When an equine patient needs to be hospitalized we expect the best care possible. Yet, just like human hospitals there are unique challenges in keeping the patient safe and healthy. One of these issues is hospital-acquired infections. It is estimated that 5% of patients in human hospitals will experience a hospital-acquired infection. We assume that similar rates occur in equine hospital settings. There are a few key issues to remember. Opportunistic microorganisms (bacteria, fungi, and viruses) can affect the hospitalized horse. Many of these “bugs” can be carried by one hospitalized patient and not cause illness in that patient but can be shed into the housing environment, contaminating diagnostic or treatment equipment and other materials. Also, some animals might be incubating an infectious disease and shedding into the environment prior to actually having clinical signs. This emphasizes the need for routine cleaning, disinfection, and good hand hygiene in all areas of equine hospitals.

Secondly, despite our best efforts some hospital-acquired infections occur. Equine hospitals are different than human hospitals. We have hay, dust, and stalls made of wood and concrete. Our equine patient is large (1,200 lb. or more) with thick hair coats and produce 50 pounds of manure and urine per day. Infection control is a challenge even in human hospitals where almost every surface is easily cleaned and disinfected. Hospital-acquired infections are a risk whenever horses are hospitalized. Some equine patients may have a compromised immune system and are more at risk for opportunistic infections. As such, veterinarians need to discuss these potential risks for any hospitalized horses to their clients. Often owners of hospitalized horses receive admission and discharge information about the potential for hospital-associated infections.

Also, consider the surgical and intensive care procedures we can now perform on horses. These include long-term intravenous therapy, oxygen support, and mechanical ventilation as some of the advanced therapies available for critically ill patients. The longer a patient is hospitalized the greater the potential to acquire an opportunistic infection.

Hospital infections can be costly. In a recent survey, 33 of 38 veterinary teaching hospitals reported an outbreak in the five years prior to the survey. Some of these outbreaks resulted in hospital closures. Most equine hospitals will have procedures in place to reduce the likelihood of environmental contamination and follow strict isolation and quarantine procedures. We need to respect these policies which may impact a client’s ability to visit the hospital and their animal. Owners should refrain from interacting with other hospitalized horses and recognize that their clothes, hands, and boots can transport potential pathogens to the hospital environment and to other horses. Owners may be asked to put on protective coveralls, shoe covers, and gloves prior to visiting their hospitalized animal as a biosecurity protocol.

Overall, hospital-acquired infections can be reduced by recognizing the risk, having appropriate cleaning and disinfection protocols, and practicing good hygiene. Considered strategies include and in addition, take measures to improve their own farm biosecurity to limit pathogen spread.
Equine herpesvirus (EHV)-1 related diseases

Outbreaks of EHV-1 respiratory disease were reported by France (11 outbreaks in five regions), Germany (two outbreaks), Switzerland and the USA. France confirmed 14 outbreaks across five regions, with infections confirmed in 186 equines and 60 bovines on 433 premises. France, Germany, Ireland, Switzerland, and the UK recorded outbreaks of African horse sickness, with the majority of cases being reported in South Africa (140). Texas, Oklahoma, California and Missouri had the highest numbers of cases.

The USA recorded continued vesicular stomatitis activity, all involving the New Jersey serotype of the virus. The disease was confirmed on 10 additional premises, bringing the total to 69 in Colorado, Texas, and one in Nebraska. In 2014, 17 countries were affected in Colorado, 13 in Texas and one in Nebraska, with infections confirmed in 844 equines and 60 bovines on 433 premises. France, Germany, Switzerland, and the USA recorded outbreaks of African horse sickness. A total of 28 outbreaks were confirmed in 18 regions in France. Endemic in the USA, outbreaks were reported in 15 counties in the UK (horses, ponies and donkeys), many involving vaccinated animals. Endemic in the USA, outbreaks were recorded in Florida, Kentucky, Oregon, and Washington.

Equine inappetence (EHV-1 related disease) was reported by France, Germany, Japan, South Africa, Switzerland, the UK and the USA. A respiratory disease was confirmed in France (six outbreaks), Germany (two outbreaks), Switzerland (one case), the UK (three outbreaks affecting ponies and donkeys), and the USA (20 outbreaks affecting donkeys and the USA). Cases of abortion were diagnosed in Japan (isolated cases on two premises), as well as vaccinated Thoroughbreds, South Africa (two cases) and the USA (four cases). One outbreak of EHV-1 encephalomyelitis involving two horses was confirmed in Idaho, USA. Outbreaks of EHV-4 respiratory disease were reported by France (15 outbreaks in five regions), Germany (eight cases on two premises), and the UK (one outbreak involving one Thoroughbred mare). Multiple cases of EHV-2 and -5 infections were confirmed in Texas and Kentucky in the USA. Germany confirmed persistent equine arthritis in one stallion and Switzerland reported one case of this infection. Equine infectious arteritis was diagnosed in France (one Thoroughbred) and the USA (one Quarter Horse treated). Equine plasmacytosis was reported as endemic in France and the United Arab Emirates.

A case of leptospiral abortion was diagnosed in a Thoroughbred mare in France. The USA recorded two cases of atypical abortion and abortion. Salmonellosis enteritis due to Salmonella enteritidis (S. enteritidis) and Switzerland recorded one case of salmonellosis on separate premises, and Switzerland recorded one case of salmonellosis (S. enteritidis).

The USA confirmed several cases of classical equine abortion due to E. coli, E. coli type P7, and equine piroplasmosis (E. caballina) in Idaho. A case of equine respiratory disease was reported by the UK and the USA. France confirmed four outbreaks. Some 18 outbreaks were confirmed in the UK (horses, ponies and donkeys), many involving vaccinated animals. Endemic in the USA, outbreaks were recorded in Florida, Kentucky, Oregon, and Washington.

Equine rhinopneumonitis (PPV + related disease) was reported by France, Germany, Japan, South Africa, Switzerland, the UK and the USA. An equine respiratory disease was confirmed in France (six outbreaks), Germany (two outbreaks), Switzerland (one case), the USA (three outbreaks affecting ponies and donkeys) and the UK (five outbreaks affecting ponies and donkeys), many involving vaccinated animals. Endemic in the USA, outbreaks were recorded in Florida, Kentucky, Oregon, and Washington.

Equine infectious anemia was diagnosed in Japan (isolated cases on five premises, all in vaccinated Thoroughbreds), South Africa (one case) and the USA (two cases). One outbreak of EHV-1 encephalomyelitis involving two horses was confirmed in Idaho, USA. Outbreaks of EHV-4 respiratory disease were reported by France (15 outbreaks in five regions), Germany (eight cases on two premises), and the UK (one outbreak involving one Thoroughbred mare). Multiple cases of EHV-2 and -5 infections were confirmed in Texas and Kentucky in the USA. Germany confirmed persistent equine arthritis in one stallion and Switzerland reported one case of this infection. Equine infectious arteritis was diagnosed in France (one Thoroughbred) and the USA (one Quarter Horse treated). Equine plasmacytosis was reported as endemic in France and the United Arab Emirates.

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Global Horse Transportation Issues

The number of high-value insured horses travelling internationally is difficult to quantify, making true "risk assessment" for insurance purposes problematic. A record number of 1,003 United Kingdom-based Thoroughbred racehorses competed internationally in 2014. They travelled to France (417), Ireland (249), Dubai (144), Channel Islands (75), USA (34), Germany (22), Australia (15), Turkey (12), Switzerland (9), Canada (7), Sweden (7), Hong Kong (5), Italy (2), Singapore (2), Czech Republic (2), Japan (1), and Spain (1). There were 350 FEI international events in 1996 and this number grew progressively to 457 in 1999, 1,530 in 2006, and 3,215 by 2011. Stallion heats between both Northern and Southern hemispheres require transportation due to equine breeds and the horse-based activities are much less documented, but long-distance transport occurs within national frontiers, as in the USA within Japan and Australia.

Long-distance travel may be an inevitable consequence of horse transport. Confinement in a lorry or in an airframe does not provide immunity from all the problems that can occur in the normal day-to-day lives of horses. Possible injury, colic, and disease are ever-present and are arguably increased as hazards when these "creatures of habit" are exposed to unfamiliar circumstances. Quarantine and isolation, although always advocated, are not always observed, especially when they are mandatory, as in the case of international travel. However, there are no guarantees. Even measures imposed by the animal health authorities in Japan and Australia failed to prevent the introduction of equine influenza into Australia in 2007.

However, the principal problem associated with long-distance transport is the combination of pleurisy and pneumonia that is known colloquially as "shipping fever." This condition creates a potentially problematic differential diagnosis for the attending equine clinician, who has to decide, often in the absence of sophisticated diagnostics, whether a post-arrival fever is a treatable shipping fever or a potentially imported exotic disease. Reports of the incidence of shipping fever demonstrate the magnitude of this problem. Between 11 and 12% of U.S. imported horses that arrived into either New York or Los Angeles were febrile at arrival, and 60% of horse-flights into Hong Kong had at least one case of shipping fever that was evident on arrival. Advances in diagnostics, increased awareness, and better therapy mean that the majority of those shipping fever cases make an uneventful recovery provided treatment is initiated promptly. Delay can be fatal and the earlier the diagnosis is made and treatment is initiated, the more likely a successful outcome. Reports of shipping fever cases in the USA, however, do not account for all high-value shipments. It is insurers’ best interests to insist that they do so.

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Re-emergent Diseases

The terms “emergent” and “re-emergent” are used interchangeably without apparent appreciation of the meaning of each term in a description of specific infectious diseases. It is important to make a distinction between the terms used as they are not synonymous. “Emergent” refers to the first recorded appearance and recognition of a disease in a population for which there are no published reports. “Re-emergent” disease, on the other hand, are those that have been experienced in the past but either have reappeared in a new region or have occurred in a different epidemiological setting. A wide range of factors involving infection agents, hosts, or the environment can contribute to the occurrence of an emergent or re-emergent disease. These can include microbial change and adaptation, host susceptibility to infection, modulations of climate, altered ecosystems, population demographics, trends in international trade and travel, and changes in disease surveillance systems.
The majority of the better-known examples of viral diseases are zoonoses, especially those of avian influenza virus, influenza-A/equine/89 (H3N8), since in 1989 gave rise to very high morbidity and associated case-fatality rates in the equine populations exposed to it. Very fortunately, the H3N8 virus strain of H3N8 virus has not spread outside of China. Other examples that qualify as re-emergent were the outbreaks of Venezuelan equine encephalomyelitis caused by subtype-1E strains of the virus that occurred in Chiapas and Oaxaca states in Mexico in 1993 and 1996. Both disease events were associated with unprecedented clinical-attack rates and moderate case-fatality rates. Prior to these occurrences, subtype-1E strains of the virus were not known to cause significant disease and losses.

Neurological disease is one of the most widely known re-emergent diseases of horses in equine herpesvirus-4 (myeloencephalitis) (89 (H3N8), in China in 1989 gave rise to a strain of virus has on occasion resulted in significant clinical disease and a high mortality rate.

Researchers have found that horses that present with colic or colitis and have persistent azotemia with Cr levels exceeding 5.0 mg/dL (440 µmol/L). 1% have more severe azotemia (serum creatinine concentration [Cr] >2.5 mg/dL [220 µmol/L]), and 1% have more severe azotemia due to kidney insufficiency (azotemia with a serum creatinine concentration of >2.5 mg/dL [220 µmol/L], and 1% have only trace amounts of urinalysis) with Cr levels exceeding 5.0 mg/dL (440 µmol/L).

Non-steroidal anti-inflammatory drugs (NSAIDs) should not be considered renoprotective and institution of appropriate supportive care is critical to improve patient outcome. In recent years, it has however, development of acute kidney injury (AKI) with other disease processes is a serious complication that can increase morbidity and mortality. Of the approximately 2,000 horses presented to Michigan State University's Veterinary Medical Center each year, approximately 4% have decreased amounts of renal function in their blood (serum creatinine concentration [Cr] >2.5 mg/dL [220 µmol/L], and 1% have only trace amounts of urinalysis) with Cr levels exceeding 5.0 mg/dL (440 µmol/L).

According to the American Kidney Foundation, 11% have chronic kidney disease (CKD) that is present with or without clinical and/or persistent azotemia. Failure of azotemia to resolve after three days of treatment were three times more likely to die or be euthanized as compared to patients in which azotemia resolved. Thus, prompt recognition of compromised renal function, minimizing the use of kidney damaging (nephrotoxic) medications, and institution of appropriate supportive care are critical to improve patient outcomes. Non-steroidal anti-inflammatory drugs (NSAIDs) that have a greater inhibitory action against cyclooxygenase-2 (COX-2) have been developed in attempt to limit the unintended side effects of NSAIDs. A misconception has developed that these medications exert less adverse effects on renal function than non-selective COX inhibitors (NSAIDs) that have a greater inhibitory action against cyclooxygenase-2 (COX-2). However, COX-2 has several essential roles in maintenance of renal blood flow, thus use of COX-2 selective NSAIDs should be considered contraindicated.

Chronic kidney disease (CKD) may develop as a consequence of incomplete resolution of AKI (failure of azotemia to resolve after three days of treatment) or as a consequence of incomplete resolution of AKI (failure of azotemia to resolve after three days of treatment) that are associated with acute kidney injury (AKI). Hence, COX-2 plays an essential role in maintenance of renal blood flow, thus use of COX-2 selective NSAIDs should be considered contraindicated.

The occurrences of more virulent strains of equine influenza virus, influenza-A/equine/89 (H3N8), since in 1989 gave rise to very high morbidity and associated case-fatality rates in the equine populations exposed to it. Very fortunately, the H3N8 virus strain of H3N8 virus has not spread outside of China.

As previously mentioned, diseases are also re-emergent if they occur in a different epidemiologic setting. Examples of two diseases that meet this criterion and which are of particular relevance to the horse include West Nile encephalitis and equine encephalomyelitis. West Nile virus, first discovered in the USA in 1937, has recently been found in an equine in Texas in 1995, has been responsible for significant annual losses in unvaccinated horses. Confirmation of the first time this disease was reported outside of the African continent.

Undoubtedly, there will be additional new and re-emergent equine diseases in the years to come, some of which may have significant economic consequences for the equine industry in certain countries. Early recognition of such diseases is of paramount importance if their impact is to be minimized.

**Equine Urinary Disease**

Primary renal disease remains uncommon in horses; however, development of acute kidney injury (AKI) with other disease processes is a serious complication that can increase morbidity and mortality. Of the approximately 2,000 horses presented to Michigan State University's Veterinary Medical Center each year, approximately 4% have decreased amounts of renal function in their blood. These horses may be euthanized as compared to patients in which azotemia resolved. Thus, prompt recognition of compromised renal function, minimizing the use of kidney damaging (nephrotoxic) medications, and institution of appropriate supportive care is critical to improve patient outcomes. Non-steroidal anti-inflammatory drugs (NSAIDs) that have a greater inhibitory action against cyclooxygenase-2 (COX-2) have been developed in attempt to limit the unintended side effects of NSAIDs. A misconception has developed that these medications exert less adverse effects on renal function than non-selective COX inhibitors (NSAIDs) that have a greater inhibitory action against cyclooxygenase-2 (COX-2). However, COX-2 has several essential roles in maintenance of renal blood flow, thus use of COX-2 selective NSAIDs should be considered contraindicated.

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**SUMMARY**

The number of re-emergent and re-investigation diseases of humans, animals, and plants continues to increase as more sophisticated technologies become available that enable detection of previously undiscovered infection agents in the host and the environment.

There are various examples of re-emergent diseases, some of which are best reviewed to members of the family Equidae, whereas others can infect different domestic and/or wildlife species besides the horse. The majority of the better-known examples are viral diseases. The emergence of certain of equine influenza virus, influenza-A/equine/89 (H3N8), since in 1989 gave rise to very high morbidity and associated case-fatality rates in the equine populations exposed to it. Very fortunately, the H3N8 virus strain of H3N8 virus has not spread outside of China.
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or polycystic kidney disease). Presenting complaints for CKD are vague and include decreased performance or loss of condition. However, a diagnosis of CKD is easily supported by characteristic laboratory abnormalities including azotemia, hypercalcemia, anemia, and decreased diuresis. Abnormalities on urinalysis and the presence of kidney stones (nephroliths) are informative. Unlike people, removal of nephroliths is rarely helpful for horses with CKD unless they obstruct urine outflow.

CKD, by nature, is a progressive disease but the rate of progression varies widely between patients. Supportive treatment is focused on maintaining body condition through nutrition (pasture is the ideal diet) and avoiding use of nephrotoxic medications. Its patients with immune-mediated renal disease and proteinuria, treatment with corticosteroids and angiotensin converting enzyme inhibitors may also be helpful. Supplementation with omega-3 fatty acids also merits consideration as this approach does progress of CKD in dogs and cats (as well as a small subset of omega-3 fatty acid).

Although no research proves that CKD is painful, horses can suffer from nephrolithiasis. Finally, lower urinary tract disorders, including bladder stones (cystolithiasis), urinary incontinence, and blood in the urine (hematuria), are actually more common than upper tract disease. Considering that horses normally excrete large amounts of calcium carbonate and calcium oxalate crystals in urine, it is somewhat surprising that urinary stones (cystine, oxalate, or urates) are seen more commonly in dogs than horses. Nevertheless, cystine in equine plasma appears to cause hypocalcemia (90%), suggesting a genetic predisposition in affected horses. Horses with bladder muscle dysfunction due to diuresis, neurologic disease, or unidentified causes develop progressive bladder enlargement and overflow incontinence. Affected horses may also accumulate a large concretion of uric acid stones, which are often radiolucent (X-ray occult). Although no research proves that CKD is painful, horses can suffer from nephrolithiasis.

Figure 1 shows the decrease in sales levels from 2007 to 2010, and the rally through 2014. In addition to sales, stud fees are also a significant revenue stream for the equine sector. Figure 2 below shows an estimate of stud fee revenues in Kentucky based on the Kentucky Thoroughbred Breeders’ Incentive Fund program. These estimates are likely conservative, since not all breeding activity is subject to sales taxes, such as using shipped semen, the stallion and mare being the same owner, and the use of season shares.

Recall that stud fee revenues are based on two factors: the number of mares bred and the stud fee. The only definitive way to increase stud fee revenues is to improve both of these factors. While stud fees may have been trending upward in the past few years, according to 2015 Kentucky Farm Book produced by The Jockey Club

Kentucky Equine Market Continues to Show Improvement

Horses have been one of the signature sectors of Kentucky’s agricultural economy for many years. Equine receipts were the top agricultural commodity in the Bluegrass State for several years following the tobacco buyout and are typically one of the major economic contributors. However, like most sectors of the economy, equine markets were heavily impacted by the recession. Keeneland sales, a major driver of Kentucky equine receipts, fell by 53% from 2007 to 2010. Since that time period, equine markets have been largely in a state of recovery. Keeneland sales for 2014 were up by 40% from those reduced 2010 levels. Figure 1 shows the decrease in sales levels from 2007 to 2010, and the rally through 2014. In addition to sales, stud fees are also a significant revenue stream for the equine sector. Figure 2 below shows an estimate of stud fee revenues in Kentucky based on the Kentucky Thoroughbred Breeders’ Incentive Fund program. These estimates are likely conservative, since not all breeding activity is subject to sales taxes, such as using shipped semen, the stallion and mare being the same owner, and the use of season shares.

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Stallion numbers reached a peak in 2008 and fell steadily through 2010, only starting an upward trend in 2013.

The fact that the improved sales levels of 2013 were maintained for 2014 was certainly a good sign for the equine markets last year and likely signals a significant recovery from the 2008 to 2010 time period. Improved sales also bode well for stallion fees in the coming years, which have not seen the level of improvement that sales have. Widespread improvement in the equine markets would be welcome news in Kentucky, where equine typically accounts for a significant portion of the state’s agricultural land use and has significant secondary and tertiary effects on the state’s economy.

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Figure 1. Annual Keeneland sales totals (2006-2014).

Figure 2. Estimated revenue from stallion fees in Kentucky (2006-2013).