

BEST MANAGEMENT PRACTICES FOR EQUINE DISEASE PREVENTION

Brett D. Scott*

Animal health officials define an exotic or foreign animal disease as an important transmissible livestock disease that has potentially devastating health and economic impacts but that is currently believed to be absent from the United States and its territories. The U.S. Department of Agriculture's Animal and Plant Health Inspection Service is working with animal health and veterinary professionals to identify, control and eradicate such diseases. Zoonotic diseases are caused by infectious agents that can be transmitted between animals and humans.

Infectious diseases are caused by bacteria, viruses, protozoans, fungi and rickettsiae, which invade a susceptible horse's body and cause an illness.

Most infectious diseases are transmitted from one animal to another by contact with infected urine, feces and other bodily secretions or by the inhalation of germ-laden air droplets. A few are sexually transmitted. Others are acquired by contact with spores or bacteria in the soil, which enter the body through the mouth, respiratory tract, or a break in the skin.

According to the Center for Food Security and Public Health, diseases—zoonotic and otherwise—are transmitted through these routes:

- ▶ **Aerosol transmission:** Infected droplets pass from one animal to another through the air.
- ▶ **Oral transmission:** Disease-causing agents are consumed in contaminated feed or water, or by licking or chewing on contaminated objects.
- ▶ **Direct contact transmission:** A susceptible animal contacts the disease agent through an open wound or mucous membranes, or through blood, saliva, nose-to-nose contact, rubbing or biting. Reproductive diseases can spread directly through mating or *in utero*.
- ▶ **Vehicle transmission:** An inanimate object carries a disease-causing agent from one susceptible animal to another.



- ▶ **Fomite transmission:** Disease agents spread through contaminated food, water and soil. Traffic transmission, a subtype of fomite transmission, is spread when disease-carrying organic material is carried from one location to another. A vehicle, trailer or person can transfer this material between locations.
- ▶ **Vector-borne transmission:** Insects or ticks carry a disease agent from one animal to another. Mechanical transmission happens when the vector carries the pathogen directly from an infected animal to a susceptible animal. Biological transmission occurs when the pathogen undergoes a biological function within the body of the vector before being transmitted to a susceptible animal.

IMMUNITY

Immunity is the ability to resist a particular disease by preventing the development of a pathogenic microorganism or by counteracting the effects of its toxins. An animal immune to a specific germ carries antibodies that destroy that germ before it can cause an illness. Once an animal has contracted a disease, it produces antibodies that will protect against reinfection for a period of time.

Natural, species-specific immunity means a horse does not catch a disease that is specific to cattle; however, some diseases are not species-specific.

*Extension Horse Specialist, The Texas A&M System

Active immunity is acquired through vaccination with killed or live and attenuated germs that stimulate antibody production without causing illness. Active immunity can decrease over time; annual booster shots might be required.

Passive immunity occurs when antibodies are directly transferred from one animal to another. Some animals are born with immunoglobulins and antibodies that they received from their mothers before birth. For horses, however, antibodies are not transferred through the placenta, and the foal must nurse to receive the immunoglobulins and antibodies in the milk.



Photo: Jay Hardy Photography.

MANAGEMENT CONSIDERATIONS

Farm safety and biosecurity covers many factors, but for the horse industry major focus must be given to transportation. The horse industry, for the most part, is very mobile. Whether traveling to and from competitions, trail riding or transporting breeding stock, horse owners must always consider the possibility that their animals may have contact with diseases and bring those diseases back to their farms.

The Canadian Ministry of Agriculture, Food and Rural Affairs states, "Biosecurity refers to management practices that reduce the chances infectious diseases will be carried onto the farm by animals and people and the spread of infectious disease on farms." This is complicated by horses' curious nature and natural inability to resist disease.

A closed herd might be the best management practice, but it is not very practical. Instead, a horse owner can separate the farm into sections or areas and keep

nontransient animals in an area away from the horses that are constantly coming and going.

Separating the broodmares from the show horses can lessen the chance of the mares contracting a disease from the transient horses. If a broodmare does leave the designated area, keep her in another location for at least 30 days. When introducing a new mare into the broodmare area, follow the same 30-day rule.

When introducing a new horse into the operation, know the horse's background and the status of its vaccinations that are appropriate to the new area. Any new horse should be accompanied by a current health certificate, negative equine infectious anemia test, and a record of vaccinations. Remember, a horse can be infected without showing outward symptoms of a disease.

To minimize the risk of introducing a new disease onto the farm, quarantine any new horse away from the other horses for a minimum of 30 days. When the health status and history of the horse is known, the quarantine period may be 3 to 7 days.

Transport new horses in equipment belonging to your farm; afterward, thoroughly clean and disinfect the transportation equipment before using it again. Do not allow the horses to share feeders or watering tanks; do not use grooming tools or equipment on new horses until they are out of quarantine. New horses should be vaccinated during the quarantine period to be current with the farm's vaccination program.

Before handling other horses, personnel who have had contact with new horses must thoroughly clean and disinfect their clothing or change clothing worn while working with quarantined horses. Limit the number of personnel who have contact with quarantined horses.

Any horse that leaves and returns to the farm should be treated as a new arrival. When the animal is away from the farm, limit its exposure to other animals. Use only feed and water containers brought from the home farm. Do not use any equipment, such as lead ropes, saddle pads and blankets, belonging to other horse owners. If your equipment is used by others, clean and disinfect it before returning it to your operation. Do not allow horses to consume feed or water contaminated by feces or urine.

Young and geriatric horses are more at risk for disease than other horses. A foal receives immunity from the colostrum in its mother's milk. Because foals do not receive many vaccines until they are 2 or 3 months old, they should have minimal exposure to other horses.

While aging has been shown to have little effect on the innate immune response, geriatric horses do not produce as many antibodies from vaccination as younger horses do. Older horses also are prone to age-related disorders

such as liver failure, kidney disease, tumors and anemia, which can affect the immune system.

Limiting the number of visitors to the farm can lower the risk of disease; however, many farms offer tours as part of a marketing/promotion plan. Each farm should have a log book for all visitors, and require visitors to list any recent trips to other farms. Visitors' contact with horses should be limited. Make them aware of any areas of the farm not accessible to the public.

The U.S. Department of Agriculture's Animal and Plant Health Inspection Service (USDA-APHIS) recommends that each farm have only one entrance, which is marked as the main entrance, to help monitor the traffic flow. Park all vehicles away from the horses to limit the potential of disease being introduced by the vehicles. The agency also recommends placing a footbath where most visitors enter the farm. For directions on making a footbath, get a copy of the agency's Program Aid No. 1825.

MANAGEMENT OF DISEASE TRANSMISSION

The Center for Food Security and Public Health has these suggestions for minimizing the risk of disease transmission:

- ▶ Aerosol transmission of disease can be lessened by increasing the distance between animals. Wind speed, temperature and humidity can influence this form of disease transmission. Barns should be well ventilated. Have multiple water sources and feeding locations to decrease the number of horses in one area.
- ▶ Oral transmission can be decreased through proper pasture maintenance. Do not allow hay to be contaminated by feces. Check water sources frequently for contaminants that might accumulate from runoff. When traveling with horses, bring grain, hay and water from home, if possible, to lessen the possibility of oral disease.
- ▶ Manage direct transmission by quarantining new arrivals to the farm. Reduce the risk of reproductive disease by making sure the stallion and the mare have had thorough breeding soundness examinations. Mares' examinations should include a uterine culture to identify potential pathogens.
- ▶ To prevent vehicle transmission from an inanimate object, workers should change or thoroughly clean clothing, shoes and equipment after working with new, quarantined or sick horses.
- ▶ Fomite transmission can be reduced if workers do not move items, such as tractors, manure spreaders, wheel-barrows and manure forks, from one area of

the farm into another without making sure that all organic material has been removed.

- ▶ To help prevent insect infestation, remove all standing water from around the barn and water tanks. Make sure that wash racks drain properly. Manure or compost piles should be as far from the barn as possible and removed often.

Complete vector eradication is extremely difficult. Different types of sprays and baits have varying results. Placing birdhouses in the barn area will help with insect control. Releasing wasps that eat fly larvae may help, but insect sprays will kill these wasps.

VACCINATIONS

Vaccines can prevent some infectious diseases in horses, but only if administered before a horse is exposed to a disease. Vaccines are prepared from killed microorganisms; living, attenuated organisms; or living, fully virulent organisms. For most vaccines, a primary and booster vaccination are required. When an animal is exposed to a vaccine, its body makes antibodies to combat the foreign material in the vaccine. If the animal is later exposed to the disease, the body recognizes it and rapidly produces more antibodies.

Although allergic reactions are uncommon, the handler administering vaccines should be able to recognize and treat acute anaphylaxis. Anaphylactic shock is an often severe and sometimes fatal reaction to a second exposure to a specific antigen. Symptoms are respiratory distress, fainting, itching and hives.

The American Association of Equine Practitioners' (AAEP's) *AAEP Guidelines for Vaccination of Horses* covers the recommended vaccination schedules for foals/weanlings, yearlings, performance and pleasure horses, and broodmares for 12 diseases. The American Veterinary Medical Association (AVMA) divided these vaccination recommendations into two categories: core and risk-based. The veterinary association defines core vaccinations as those "that protect from diseases that are endemic to a region, those with potential public health significance, required by law, virulent/highly infectious, and/or those posing a risk of severe disease. Core vaccines have clearly demonstrated efficacy and safety, and thus exhibit a high enough level of patient benefit and low enough level of risk to justify their use in the majority of patients."

The AVMA defines risk-based vaccinations as those that should be used if indicated by a risk-benefit analysis. The need for these vaccinations may vary by region, from population to population within an area, or between individual horses. Consult a veterinarian when developing a vaccination program.

CORE DISEASE VACCINATIONS

Tetanus

Also called lockjaw, this noncontagious bacterial disease spreads through direct and fomite transmission. Horses have less natural immunity to tetanus than other domestic animals and are subject to injuries that may lead to tetanus. Symptoms can appear as early as 1 week after injury or not for several weeks. Wounds may be difficult to locate. Early signs are colic and vague stiffness.

Tetanus toxoid vaccine is recommended for all horses. A booster should be given each year and when the horse is injured or has surgery, if the last dose was more than 6 months earlier. Foals should receive two to three vaccinations, regardless of the vaccination status of the mare. If the dam was unvaccinated, begin the series of vaccinations when the foal is 1 month old; if the dam was vaccinated, begin the series of vaccinations when the foal is 4 months old.

Encephalomyelitis

These zoonotic diseases involve inflammation of the brain and spinal cord. The three mosquito-transmitted infectious diseases that attack the central nervous system of horses are Eastern equine encephalomyelitis, Western equine encephalomyelitis and Venezuelan equine encephalomyelitis. The Eastern is the most virulent, with fatality rates of 75 percent to 90 percent. Reservoirs of this disease exist throughout the country. Continual vigilance and conscientious immunization programs will always be necessary. Western encephalomyelitis is least virulent, with fatality rates of 20 percent to 50 percent. The highly pathogenic form, Venezuelan equine encephalomyelitis, has not occurred in the United States since 1971. However, in 1993 an outbreak of the disease in Chiapas, Mexico, prompted the USDA-APHIS to temporarily increase surveillance and tighten quarantine requirements for equine species entering the United States from Mexico.

Monovalent, bivalent or trivalent horse vaccines are available. Horse owners should choose vaccines based on the prevalence or likely occurrence of the disease. The AAEP guidelines suggest that in endemic areas, boosters for Eastern and Western should be given every 6 months; boosters for Venezuelan are needed only if exposure is threatened. Venezuelan vaccine may only be available as a combination with Eastern or Western vaccine. An annual booster for adult horses and a three-dose series for foals and weanlings are recommended.

Rabies

This fatal, zoonotic disease affects nearly all warm-blooded animals and usually is transmitted by direct contact through the bite of a rabid animal. Although much less likely, virus in saliva, salivary glands or brain tissue can enter the body through other fresh wounds or intact mucous membranes. Usually, saliva is infectious when clinical signs occur, but dogs and cats can shed virus for several days before these symptoms appear.

Viral shedding has been reported in skunks for up to 8 days before signs appear. Infected horses and mules often show extreme agitation, which may be interpreted as evidence of colic, especially when accompanied by rolling.

Rabid horses may bite or strike viciously and, because of their size and strength, become unmanageable in a few hours; some people have been killed outright by these horses. These animals frequently suffer self-inflicted wounds.

Rabies can be prevented by vaccination. The AAEP recommends vaccinating horses where the disease is endemic, but not with modified-live-virus vaccines. A single annual vaccination is recommended; broodmares should be vaccinated before breeding.

West Nile Virus

This mosquito-borne, zoonotic virus was first detected in the United States in 1999. The virus, which causes encephalitis, or inflammation of the brain, has been found in Africa, Western Asia, the Middle East, the Mediterranean region of Europe, and the United States.

Mosquitoes acquire the West Nile virus from birds and transmit it to other birds and animals. Migrating birds may help spread the disease. No documentation on the spread of the disease from infected horses to humans or other animals has been found.

Symptoms of this potentially fatal disease in horses include stumbling or poor coordination, depression or apprehension, weak limbs, partial paralysis and muscle twitching. Currently, no treatment is available, but two licensed vaccines can help prevent the disease in horses. Fort Dodge, Iowa, Animal Health makes a killed West Nile virus vaccine, and Merial Inc. manufactures a live vectored recombinant vaccine. The AAEP guidelines recommend giving an annual booster after the primary series. In endemic areas, boosters are determined by local conditions. For foals and weanlings, a three-dose series is recommended, based on the vaccination status of the dam.

RISK-BASED DISEASE VACCINATIONS

Anthrax

This zoonotic disease is caused by *Bacillus anthracis* and is transmitted by aerosol, direct, fomite and vector methods. Anthrax is most common in herbivores such as cattle, sheep, goats, camels and antelopes. Symptoms depend on the route of infection, the host and the strain. In horses, the first symptoms are high fever, colic and hot, swollen areas on the neck, throat and belly.

Horses develop rapid breathing, stupor, staggering gait and coma, and then die. The disease also causes bloody discharges, particularly from the rectum. Spores can remain infective in soil for many years, endangering grazing livestock.

Anthrax can be controlled through vaccination and quarantine. The non-encapsulated Sterne-strain vaccine is used for livestock. Vaccinate livestock 2 to 4 weeks before seasonal outbreaks are expected. Do not administer antibiotics within 1 week of inoculation with a live vaccine.

Additional control procedures are necessary to contain the disease. Soil can be decontaminated with formaldehyde if not excessively contaminated. The process generally requires removing the soil. Carcasses in suspected confirmed cases should be burned.

Botulism

This disease, which is transmitted orally, is an intoxication rather than an infection. It results from ingesting toxin in decaying carcasses or vegetable materials such as grass, hay, grain or silage. Shaker foal syndrome is caused by the ingestion of botulism bacteria spores. Affected foals, usually less than 4 weeks old, may be found dead without warning signs; most often, they show progressive symmetric motor paralysis. Other symptoms are stilted gait, muscle tremors and the inability to stand for more than 4 to 5 minutes. Death usually occurs 24 to 72 hours after the onset of clinical signs.

The AAEP guidelines recommend vaccinating foals and weanlings in endemic areas. This three-dose series of toxoid is given at 30-day intervals starting at 2 to 3 months of age. Foals from nonvaccinated mares may benefit from inoculations at 2, 4 and 8 weeks of age; transfusion of plasma from vaccinated horses; or antitoxin. Broodmares should receive a three-dose series at 30-day intervals, with the last dose 4 to 6 weeks prepartum, and annually thereafter, 4 to 6 weeks prepartum.

Equine Herpesvirus

This acute respiratory disease, also known as equine viral rhinopneumonitis and equine abortion virus, is spread by aerosol, oral and fomite transmission. The primary symptom is a copious nasal discharge, which can become pus-like. Infected foals may develop a dry cough. Severe or fatal foal pneumonia is the major complication of rhinopneumonitis. In pregnant mares, the disease can cause epidemic abortions late in pregnancy, weeks or months after exposure to the virus.

Frequent vaccinations are required to maintain resistance. The AAEP recommends a 6-month revaccination interval for horses less than 5 years old, horses on breeding farms or in contact with pregnant mares, and performance horses at high risk. Give special attention to foals, yearlings, stallions and broodmares.

Equine Viral Arteritis

Most horses are exposed to this virus, which is spread through aerosol and reproductive transmission, but only a few develop symptoms.

Horses with the disease might have fever, anorexia and depression; clinical signs of respiratory infection caused by the virus are serous nasal discharge and cough. These signs last 2 to 9 days.

A carrier state occurs in some stallions following natural infection and is primarily responsible for the virus's persistence in the horse population. Manage these carrier stallions to avoid accidentally spreading the virus to other horses. Breed these stallions only to naturally immune mares or mares that have been adequately immunized.

Infected fresh-cooled or frozen semen also can spread the virus. Test semen used for artificial insemination, especially if imported.

This preventable disease can be controlled by sound management practices and selective use of a modified-live virus vaccine. The AAEP suggests vaccinating breeding stallions and teasers annually, 28 days before the start of breeding season. Vaccinated mares do not develop clinical signs even though they become transiently infected and may shed virus for a short time.

Although the vaccine is safe for stallions and nonpregnant mares, do not use it in pregnant mares, especially in the last 2 months of gestation, or in foals less than 6 weeks old, unless the risk of exposure to natural infection is high. Annual vaccinations should be given to colts intended to be breeding stallions. Before the initial vaccination, intact males and horses intended

for export should be confirmed negative for antibodies to the disease. Testing should be performed shortly before, or at, the time of vaccination.

Influenza

Sometimes called the “flu,” this contagious illness is caused by two species of myxovirus that attack the respiratory system. The infection in the lower respiratory tract can lead to pneumonia. Young and older horses are more susceptible to influenza. The main symptom is a dry, hacking cough that later becomes moist and productive. Isolate infected horses to prevent the spread of the disease.

Two types of vaccines are available for horses: an inactivated injectable and an intranasal modified-live virus. The AAEP recommends a series of at least three doses for foals beginning at 6 months of age. Use the inactivated vaccine for prepartum booster in broodmares. Vaccinate mature horses twice a year if they are at high risk.

Potomac Horse Fever

This diarrheal disease, which spreads through oral transmission, is accompanied by mild abdominal discomfort. Some horses develop severe toxemia and dehydration; up to 40 percent develop laminitis. Pregnant mares may abort several months after having the disease.

The disease often occurs in spring, summer and early fall, and is associated with pastures on creeks or rivers. Several inactivated, whole-cell vaccines are available. The AAEP recommends a revaccination interval of 3 to 4 months when the disease risk is high. Foals should receive a two-dose series beginning at 5 months of age.

Rotavirus A

This highly contagious disease, spread by oral transmission, causes inflammation of the intestines in foals up to 6 months old; most cases occur in 2-month-old foals when natural antibody levels decline. Older horses usually do not develop the disease but may be carriers.

The AAEP recommends testing foals for the level of colostral antibodies. Pregnant mares should be vaccinated in each pregnancy at 8, 9 and 10 months of gestation. Vaccination is not recommended for foals or for other classifications of horses.

Strangles

Infectious and contagious, this disease is characterized by abscesses of lymphoid tissue in the upper respiratory tract. The incubation period is 3 to 14 days. The first symptom is fever; within 24 to 48 hours, the horse will have a nasal discharge, depression and enlarged lymph nodes that can cause difficulty in swallowing and breathing. Older animals with residual immunity may develop nasal discharge, cough and mild fever. This disease causes high morbidity and low mortality in susceptible animals.

Transmission occurs through aerosol, oral and fomite means. The organism can survive 7 to 9 weeks outside the host. Paddocks and barn facilities used by infected horses are contaminated for about 2 months after the end of an outbreak. All equipment should be disinfected to prevent the spread of the disease.

Metastatic strangles, referred to as bastard strangles, causes non-visible abscesses, particularly in the lymph nodes of the abdomen and, less frequently, the thorax.

Mature horses should be vaccinated semiannually. Vaccines containing M-protein extract may be less reactive than whole-cell vaccines. Foals as young as 4 weeks may safely receive the intranasal strangles vaccination.

OTHER EQUINE DISEASES

Adenovirus

This mild respiratory illness of young horses spreads through oral transmission. However, this virus group can cause serious illness or death in neonatal foals without maternal antibodies. In Arabian or part-Arabian foals with a combined immunodeficiency syndrome, adenovirus infection is fatal. Adenoviruses appear to cause serious illness only in foals without normal immunity.

African Horse Sickness

This acute, insect-borne viral disease is endemic to Africa. Symptoms are the same as those associated with respiratory and circulatory impairment.

At the first signs of the disease, eliminate affected horses and vaccinate noninfected horses with polyvalent vaccine; then let them rest for 2 weeks.

Horses entering the United States from African countries are quarantined for 2 months and then tested for the virus. The presence of antibodies does not prevent importation of horses into countries free of the disease.

Brucellosis

This zoonotic disease spreads by direct and fomite transmission. Horses become infected by consuming contaminated feed or water, or by bacteria passing through the mucous membranes. Nonspecific symptoms include intermittent fever, listlessness, muscle stiffness and reluctance to move. The two main conditions, fistulous withers and poll evil, occur when the bacteria enters through a break in the skin, causing one or more draining, pus-discharging sinus tracts, or fistulas.

These wounds can close spontaneously or with treatment, but often recur. If conditions become chronic, wide surgical removal of infected tissue is required.

Keep horses away from infected cattle. Do not allow horses into pastures used by infected cattle for at least 3 months. A vaccination program is not available.

Clostridial Enterocolitis

This acute, sporadic disease of horses is characterized by diarrhea and colic.

Transmission occurs orally. The condition has also been referred to as idiopathic colitis; evidence now shows that these organisms are responsible for enterocolitis in horses.

No proven products are available to immunize horses or foals against *clostridial enterocolitis*. When several foals have the disease, implement preventive measures by administering oral probiotics to foals soon after birth and vaccinating pregnant mares twice at 2- to 4-week intervals at least 1 month before foaling. The *Clostridium perfringens* type C and D toxoid and antitoxin are not approved for use in horses; however, these products have been used by some owners because of the high mortality rate in foals with clostridial enterocolitis. Adverse reactions to the *Clostridium perfringens* type C and D toxoid have been reported in broodmares.

Contagious Equine Metritis

An acute, highly contagious venereal disease of horses, this condition is spread reproductively and is characterized by a profuse discharge of pus from the vagina. Infected stallions and chronically infected mares

show no clinical signs. The disease occurs primarily in Europe.

Treat stallions by thoroughly cleaning the extended penis with chlorhexidine surgical scrub, then applying nitrofurazone ointment. Repeat the treatment daily for 5 days; retest the stallion at least 10 days after treatment.

Most mares rid themselves of uterine infection after a few weeks. Those that become chronically infected harbor the disease in the clitoral fossa or sinuses. Treat these mares by thoroughly cleaning the clitoral area with chlorhexidine surgical scrub and applying nitrofurazone ointment.

Control of the disease depends on identifying carrier animals and then treating them or eliminating them from breeding programs. Many countries have strict import regulations to avoid the introduction of this disease, and at present it is uncommon.

Equine Infectious Anemia

This condition is caused by a retrovirus specific to equines. Transmission is by vehicle and vector. Although most persistent infections are mild, in epidemics the condition can cause high morbidity and mortality. Infection can be accurately diagnosed with laboratory tests. Because no effective and safe vaccines or treatments are available, many countries have control programs based on serologic testing.

Antibody-positive animals should be kept about 200 meters from other horses, except for the progeny of test-positive mares, which may possess maternal antibodies. In most cases, protection wanes by 6 to 8 months of age.

Vesicular Stomatitis

This viral disease is caused by two serotypes of vesicular stomatitis virus—New Jersey and Indiana.

These zoonotic viruses may cause influenza-like symptoms in people who come in close contact with the virus, including laboratory workers and those who work with infected animals. Symptoms in horses include ulceration of the mouth, nose, tongue, coronary bands and teats, along with crusting lesions of the muzzle, ventral abdomen and sheath.

The virus can be transmitted through contact with infected animals or by blood-feeding insects. Ulcers are the most common lesion. Loss of appetite because of mouth sores and lameness caused by foot lesions clear up quickly because the disease usually runs its course within 10 to 14 days. Virus-neutralizing antibodies to either serotype persist for about 5 years, but reinfection can occur following a second exposure.

Vesicular stomatitis outbreaks happen sporadically in the United States, but since the 1980s have been limited to Southwestern states.

ECONOMIC IMPACT OF VACCINATION PROGRAMS

Preventive and emergency health care costs account for about 16 percent of the total annual cost to maintain a horse. Preventive health care represents 6 percent of the total 16 percent, and 2 percent of the total cost is for core vaccinations. These percentages do not include office/trip charges or professional fees and are based only on the cost of the vaccines themselves and could increase if multiple vaccinations are required.

A horse owner might save about 2 percent of the annual cost by not inoculating the horse with the core vaccines; however, the cost of not vaccinating can far outweigh the potential savings.

For example, the cost of a single rabies vaccine is about 0.59 percent of the annual cost of keeping a horse. If an unvaccinated horse contracts rabies, the horse owner may not only lose that horse, but also incur the costs of testing and isolating other animals, disposal fees and treating any people exposed to the animal. The cost of vaccinations and medical care for one person will equal or exceed the entire cost of keeping one horse for a year.

SUMMARY

Horse owners should implement wise management practices to minimize their animals' exposure to disease and, should a disease occur, prevent its spread. Many factors contribute to disease prevention or lessening the spread. Diseases can cause catastrophic losses on any type of farm and many not involve only your animals. Consult a veterinarian when establishing the best management practices for your farm.

REFERENCES

- Arnoldi, Joan M., 1998, *Part II / Critical Foreign Animal Disease Issues for the 21st Century*, Joan M. Arnoldi, [Foreign Animal Diseases, Revised 1998]
School of Veterinary Medicine, University of Wisconsin-Madison. *Zoonotic Diseases Tutorial*.
- Hammer, Carolyn, 2005, *Equine Biological Risk Management*. Iowa State University. www.cfsph.iastate.edu
- Griffin, James M., and Tom Gore, 1998, *Horse Owner's Veterinary Handbook*. Second Edition. Howell Book House. New York.
- Wright, B., 2000, *Biosecurity for Horse Farms*. Fact Sheet. ISSN 1198-712X.
- U.S. Department of Agriculture/Animal and Plant Health Inspection Service. Biosecurity, 2005, *The Key to Keeping Your Horses Healthy*, Program Aid No. 1825.
- Friedman, Ron, *How Vaccines Help Horses Fight Disease*. <http://www.oregonequine.com>
- Guidelines for Vaccination of Horses*. 2008. <https://aaep.org/horse-owners/owner-guidelines/owner-vaccination-guidelines>
- West Nile Virus*. 2004. Factsheet. U.S. Department of Agriculture/Animal and Plant Health Inspection Service, Veterinary Service.
- Eastern Equine Encephalomyelitis*. 2003. Factsheet. U.S. Department of Agriculture/Animal and Plant Health Inspection Service, Veterinary Service.
- Venezuelan Equine Encephalomyelitis*. 2002. Factsheet. U.S. Department of Agriculture/Animal and Plant Health Inspection Service, Veterinary Service.
- How to control Equine Herpes Virus on your farm/stable*. The Merck Veterinary Manual Ninth Edition, pp. 1203- 1205.
- The Merck Veterinary Manual*. 2006. <https://www.merckvetmanual.com/>
- A Review of Equine Zoonotic Diseases: Risks in Veterinary Medicine*. 2002. American Association of Equine Practitioners' Proceedings, Vol. 48. p. 362.