and economic impact on international trade. It is a dreaded, non-contagious, vector-borne disease with the potential to kill 50% to 95% of affected horses.

The etiological agent of AHS is an RNA virus belonging to the family *Reoviridae*, genus *Orbivirus*, that is transmitted naturally by species of *Culicoides* or midges. There are nine antigenically distinct serotypes of the virus. While the primary host species are members of the family, *Equidae*, evidence of infection has also been found in African elephants, black and white rhinoceroses, camels and dogs, none of which are considered epidemiologically significant.

Historically, AHS was considered restricted to tropical and subtropical regions of sub-Saharan Africa, where it had been known to occur regularly for over 200 years. Although infrequent, the disease has spread from west and north Africa to various southern European or Middle Eastern countries. The most significant such event occurred between 1959 and 1963 when serotype 9 of AHS virus spread out of Africa into and throughout the Middle East, as far north as Turkey, and extended as far east as Afghanistan, Pakistan, and India.

Concern over the risk that AHS poses for horse industries in Europe has been keenly felt for some time. Southern European countries are faced with the potential threat of disease introduction from migration of the virus northwards from regions in Africa, where the disease is endemic. Spread of the virus could result from the movement of nomads and their animals, passive wind-borne carriage of infected *Culicoides* over long distances, and legal or illegal trade in zebra from countries where the disease is currently active. A similar if not greater risk exists for the Middle East which experienced incursions of AHS more frequently than any other region or country.

As the most recent occurrence of AHS in Thailand has shown, distance is no guarantee of safety from the risk of introduction of this disease. Thailand is approximately 6,000 miles distant from where the virus responsible for this event probably originated, and the furthest east in Asia where AHS has ever been recorded. The most plausible explanation as to the source of virus lies in the fact that a shipment of zebra arrived in Thailand three to four weeks before the first AHS outbreak of the disease was discovered. Zebra are considered the natural reservoir of the virus, developing viremias lasting up to 40 days.

This would not be the first occasion that importation of zebra from a country in which AHS is a seasonal occurrence has been implicated in the introduction of disease into a disease-free country. A shipment of zebra was the confirmed source of this virus for a major disease event that occurred in Spain in 1987 and subsequently involved Portugal and Morocco.

International trade in wildlife, both legal and illegal, is believed to have increased significantly in recent years. What happened in the Iberian Peninsula in 1987 and Thailand in 2020 highlights the inherent risks of introducing a disease, such as AHS, into previously disease-free countries.

The influence of climate change and global warming on the epidemiology of AHS must also be considered vis-à-vis the threat it poses for a disease-free country. Increased ambient temperatures and reduced rainfall over a period of years has resulted in more widespread geographic distribution of some of the major vectors of AHS, especially *C. imicola*, in southern Europe. An increase in ambient temperature can influence not only the life cycle of the *Culicoides* vector but also replication of the virus in the vector. As temperatures rise, the infection rate in *Culicoides* midges increases and transmission of the virus can occur sooner, however there is a concomitant decrease in the survival rate of the adult *Culicoides*. The overall result of these changes is a higher transmission rate of the virus in a country possibly at risk of the introduction of AHS.

Swelling of the supraorbital fossa, eye tearing of a horse affected with the ca

COURTESY DR. M. RODRIGUEZ

The occurrence in Thailand and the very recent confirmation of AHS in Malaysia underscore the importance of increasing awareness and familiarity with this dreaded disease among animal health officials, veterinarians and members of the equine industry around the world. The potential consequences of AHS for the health of a country's equine population and economy highlight the need for an adequate level of national preparedness in a) minimizing the risk of introduction of this disease, b) maintaining a program of active surveillance for the disease and c) having a response plan in place in the remote event of the introduction of the disease.

The take-home message from past and recent occurrences of AHS is that there is no room for complacency over the potential threat it represents for disease free-countries.

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elids and facial tissues, and bilateral
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NATIONAL

Consequences of Wildfires on the Health of Horses

Wildfires have become the new normal for many areas of the world, and subsequent health consequences have emerged as an important problem affecting large numbers of horses. For those of us in California with a Mediterranean climate, large areas are affected by unrelenting fires, which produce a particular challenge to horse owners and those providing veterinary care. There is a paucity of education and training in disaster and emergency response in veterinary curricula, including the health consequences of wildfires.

Wildfires can create health problems in horses by direct and indirect exposure to flames and smoke, injury during flight or evacuation, and/or disruption of the horse's food and water sources.

Wildfire-smoke health effects include primary smoke exposure with direct smoke inhalation and secondary smoke-related air quality issues in areas adjacent to fires where smoke has permeated the environment. Wildfire smoke reduces air quality. It contains small amounts of the toxic gases within the smoke and particulate matter, soot, and other substances depending on what has burned. Particulate matter within smoke is microscopic and quickly descends into the lower airways of horses producing bronchial and pulmonary inflammation. Eye and nasal irritation, coughing, and increased respiratory efforts may be observed primarily in horses with a history of heaves or recurrent airway obstruction disorders. Published daily reports of air quality indexes that guide humans should be considered for determining horse-related activities. Events that induce increased respiratory efforts may need to be postponed, and horses with massive smoke exposure may need four to six weeks to recover completely from lower airway inflammation.

Horses with elevated respiratory rates or persistent cough may require veterinary intervention, including bronchial dilators, airway hydration, and further testing. Smoke inhalation from immediate association with fire can produce thermal injury to the lungs from hot gases and the toxic effects of the smoke components. Often these horses also show evidence of thermal skin injuries.

Thermal injury burns to the skin, eyes, limbs, and hoofs can be seen in horses exposed to excessive heat and flames. Horses can incur first-, second-, and third-degree burns. The extent of affected body surface area and the degree of burns can determine prognosis. Equine burn victims may require daily treatments lasting several weeks.

Flight-related injuries may be diverse and occur when horses are fleeing the loud noises associated with rapidly approaching wildfires and related responses of emergency personnel and fire suppression vehicles.

Horses left behind during evacuation may remain uninjured by the fire. However, they can be without food and water for extended periods, because owners are often prevented from returning to the affected area for several days.

Horses are frequently evacuated from areas at risk. Evacuation carries many risks to horses associated with trailer loading mishaps and injuries, exposure to infectious diseases due to housing in new areas with high densities of horses, and poor biosecurity. Many evacuations must occur rapidly and at night, which produces additional risks. Early evacuation is strongly suggested using a previously prepared plan that addresses capture, movement to a safe area, and horse identification.

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KENTUCKY

Rhodococcus Equi-associated Extra-pulmonary Disorders

Rhodococcus equi is a ubiquitous environmental bacterium that causes one of the costliest diseases on equine breeding farms. The most common disease manifestation is pneumonia in young foals. Infection with *R. equi* appears to occur in the first few days of life and remains subclinical for several weeks. Many foals eliminate infection on their own, while others develop respiratory disease. Management of rhodococcosis can be further complicated by the development of extra-pulmonary disorders (EPDs).

Extra-pulmonary disorders refer to any clinical manifestation of rhodococcosis other than pneumonia. A large study estimated that 74% of infected foals had at least one EPD. In many cases, EPDs were not diagnosed until postmortem examination. In this study, survival was significantly lower in foals with EPDs. Factors that influence development of EPDs are not completely understood, but it is generally accepted that EPDs are indicative of a more severe infection. EPDs can pose a major diagnostic challenge and warrant thorough evaluation of any sick juvenile foal. Identification of EPDs can aid in selection of appropriate therapy, monitoring response to therapy, and prognostication.

Clinical signs of *R. equi* pneumonia rarely develop before three to four weeks of age. While blood work and ultrasonography can increase suspicion of infection, a tracheal wash provides a definitive diagnosis. Suspicion of *R. equi* pneumonia should prompt investigation for EPDs elsewhere in the body.

Intra-abdominal abscessation is one of the most common EPD. It is suspected that *R. equi* spreads hematogenously or is ingested in sputum to cause abdominal lesions. Abscesses are best diagnosed via ultrasonography, highlighting the importance of abdominal ultrasonography in foals with pneumonia. Alternatively, abdominal abscessation might only manifest as a recurrent fever or unexplained high white blood cell count. Generally, a sample cannot be obtained from abscesses to confirm *R. equi* involvement. Presumptive diagnosis is made based on the foal's age and concurrent pneumonia. Successful treatment of abscessation is possible, but foals with intra-abdominal abscesses are at a significantly greater mortality risk. Survivability seems to decrease with increasing size of abdominal abscesses. Treatment of abdominal *R. equi* infection includes provision of a long course of antimicrobials. Surgical debulking or resection typically is not possible due to attachments of the abscess to adjacent structures.

R. equi can spread hematogenously and result in osteomyelitis. Clinical signs of affected foals include lameness, ataxia, and recumbency. Retrieving diagnostic samples from affected sites for disease confirmation can be difficult. Osteomyelitis may be best diagnosed via radiography or computed tomography. Successful treatment has been reported, but prognosis is typically considered poor. Other documented sites of *R. equi* infection include the central nervous system, kidney, and liver.

Polysynovitis is perhaps the most commonly observed EPD. It is characterized by symmetric joint effusion without lameness. *R. equi* is rarely cultured from affected joints; this finding has long-supported a conclusion that this phenomenon is immune-mediated. Recently, experimental infection of foals resulted in the isolation of *R. equi* from synovial fluid 14 days post-infection. This lends support to a newer theory that polysynovitis is a septic complication of infection that might actually result from hematogenous spread. In the same study, experimental infection also resulted in the isolation of *R. equi* from ocular fluid. Uveitis has also been considered immune-mediated. Unlike polysynovitis, *R. equi* uveitis is strongly associated with nonsurvival in foals. With both of these EPDs, a suspected hematogenous origin is an interesting development in our understanding

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of the disease as many other EPDs appear to precipitate from bacteremia. The role of the immune response in the development of EPDs should not be discounted yet, as several reports exist of foals affected by immune-mediated hemolytic anemia associated with *R. equi* infection.

Extra-pulmonary disorders are frequently encountered during the management of foals infected with *Rhodococcus equi*. As current literature suggests a septic process in the pathogenesis of polysynovitis and uveitis, it is logical to speculate that the precipitation of most EPDs is a function of bacteremia and the host's immune response to systemic infection.

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Swelling of the supraorbital fossa, eyelids and facial tissues, and bilateral tearing of a horse affected with the cardiac form of African horse sickness.
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