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IN THIS ISSUE

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LLOYD'S

Commentary

The National Animal Health Monitoring Systems (NAHMS) Equine '98 study was the first of its kind and represents a substantial investment by the USDA:APHIS:Veterinary Services with a goal of meeting some of the needs of the equine industry for health and management information.

The baseline information offers the equine industry a benchmark against which to measure future changes. It also has put the equine industry of the United States in the unique position of having the most well-defined parameters regarding the composition, management, and health of their horses of any country in the world.

The Equine '98 study required participation of the National Agricultural Statistics Service (NASS), the National Veterinary Services Laboratories (NVSL), the Agricultural Research Service Laboratory (ARS), and a state and federal field force of veterinarians, animal health technicians, and equine owners and their horses for the study to be a success.

NAHMS has optimized use of data gathered during the study by making it available in many formats. Since spring 1998 when the study was initiated, multiple written publications and presentations have been generated, with more to come.

Copies of the reports and informational sheets are available from The Centers for Epidemiology and Animal Health, 555 S. Howes Street, Fort Collins, Colorado 80521; (970) 490-8000. Electronic copies also are available at *NAHMSinfo@usda.gov*.

Thanks to the Equine '98 study, USDA:APHIS:VS had a better knowledge and working relationship with the equine industry when they assisted in the investigation of the West Nile Virus outbreak both in 1999 and 2000.

Multiple examples of equine health monitoring in the U.S. exist, and Equine '98 is just part of the mosaic of animal health monitoring activities. Horse owners and veterinary practitioners on the front lines are in the ideal position to recognize and report unusual events.

The state veterinarians are the focal point for reporting officially regulated diseases occurring in their jurisdiction. The USDA:APHIS:VS is responsible for regulating the interstate movement of horses with equine infectious anemia (EIA) and also has a testing program at federal import stations for selected diseases. Each component of the U.S. monitoring system is designed to provide information on a specific aspect of animal health.

The time has now come for reasons of cost efficiency, public burden, demands of trading partners, and increased potential for catastrophic consequences for disease outbreaks to develop an integrated approach to animal health monitoring.

The Equine '98 study has provided baseline values for demographics, management and health of equids. The information serves as a basis for the next step toward an integrated, coordinated system that will achieve several objectives. These include tracking and rapidly identifying outbreaks of disease; identifying changing patterns of disease that might signal a new agent or increased virulence of an existing agent; identifying management practices that optimize the health of the equine population, and identifying opportunities for research.

Finally, it provides an opportunity to educate animal owners and veterinarians with information to make better health care decisions. ■

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International

Third Quarter 2000

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

The respiratory form of equine herpes virus infection was diagnosed among various breeds in France, among racehorses at Istanbul racetrack in Turkey, and on two premises in Ireland. Abortions attributable to EHV-1 were reported from Denmark and the paralytic form was diagnosed among non-Thoroughbreds in Norway and a polo pony in Singapore.

Two positive cases of equine infectious anemia (EIA) were recorded out of 20 horses tested in the endemic area of Queensland, Australia. A further report on the EIA outbreak in the south of France indicated that 36 of 53 horses were euthanized at the primary focus site in Var and nine horses euthanized at five other sites based on 550 animals tested.

Three sero-positive equine viral arteritis (EVA) Thoroughbred stallions were identified on two farms in France but virus was not isolated from their semen. Three mares that returned from France to England at the end of the breeding season had sero-converted to EVA.

Influenza was diagnosed extensively among non-Thoroughbreds in France, on one premise in Sweden, and among non-Thoroughbreds and donkeys, which were severely affected on two premises in the south of England.

Turkey reported that no serological evidence of glanders had been found among registered Thoroughbred, Arabian and other registered breeds during their equine disease surveillance program.

Serological evidence of piroplasmosis was reported from Switzerland and a single clinical case was diagnosed at the Istanbul racetrack.

Isolations of Ross River virus (an insect-transmitted alphavirus closely related to Getah virus) were reported from Victoria, Australia.

Strangles was reported widely among the riding and trotting horse population in Sweden, on eight premises in Ireland, and from Australia, Switzerland, and the United Kingdom.

Thirty-two equine cases of West Nile Virus infection were reported from a confined area in the south of France with no reported human cases. ■

Chromosomal Abnormalities in Horses

Consider these horses: Case 1) a potential broodmare with tiny ovaries and showing no apparent estrous cycle; Case 2) a foal with severe limb contractures and metabolic disorders; Case 3) a stakes-winning mare who failed to conceive after two breeding seasons; and Case 4) a young stallion with reduced fertility. All were diagnosed with chromosomal abnormalities.

Normal horses have 64 chromosomes in each cell, 62 autosomes plus 2 sex chromosomes, either XX in a mare or XY in a stallion. Half the chromosomes are inherited from the sire and half from the dam. When the normal chromosome configuration is disturbed, problems arise that range from mild to fatal.

To determine how many chromosomes a horse has, a blood sample is drawn and sent to the laboratory. White blood cells are stimulated to divide by growing them in a special growth medium for 72 hours.

The chromosomes are arrested at a cell cycle stage called "metaphase" and the suspension of cells dropped onto microscope slides. Special staining enables the chromosomes to be viewed under a microscope. Images of the chromosomes are taken, identified, and paired in a standardized array or "karyotype," allowing them to be examined for abnormalities in number or morphology.

The most common chromosomal abnormality found in horses is the absence of one sex chromosome in infertile mares called X monosomy or "XO". An XO mare is the equine equivalent of the human condition called Turner Syndrome, the most common sex chromosome abnormality in humans with an incidence of 1 per 700 live female births. There are no statistics on the incidence of X monosomy in horses.

The mare in Case 1 was an XO mare. XO mares appear normal but may be smaller in size than their contemporaries. They may be excellent performance horses with no apparent problems until they are taken to the breeding shed. These mares generally have tiny, inactive ovaries and show no signs of estrous and are infertile.

Case 2 was a foal with an extra chromosome 31 or "Trisomy 31." This foal had severe skeletal abnormalities and metabolic disorders that made it impossible for the colt to survive. Only 8 cases of equine autosomal trisomy have been reported.

Structural chromosomal abnormalities are rare

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in horses but have been described, including the translocation of one chromosome piece to another chromosome or the deletion of part of a chromosome.

The mare in Case 3 carried a large translocation that caused her infertility and the subfertile stallion in Case 4 had a small deletion in one autosome. It is not yet known which genes influencing fertility reside on the affected chromosomes.

Healthy horses have just the right number of chromosomes in the proper configuration. Minor alterations in chromosomal configuration may be tolerated but cause infertility or poor health, while major alterations may result in embryonic loss or death of a foal.

Karyotyping enables us to identify chromosomal abnormalities. Advances in technology and gene mapping information will enable us to understand how chromosomal abnormalities cause genetic diseases in horses. ■

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National

West Nile Update

Information for this update was derived from the National Atlas of the United States at www.nationalatlas.gov/virusmap.html, the State of New York Department of Health at www.health.state.ny.us, Promed at www.promedmail.org, and USDA at www.aphis.usda.gov.

With the onset of colder weather during November, many states have curtailed their surveillance activities. As of November 27, 2000, 12 states in the northeast have reported the presence of the virus—Connecticut, Delaware, Maryland, Massachusetts, New Hampshire, New Jersey, New York, North Carolina, Pennsylvania, Rhode Island, Vermont, and Virginia—plus Washington, D.C. **(Figure 1)**.

Infection has been reported most frequently in dead birds and mosquitoes, with 18 human cases, including 1 fatality, and 64 equine cases, of which at least 22 were reported fatal.

The state of New York has identified 1,271 positive dead birds of 64 different varieties, 847 of which were crows, distributed over 57 counties, including boroughs of New York City. In the same state, WNV infection has been identified in bats (14), live birds (8), rabbits (3), squirrels (3), cats (2), raccoons (2), and a chipmunk. A positive skunk has been identified in Connecticut.

In New Jersey 1,137 dead birds were positively identified; Connecticut, 1,105; Massachusetts, 442; Rhode Island, 77; Maryland, 50; Pennsylvania, 32; New Hampshire, 7; Virginia, 7; Washington, D.C., 3; and 1 bird each in North Carolina and Vermont.

While flocks of sentinel chickens have been monitored extensively, 6 chickens at 6 sites in New York (2) and New Jersey (4) have so far sero-converted.

WNV has been identified in mosquito pools in New York (357), New Jersey (53), Pennsylvania (46), Connecticut (14), and Massachusetts (4). The majority of positive mosquito pools was clustered around and in New York City.

Several different mosquito species were infected, including species active at dusk and dawn and during the day feeding on avian and mammals. The majority was *Culex pipiens* but also identified were *C. melanura*, *C. restuans*, *C. salinarus* and *Aedes species*, *A. albopictus*, *A. cantator*, *A. japonicus*, *A. triseriatus*, *A. vexans*, *Anopheles punctipennis*, and *Psorophora ferox*.

Of the 18 human cases, 13 were in New York City, 4 in New Jersey, and 1 in Connecticut. The 64 equine cases were in New Jersey (27), New York (24), Connecticut (7), Delaware (3), Massachusetts, Pennsylvania, and Rhode Island. ■

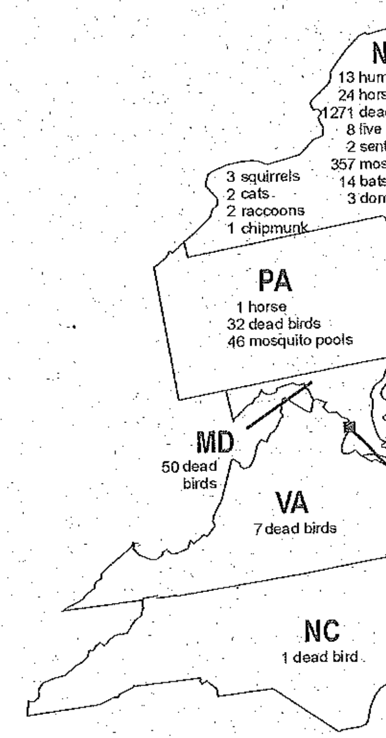
The Risk of EIA in Foals

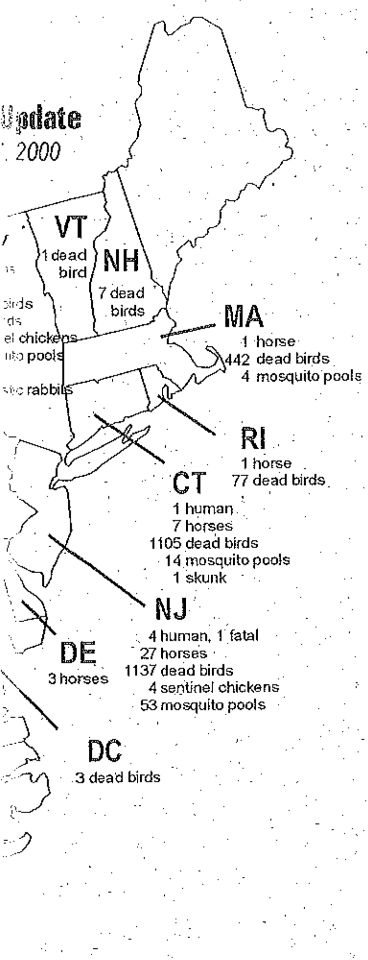
Although it seems counter to logic, acquiring equine infectious anemia (EIA) by being alongside an infected carrier horse may be reasonably rare for a foal. Foals of EIA-positive dams with clinically inapparent infections have an excellent chance of being raised uninfected, even if they have been held together in pasture situations with high populations of mechanical vectors of EIA virus (EIAV). A number of factors contribute to this.

Foals appear to be resistant to infection, but data to support this is not available. In a study early fetuses succumbed to infection with a relatively avirulent strain of EIAV, while fetuses inoculated after 204 days of gestation produced antibodies *in utero* and were born virus- and antibody-positive.

Figure 1.

West Nile Virus
as of November 2





What are the factors that make foals less likely to acquire EIA than adults? The first candidate is passively acquired colostral antibody. Studies suggest that passively transferred antibodies against EIAV may confer a level of protection against disease but do not protect against infection.

Are foals less attractive to vectors, *i.e.*, do they exude fewer or less attractive chemicals to be perceived by the blood- feeding insects? No studies have been conducted demonstrating a statistical difference in attractiveness between foals and adult equids, but we do not know all the cues that vectors use to find their blood sources.

Once the vector perceives a host, defensive behavior of the host often dictates whether or not the vector will feed to repletion or, conversely, repel or interrupt the vector. Small to medium-sized tabanids are more likely to feed to repletion on the first host than larger tabanid species *(e.g., Tabanus americanus)*, provoking defensive behavior in adult horses (twitch, stomp, swish, etc.) that interrupts feeding.

This defensive behavior may be accentuated in foals that literally high-tail it away from active vector pressure or roll in mud. Such aggressive avoidance of vectors reduces the risk of acquiring EIA in foals.

Managing foals of test-positive dams requires monitoring every 14 days by laboratory tests to compare the reactions of the foal relative to that of the mare. They include official tests for EIA to compare sequential samples from the foal, and to test for evidence of active infection using RT-PCR.

The presence of antibodies before colostrum is suckled indicates active infection. At 48 hours of age, the foal should have the highest titer of passive antibodies and their decay should proceed according to the half-life of the antibodies. At its peak, the foal acquires an antibody level roughly equivalent to that of the mare.

The first hint of active infection could be a higher level of antibody than observed in the mare, a consistent titer through time, or the presence of amplifiable RNA signal indicating virus presence in the foal. The prognosis is excellent if, after 60 days of separation $\geq$ 200 yards) from test-positive equids, the antibody continues to decay and is accompanied by an absence of amplifiable viral RNA signal. ■

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Effects of Warm-Up on Performance

Warm-up exercise enhances blood flow to the active muscles and increases muscle temperature. Benefits include better oxygen delivery to exercising muscles, improved enzyme function, and increased range of motion. Until recently, little research on the benefits of warming up for equine athletes had been conducted. In the last five years, studies have shown that warm-up can be beneficial and is related to the type of activity the horse will perform.

Studies have compared exercise responses of horses when they received a mild/moderate warm-up or no warm-up at all. In a study conducted in Australia (Tyler et al, 1996; *Equine Vet J.*, 28:117) 10 minutes of warm-up (walking and trotting) decreased the oxygen deficit accumulated during a high-intensity sprint to fatigue, compared to no warm-up.

A study conducted by researchers at Ohio State University (McCutcheon et al, 1999; *J Appl. Physiol.*, 87:1914) found that warm-up reduced the oxygen deficit and the accumulation of lactate during high-intensity exercise. These results suggest that a warm-up performed shortly before high-intensity exercise, such as racing, will enhance oxygen delivery to exercising muscles.

In another study published in 1996 (Lund et al, 1996; *J. Appl. Physiol.*, 80:2190), horses had better heat dissipation during intense exercise when they completed a moderate warm-up compared to no warm-up. Heat accumulation in muscles can lead to muscle damage; therefore, enhanced heat dissipation may be beneficial to the equine athlete.

While there is a consensus that a warm-up is beneficial, there is still little information on the best warm-up procedure. The best warm-up will prepare the physiological systems, but not contribute to excessive heat accumulation or fatigue. Research in humans has shown that too much warm-up can be worse than no warm-up for certain types of exercise.

Research at the University of Kentucky compared the effects of 13 minutes of mild warm-up (walking) to 13 minutes of intensity-specific warm-up (walk, trot, canter and 20 seconds of gallop) on horses that performed either a high-intensity (near maximal) sprint for 70 seconds or a moderate exercise bout for 210 seconds.

The intensity-specific warm-up resulted in reduced lactate concentrations during the 70-second sprint, but not during the moderate exercise bout.

In the study conducted at Ohio State University, a high-intensity warm-up (7 minutes of low-intensity work followed by three 45-second sprints) resulted in earlier fatigue than a 10-minute low-intensity warm-up.

These results confirm that some warm-up is better than no warm-up and provide new insight into the types of warm-up that may be the most beneficial. When horses are going to perform a short-distance race, a moderate warm-up with a brief sprint may be more beneficial than just walking or performing a slow jog. For longer distance efforts, the benefits of warm-up become less clear.

One important consideration in planning warm-up programs is the environmental temperature. Because some of the benefits associated with warm-up involve an actual warming of the muscles and blood, the amount of exercise required to achieve the same effect may be less when it is hot and more when it is cold.

For example, exercise that causes body temperature to increase 2° F. in 70-degree weather can cause almost a 4° F. increase in hot weather.

To date, research on the effects of warming up on horses has examined metabolic responses. Studies in the future should address effects on tendons, ligaments, joints and neuromuscular function. ■

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Perinatal Asphyxia in Foals

As the 2001 foaling season begins, veterinarians and farm managers have to deal with problems related to delivery of foals. Among these is a condition called perinatal or neonatal asphyxia.

Asphyxia is defined as a decrease in the amount of oxygen supplied to the tissues as a result of a reduction in the amount of oxygen in the blood or the amount of blood flowing to the tissues. Perinatal asphyxia is a syndrome caused by decreased oxygenation of the foal's tissues during the birth process.

Foals may appear normal at birth only to develop clinical signs 6 to 24 hours later; they may be abnormal at birth; or they may be stillborn.

Foals with perinatal asphyxia exhibit an array of clinical signs referable to the central nervous system (CNS) but diarrhea, colic, and decreased urine output may occur. Commonly observed CNS signs include jerky movements, spasms, diminished sucking reflex, wandering, blindness, seizures, and coma.

Causes of perinatal asphyxia include placental abnormalities, dystocia or delayed delivery, twinning, congenital malformations, and maternal illness. Treatment involves good nursing to address the multisystemic nature of the condition designed to correct hypoxia, depression, decreased ventilation, hypovolemia, decreased cardiac output, seizures, sepsis, and gastric ulceration.

At the University of Kentucky Livestock Disease Diagnostic Center, 163 cases of perinatal asphyxia were diagnosed over a 3- year period (1998-2000), which represented approximately 7% of all fetuses 10-11 months of gestation and 1 day of age **(Table 1)**.

A review of cases where sex was indicated revealed that 69% were males and 31% females, with many different breeds represented. A diagnosis was made only in foals after 300 days of gestation with no foals (fetuses) younger than 300 days gestation. Case histories often mentioned dystocia; however, there were many cases in which it was stated that foaling was normal.

Histories sometimes indicated that the placental membranes were improperly delivered or visualized before the foal was observed. In most cases the foal was dead on delivery; however, some were born alive but had weak vital signs and died. Examination did not reveal any one lesion that allowed the diagnosis to be made.

Typical findings at necropsy included partially aerated lungs, petechial hemorrhages in the mucosa of the respiratory tract and on the heart, edema in the mesentery and mesenteric lymph nodes, and hemorrhage into the shoulder joints with reddish staining of the articular cartilage.

The hemorrhage is the result of excessive squeezing of the foal as it passes through the birth canal suggesting a difficult or delayed delivery. Cases of perinatal asphyxia are consistently negative for infectious agents.

The fact that the placenta is passed so quickly after delivery indicates that it must begin detaching from the uterus during or soon after delivery. The foal must be delivered quickly or it risks oxygen deprivation. The potential for injury is great considering the relative size of some foals and the strength of mare contractions.

Pregnant mares should be maintained in good body condition and any illness or condition should be treated. Managers can prevent perinatal asphyxia by monitoring mares for signs of impending parturition and being in attendance for all foalings. Assistance should be given during the delivery process to ensure the foal does not spend excessive time in the birth canal.

If dystocia is encountered, it should be dealt with quickly and veterinary assistance sought if indicated. Foals showing signs of asphyxia should be examined immediately by a veterinarian and appropriate therapy initiated. ■

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Table 1.

Year	Perinatal Asphyxia Cases	Total Cases*	% of Total
1998	51	778	6.5
1999	48	822	5.8
2000	64	773	8.3

*Total equine cases 10 and 11 months gestation and 1 day of age.

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