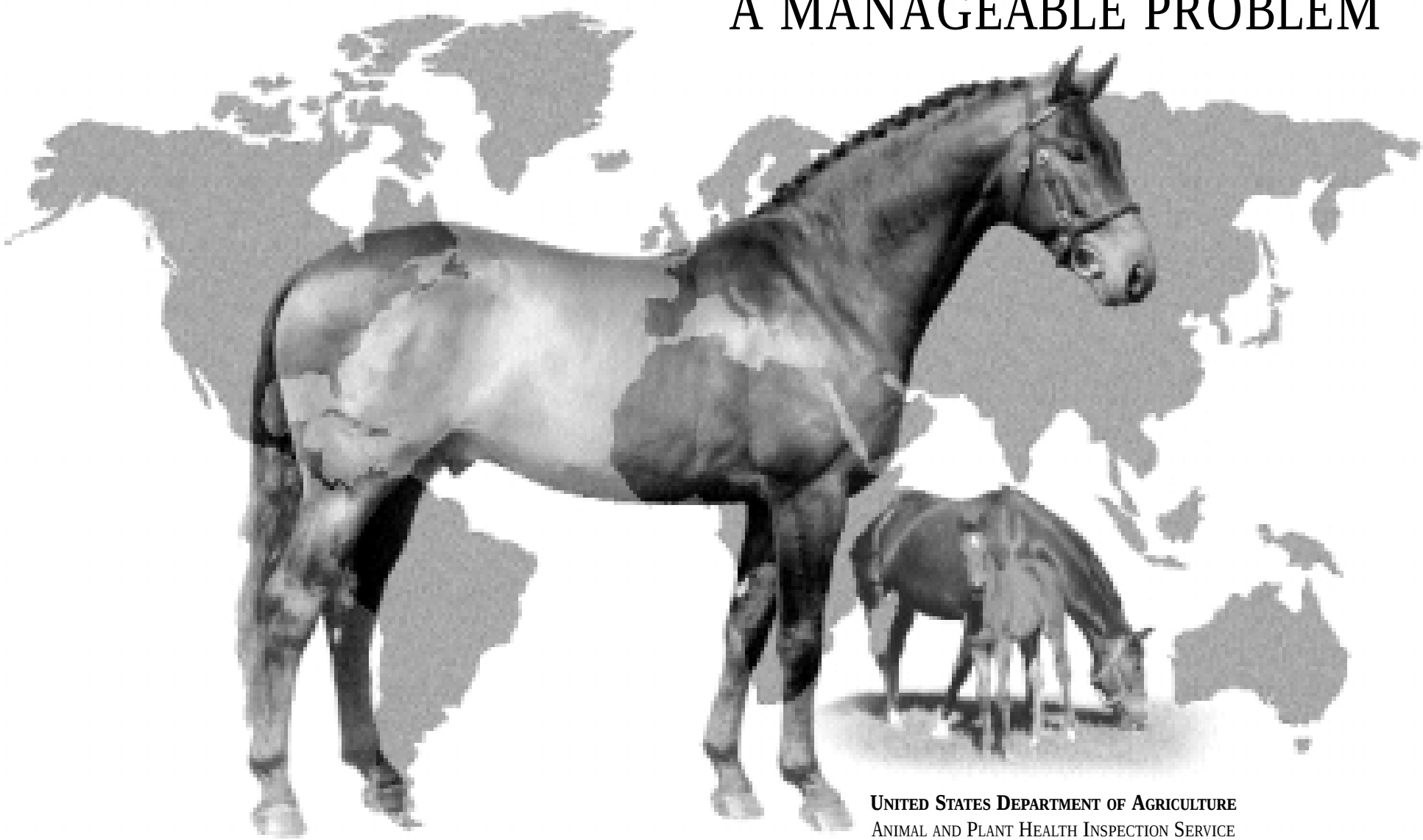
EVA

EQUINE VIRAL ARTERITIS

A MANAGEABLE PROBLEM



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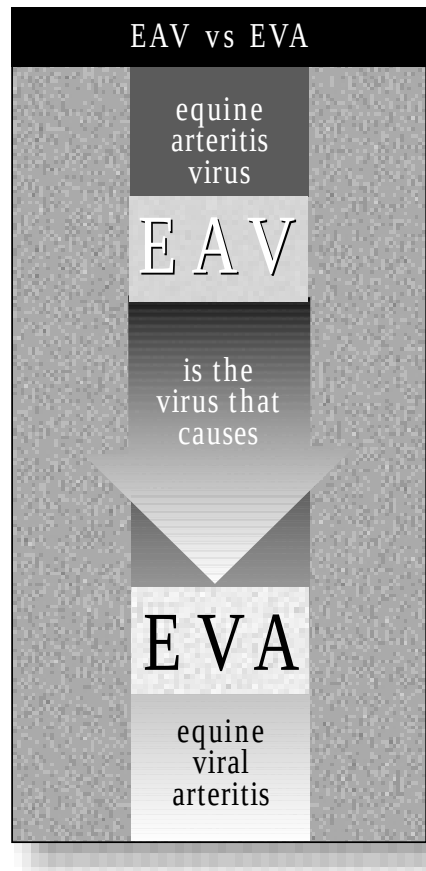
INTRODUCTION

In the past 15 years, few equine diseases have stimulated more interest or gained greater international notoriety than equine viral arteritis (EVA).

The disease was thrust into the limelight of industry attention following a 1984 epidemic on a large number of Thoroughbred breeding farms in Kentucky. No outbreaks of EVA had previously been reported in Thoroughbreds in North America. At the time, many people feared that a strain of the causative agent, equine arteritis virus (EAV), had emerged that was likely to spread within the largely antibody-negative Thoroughbred population, causing disease and extensive outbreaks of abortion. The international community took the threat posed by EVA so seriously that it placed major restrictions on the movement of horses from the United States. Many of these restrictions are still in force. EVA remains a considerable impediment to international trade in equids and semen.

In contrast to how EVA has been regarded internationally, the U.S. horse industry has traditionally attached relatively little significance to this disease. Over the past several years, however, the American Horse Council, American Association of Equine Practitioners, and United States Animal Health Association have stressed the importance of controlling EVA at the national level. Their efforts have been hampered by the lack of awareness of the disease and its potential economic consequences among most sectors of the Nation's horse industry. Recent findings from the U.S. Department of Agriculture's (USDA) National Animal Health Monitoring Systems Equine '98 Study have confirmed that the great majority of those surveyed had little if any knowledge about EVA itself, let alone why it should be prevented or how to do so.

This brochure and companion video, produced and directed by the USDA's Animal and Plant Health Inspection Service (APHIS), aim to educate you—the horse owners and breeders of the United States—about EVA. Your involvement and support are critical to the effectiveness of any industry-driven disease-control program. We hope you will use these materials to increase your general awareness of EVA, gain a clearer understanding of its true veterinary medical and economic importance, and above all, recognize that much of what has been said about this disease since 1984 was misinformation. Based on what is currently known about EVA and how to prevent it, spread of the disease can be controlled. To be successful, however, a control program must be a cooperative effort involving members of the horse industry, private-sector veterinarians, and Federal and State animal health officials.



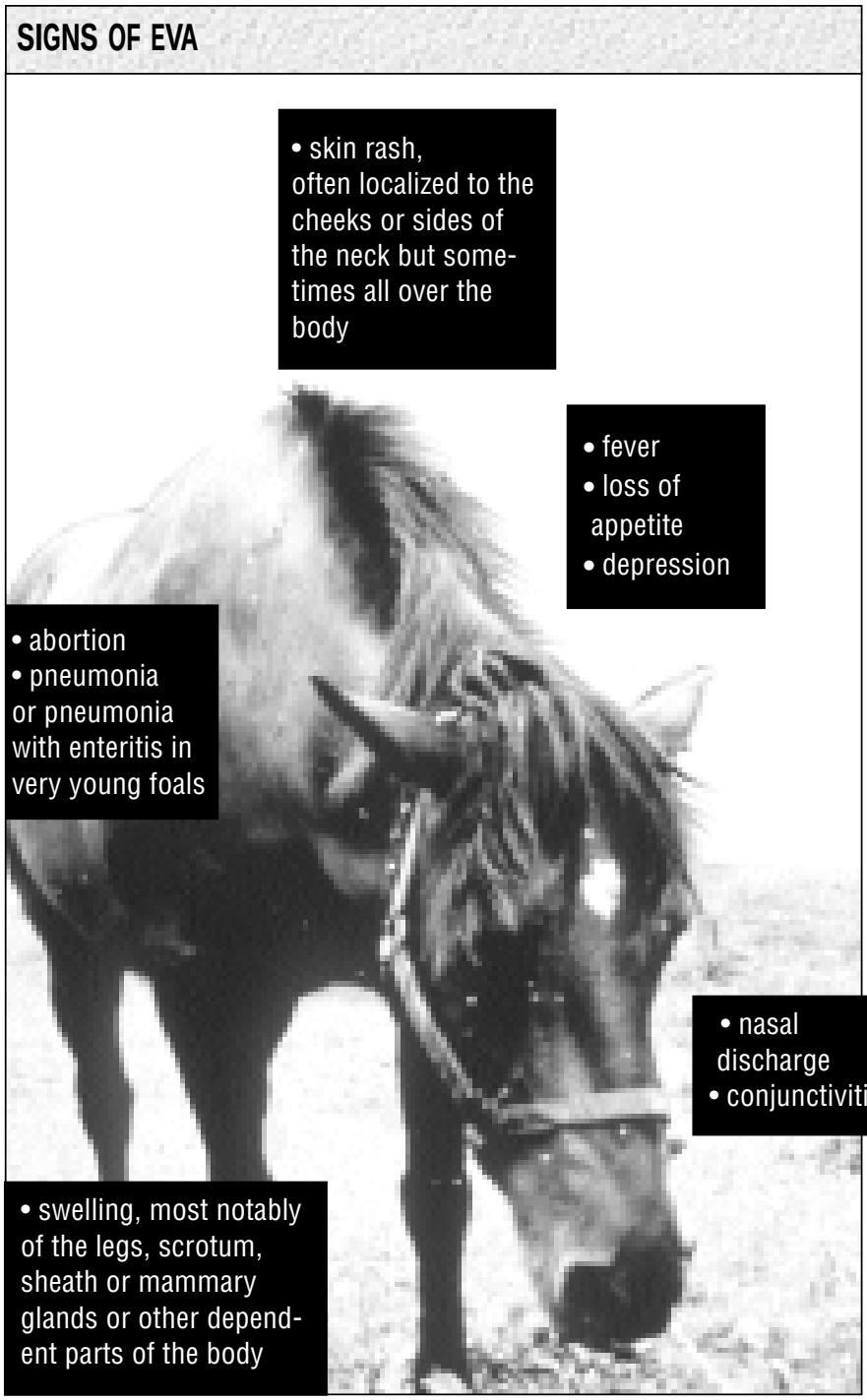
FACTS AND FICTION ABOUT EVA

Few equine diseases have been the subject of more misinformation or misperception than EVA. It is an acute, contagious viral disease known to affect horses and other members of the equid family only. EVA is not transmissible to humans or other domestic species. Like influenza and rhinopneumonitis, it is considered primarily a viral infection of the equine respiratory tract.

Contrary to the opinion of some at the time, the 1984 epidemic in Kentucky was not the first in North America or elsewhere. The veterinary literature details outbreaks of a clinically indistinguishable disease in Germany and Great Britain in the latter part of the nineteenth century. The first virologically confirmed outbreak of EVA in the world occurred on a Standardbred breeding farm near Bucyrus, OH, in 1953. Little concern was expressed at the time or indeed over the subsequent 30 years in spite of the fact that the virus had been shown to be capable of causing contagious respiratory disease and abortion in mares.

In contrast to the misperception that prevails in some coun-

SIGNS OF EVA



tries, EVA is not a disease that occurs primarily in the United States. Nor is the causal agent, EAV, particularly limited in its distribution in horse populations throughout the world.

Considerable confusion still exists over the incidence of outbreaks of EVA and the clinical outcome in cases of naturally acquired infection with the virus. In spite of its relatively widespread global distribution, EAV is seldom associated with outbreaks of disease in susceptible populations of horses or other species of equids. Detailed investigation of outbreaks of EVA over the years has confirmed that the vast majority of cases of acute infection with EAV are asymptomatic. That is, most infections are not associated with the development of any observable clinical signs of disease. There are indications, however, that the incidence of EVA has increased over the past 10–15 years, due in part to greater industry awareness of the disease, more widely available laboratory capability to diagnose this infection, and continued expansion in international trade in horses and semen.

Confusion also prevails over the veterinary medical importance of EVA. First, it should be emphasized that most horses naturally infected with EAV display no visible signs of disease. The term EVA refers to a specific disease syndrome—a particular set of clinical signs that certain horses or other equines acutely infected with EAV may develop. The term is not applicable to cases of acute EAV infection where there is no clinical evidence of disease.

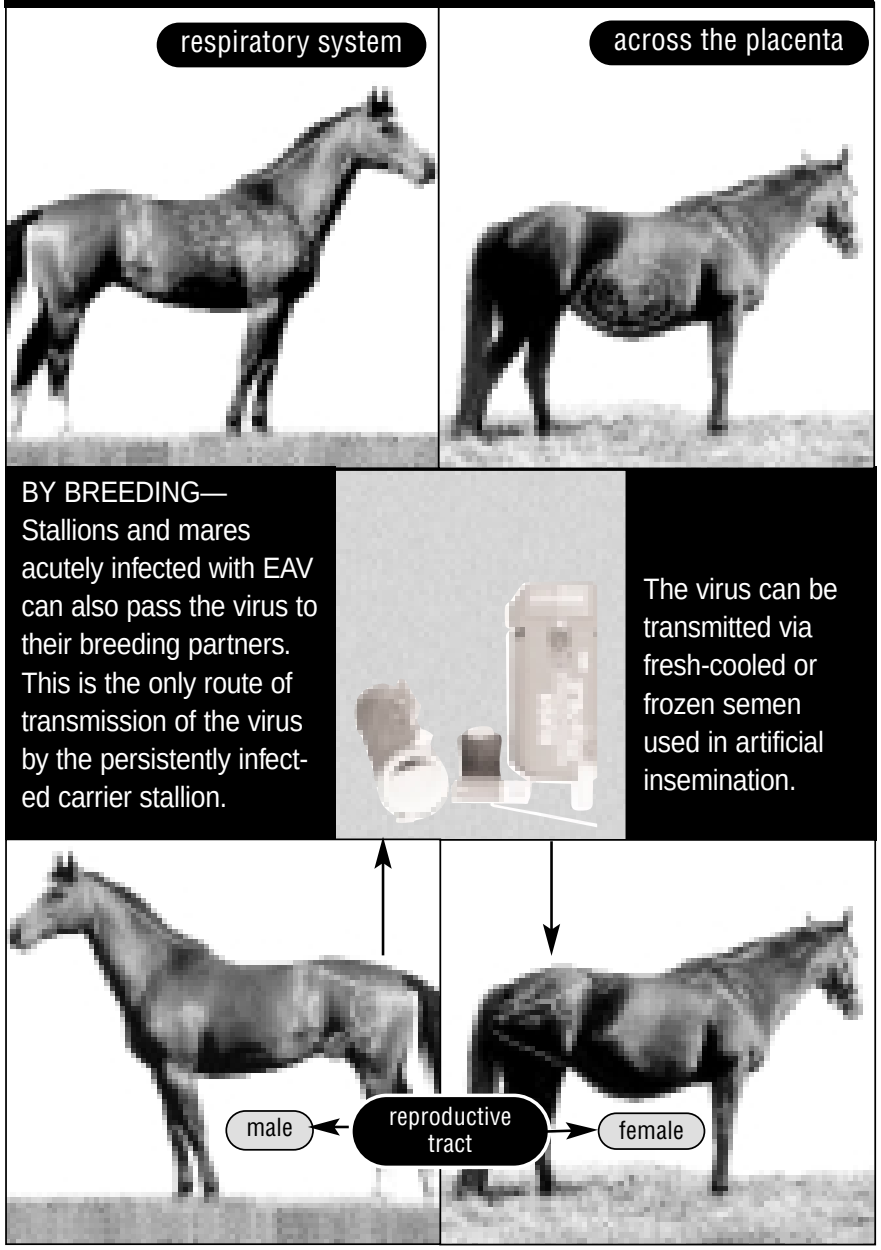
Much misinformation about the medical significance of EVA can be traced back to reports in the earlier veterinary literature that describe severe disease with a case-fatality rate as high as 40–60 percent, even in older horses. What is frequently not realized is that these descriptions refer to infection in horses with an experimentally derived variant of the virus isolated in 1953. They do not represent the type and severity of clinical disease observed in field outbreaks of EVA. Mortality is very infrequent in the field. Mortality has been reported in neonatal foals congenitally infected with the virus and, uncommonly, in foals up to a few weeks of age.

The vast majority of animals affected with EVA make total clinical recoveries. In the 40–50 years since EVA was first identified, no naturally occurring, highly pathogenic strains of the virus have been reported or isolated.

THE MOST COMMON MEANS OF EAV TRANSMISSION

BY AIR—The respiratory secretions of horses acutely infected with EAV carry large quantities of the virus

BY MARE TO UNBORN FOAL—EAV can pass across the placenta from an infected mare to the foal in her uterus.



BY BREEDING—Stallions and mares acutely infected with EAV can also pass the virus to their breeding partners. This is the only route of transmission of the virus by the persistently infected carrier stallion.

The virus can be transmitted via fresh-cooled or frozen semen used in artificial insemination.

Geographic Distribution of EAV

EAV is distributed in various horse populations throughout the world. It has been reported from countries in North and South America, Europe, Africa, Asia, Australia, and New Zealand. Outbreaks of EVA, though relatively infrequent, are often associated with the movement of horses or shipment of semen. Widespread dissemination of the virus can occur on breeding farms and at racetracks, sales, or horse shows, where horses are closely congregated. The global distribution of EAV has been and continues to be influenced significantly by the international movement of stallions that are carriers of the virus and by the shipment of infective, fresh-cooled or frozen semen.

The prevalence of EAV infection differs considerably both among countries and among particular horse breeds in the same country. Various serological surveys carried out in the United States have shown that infection with EAV can be endemic in some breeds (e.g., Standardbreds) but not in others (e.g., Thoroughbreds and Quarter Horses). There is no evidence, however, that different breeds vary in their inherent susceptibility to infection with EAV.

Clinical Outcome of EAV Infection

EVA is principally a disease of the respiratory system that can affect horses of any age. Importantly, most horses that are naturally exposed to EAV develop no signs of disease and are considered asymptomatically infected with the virus. The clinical outcome following infection with EAV is influenced by a variety of virus, host, and environmental factors. Severity of disease is likely to be greater in very young or old horses and in debilitated animals.

In cases where illness develops, the incubation period is usually 3–7 days but can be longer. Clinical signs vary in range and severity. Affected animals may exhibit some or most of the following:

- Fever;
- Swelling (edema), most notably of the legs, scrotum, sheath or mammary glands or other dependent parts of the body;
- Loss of appetite (anorexia);
- Depression;
- Nasal discharge, initially watery (serous) but frequently becoming mucoid later;

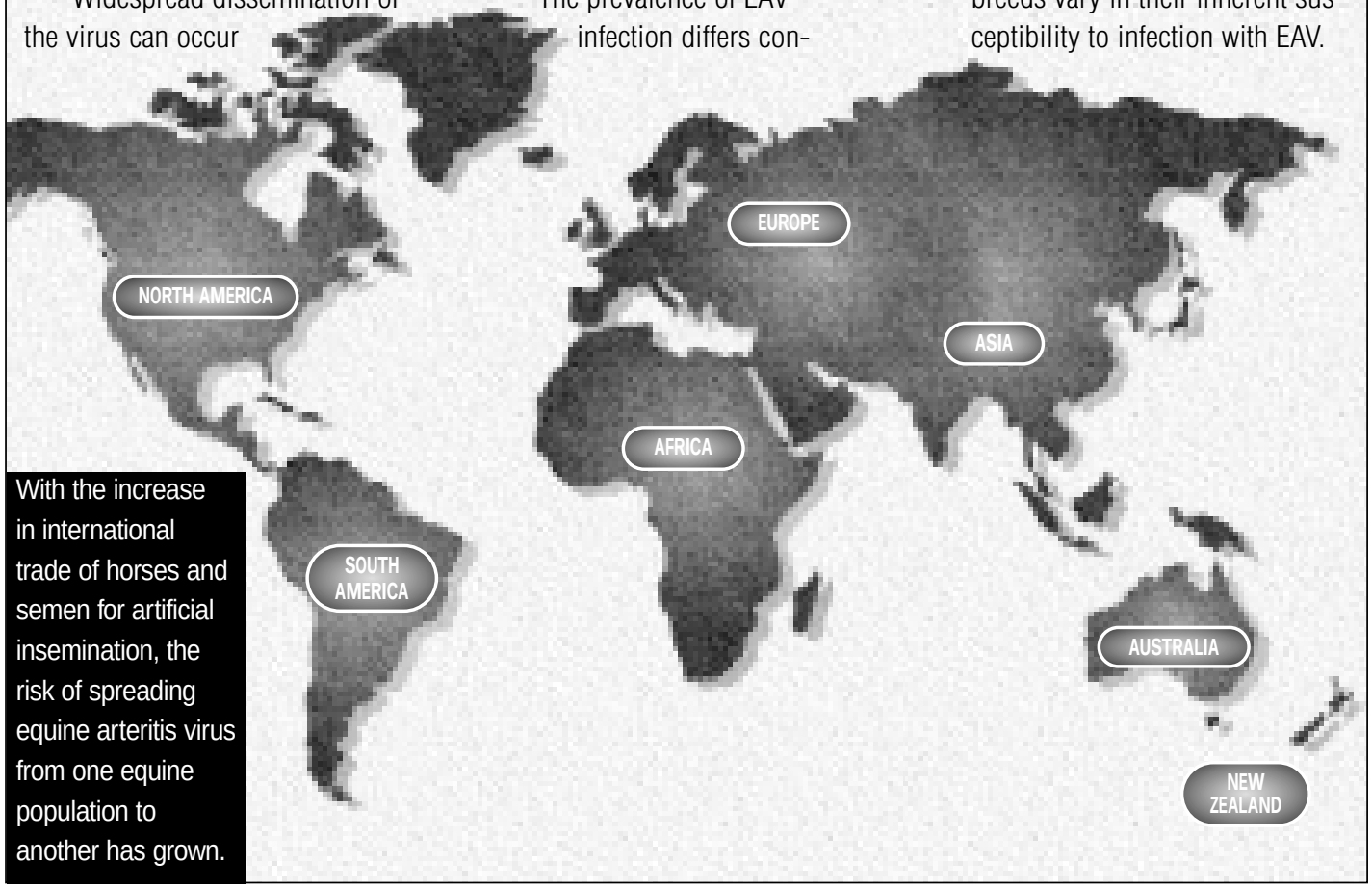
INCIDENCE

GEOGRAPHIC DISTRIBUTION OF EQUINE ARTERITIS VIRUS

Equine arteritis virus is found in various horse populations throughout the world. It has been reported from countries in North and South America, Europe, Africa, Asia, Australia and New Zealand. EVA outbreaks don't occur often, but when they do, they are frequently associated with the movement of horses or shipment of semen.

Widespread dissemination of the virus can occur on breeding farms and at racetracks, sales or horse shows, where horses are closely congregated. There is growing evidence that the global distribution of EAV has been, and continues to be, influenced significantly by the international movement of stallions that are carriers of the virus and by the shipment of infective, fresh-cooled or frozen semen.

The prevalence of EAV infection differs considerably both between countries and between particular horse breeds in the same country. Various serological surveys carried out in the United States have shown that infection with EAV can be endemic in some breeds, such as Standardbreds, but not in others, such as Thoroughbreds and Quarter Horses. There is no evidence, however, that different breeds vary in their inherent susceptibility to infection with EAV.



With the increase in international trade of horses and semen for artificial insemination, the risk of spreading equine arteritis virus from one equine population to another has grown.

- Conjunctivitis that may be accompanied by tearing down the face and swelling above or around the eyes;
- Skin rash (urticaria), often localized to the cheeks or sides of the neck but sometimes generalized over the body;
- Abortion; and
- Pneumonia or pneumonia with enteritis in very young foals.

Many strains of EAV can cause abortion in pregnant mares, with abortion rates varying from 10 percent to as high as 70 percent. Abortion occurs late in the acute phase or early in the convalescent phase of the infection and not, as some would believe, months after virus exposure has taken place. Abortion has been observed as a sequel to either clinical or asymptomatic infection with EAV. It is often the result when an unprotected or first-time EVA-vaccinated mare that has very recently been bred with virus-infective semen is commingled with one or more pregnant mares.

Stallions acutely affected with EVA may experience a period of temporary subfertility that can last up to 8 weeks. No long-term adverse effects on fertility have been reported in recovered stallions or in stallions that remain persistently infected with the

virus. Similarly, there is no scientific evidence that mares infected with EAV experience any short- or long-term, virus-related fertility problems. Horses in training can experience a period of impaired performance while acutely infected with the virus, but fortunately this is brief.

Except for EVA in young foals—and this occurs very infrequently—the vast majority of horses affected with the disease make total clinical recoveries, with or without symptomatic treatment. Where indicated, treatment of cases of EVA is symptomatic and aimed primarily at alleviating the severity of some of the clinical signs of the disease (e.g., control of fever and reduction of dependent edema). Adequate rest during the recovery period is important, especially for breeding stallions and horses in training.

How EAV Is Spread

While EAV can be spread among horses in a number of ways, the most common routes are respiratory (by the acutely infected animal) and venereal (by the acute or chronically infected stallion).

Large quantities of EAV are shed into the respiratory tract of acutely infected horses, and the virus spreads to other animals through direct contact with exhaled infective respiratory secretions. This is the principal means of dissemination of EAV during outbreaks at racetracks, shows, sales, and veterinary hospitals. It is also an important means of transmission on breeding farms. In addition, EAV can be spread through venereal contact with the semen of an acutely infected stallion or the reproductive tract secretions of an acutely infected mare. A teaser stallion or nurse mare can be a potential sources of infection for outbreaks on breeding farms.

The chronically infected or carrier stallion plays a major role in venereal transmission of the virus whether mares are bred by "live cover" or by artificial insemination. Another danger is venereal spread of EAV through the use of infective, fresh-cooled or frozen semen.

Mechanical spread of EAV can occur, though this route is believed to be less common. Virus-contaminated tack or equipment shared among horses can be a source of the virus for new hosts, and EAV can also be transported on the hands or clothing of personnel handling the animals.

Finally, EAV can be transmitted across the placenta from an infected pregnant mare to her unborn foal. In such cases, the fetus, fetal fluids, placenta, and placental fluids are plentiful sources of virus.

Persistent EAV Infection in the Stallion

A variable percentage of stallions infected with EAV may become long-term carriers and reservoirs of the virus. The carrier state has been identified only in stallions whose blood is positive for antibodies to the virus. Such animals show no clinical signs of disease nor any adverse effects on fertility, in spite of harboring the virus in certain of the accessory sex glands. Duration of virus persistence can vary greatly in individual stallions, ranging from a period of several months to many years. A small percentage of carrier stallions successfully clear the virus from their reproductive tract and are no longer a source of infection. EAV is shed constantly in the semen of carrier animals, and transmission of the virus occurs solely by the venereal route. Transmission rates as high as 100 percent can take place in mares bred by live cover or artificial insemination.

Currently, there is no proven nonsurgical means of eliminating EAV from a carrier stallion's reproductive tract.

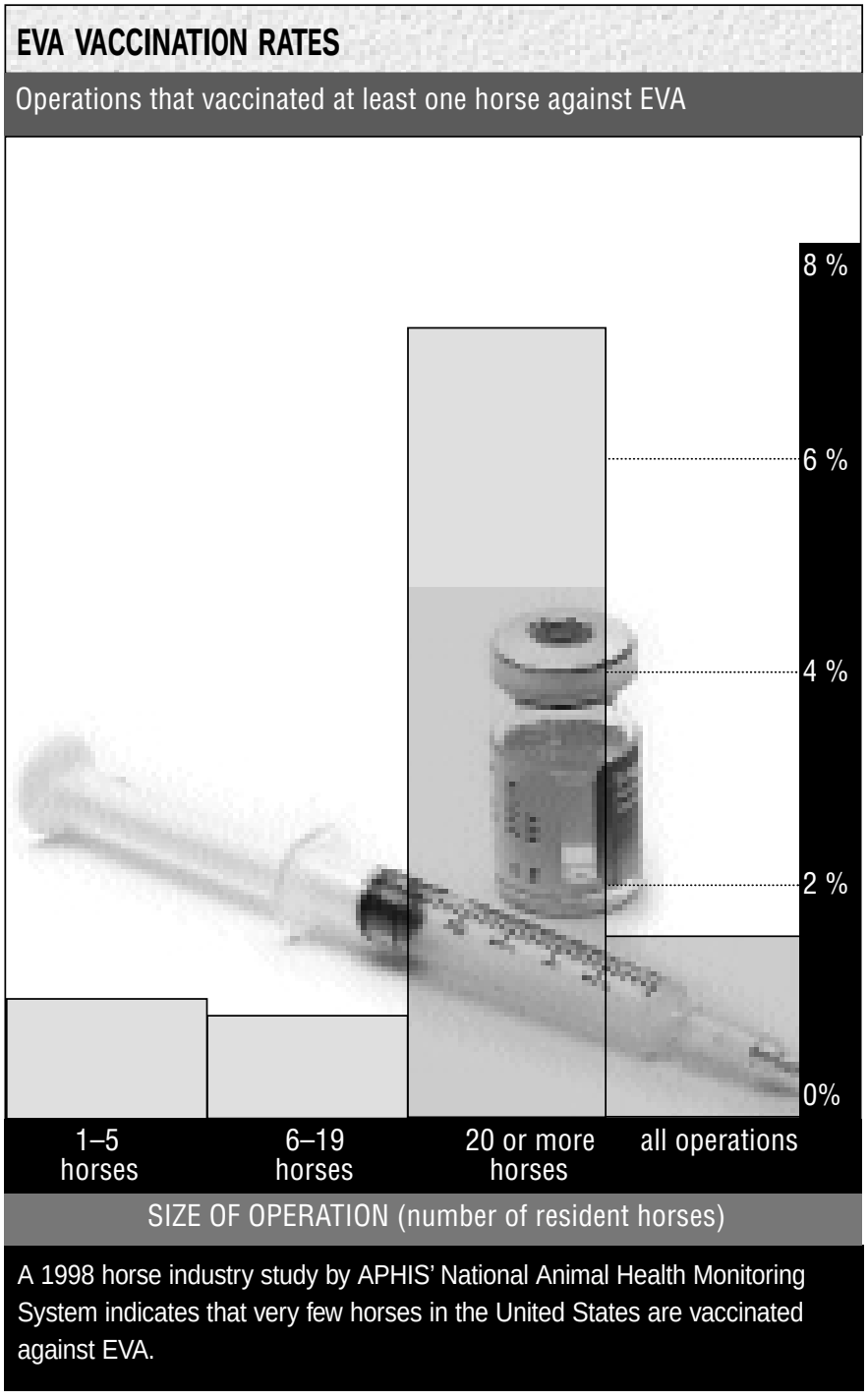
The carrier state has never been confirmed in stallions vaccinated with the current modified live-virus vaccine against EVA. Furthermore, mares, geldings, or sexually immature colts do not become persistently infected or carriers of EAV.

Economic Significance of EVA

EVA can have economic consequences for both breeding and performance sectors of the horse industry.

Direct financial losses resulting from outbreaks of the disease on breeding farms can be summarized as follows:

- Losses due to abortion and/or disease and death in young foals,
- Decreased commercial value of stallions that become persistently infected with the virus,
- Reduced demand to breed to carrier stallions because of the added expense and inconvenience involved in vaccinating and isolating mares before and after breeding,
- Denied export markets for carrier stallions or virus-infective semen, and
- Reduced export markets for fillies, mares, colts, and geldings,



A 1998 horse industry study by APHIS' National Animal Health Monitoring System indicates that very few horses in the United States are vaccinated against EVA.

and noncarrier stallions positive for serum antibodies to the virus.

An outbreak of EVA at a racetrack, equestrian event, or horse show can have considerable impact because of the potential for widespread transmission of EAV among closely congregated horses. Such occurrences can result in direct financial losses through disruption of training schedules, reduced race or competition entries, and even the cancellation of races or events.

In summary, outbreaks of EVA can have considerable economic consequences for the horse industry. At the national level, the disease can be responsible for financial losses on breeding farms, at racetracks, equestrian events, or horse shows. At the international level, EVA has significantly affected trade in horses and semen with denied export opportunities for carrier stallions, EAV-infective semen and, in some cases, all categories of horses that are positive for antibodies to the virus.

How To Confirm a Diagnosis of EAV

It is *not* possible to establish a diagnosis of EVA based solely on the nature and extent of clinical signs observed in affected animals. The clinical signs of EVA are simply not distinctive enough from those observed in certain other infectious and noninfectious diseases of the horse. Diseases that can clinically mimic EVA include equine rhinopneumonitis, influenza, purpura hemorrhagica, equine infectious anemia, urticaria, and toxicosis due to particular plants (e.g., hoary allysum). Also, a few equine diseases exotic to the United States could be confused on clinical grounds with EVA. The most economically important of these is African horse sickness.

The only definitive means of establishing a diagnosis of EVA is by laboratory testing of appropriate specimens, preferably obtained very early in the course of the infection. In the case of the acutely infected horse, EAV can be detected in certain tissues and fluids, such as nasal or conjunctival secretions, blood, semen, and, with respect to an aborted fetus, placental and fetal fluids and tissues. To maximize the chances of confirming a diagnosis, it is very important that your veterinarian collect the appropriate specimens as soon as possible after the onset of clinical signs and as early as possible in a suspected outbreak of EVA.

Besides attempting to detect EAV in a clinically affected ani-

mal, your veterinarian can confirm a diagnosis of EAV infection by testing paired blood samples for the presence of antibodies to the virus. Have your veterinarian collect the initial blood sample as early as possible in the course of the disease and obtain a second sample 3–4 weeks later. Although highly reliable, laboratory examination of paired (acute and convalescent) blood samples suffers from the disadvantage of not providing a rapid diagnosis of EVA.

Screening of a stallion for the carrier state initially involves having your veterinarian take a blood sample for laboratory testing to determine if the animal is positive or negative for serum antibodies to EAV. Only stallions testing positive (neutralizing antibody level or titer of 1:4 or greater) without any history of previous vaccination against EVA should be considered potential carriers of the virus. All antibody-positive nonvaccinated stallions should be screened for presence of the carrier state by either (1) attempting detection of EAV in semen in the laboratory, or (2) subjecting them to a test-breeding program involving two seronegative mares and monitoring the mares for the development of serum antibodies to the virus up to 28 days after breeding. Virus detection in the laboratory is inexpensive and safe and provides a timely result. It can be attempted at any time before, during, or after the breeding season because carrier stallions shed EAV constantly in their semen. It should be reemphasized that semen collected for virological examination must contain the sperm-rich fraction of the ejaculate.

Specimens from a suspected outbreak of EVA or from a stallion that is a putative carrier of EAV should be appropriately handled as advised by your veterinarian and submitted to a laboratory known to have the diagnostic capability and proficiency in testing for this infection.

Preventing the Spread of EAV

Control Programs

Although not generally realized by many in the horse industry, EVA is a very controllable disease. Controlling its spread involves minimizing or eliminating direct or indirect contact of susceptible horses with various secretions, excretions, or tissues of infected horses.

Based on the outcome of a great deal of scientific investigation of the natural and experimentally reproduced disease and the causal agent, EAV, various industry groups have developed effective programs for the prevention and control of EVA. Integral to the success of such programs is the availability of a safe and effective vaccine (ARVAC®, Ft. Dodge Animal Health) that stimulates a high level of protection against the disease.

Current control programs are focused primarily on restricting spread of the virus in breeding horse populations to (1) prevent outbreaks of EAV-related abortion and/or illness and death in very young foals and (2) minimize the risk of establishment of the carrier state in stallions. Notwithstanding the potential economic consequences involved, there are no ongoing programs targeted at preventing the introduction or restricting the spread of EAV among performance horses either at racetracks, equestrian events, or horse shows.

EVA can be effectively controlled if you observe sound management practices and implement a selective vaccination program against the disease. Current programs have centered largely around the importance of the carrier stallion as a reservoir of EAV and the means whereby the virus can be widely disseminated in susceptible breeding populations. The following specific preventive and control measures can help you minimize the spread of EVA:

- Isolate all new arrivals and horses returning from other farms, sales, or racetracks for 3 to 4 weeks.
- If at all possible, segregate pregnant mares from other horses on the farm and maintain mares in small groups until they have foaled.
- Prior to the start of each breeding season, blood-test all new breeding stallions for the presence of antibodies to EAV.
- Have the semen of any antibody-positive, nonvaccinated stallion laboratory-tested to identify any carrier animals.
- Annually vaccinate all noncarrier breeding stallions at least 4 weeks prior to the start of each breeding season.
- Maintain any EAV carrier stallions in physical isolation.
- Observe strict hygienic precautions when breeding or collecting from carrier stallions to avoid the risk of inadvertent transfer of infection through indirect contact with virus-contaminated objects.
- Restrict breeding EAV carrier stallions to only vaccinated mares or mares that have previously test-

ed positive for naturally acquired antibodies to the virus.

■ Vaccinate EAV antibody-negative mares against EVA at least 3 weeks prior to breeding to a known carrier stallion or with virus-infective semen. Mares do not have to be revaccinated if they require to be rebred to the same or another carrier stallion.

■ For 3 weeks after they have been bred to a carrier stallion, isolate mares vaccinated for the first time against EVA from all but known EAV antibody-positive animals. It is especially important to avoid contact between such mares and other pregnant mares, to which they can spread the virus by the respiratory route.

In breeds in which EAV infection is endemic (e.g., Standardbreds or various Warmblood breeds), we strongly recommend that you vaccinate all colts (immature male foals) between 6 and 12 months of age against EVA. This practice will minimize, if not eliminate, the risk of their becoming carriers of the virus at a later date. If rigorously implemented over a period of years, such a vaccination strategy will lead to a very significant reduction in the number of carrier stallions and largely eliminate the primary reservoir of EAV.

There is a very real danger of introducing EAV into a susceptible horse population through the use of infective, fresh-cooled or frozen semen. In light of the significant risk involved, it is important that you take the preliminary step of determining the virus infectivity status of semen used for artificial insemination, especially if it has been imported from abroad. The precautions you should take with mares artificially inseminated with EAV containing semen are identical to those recommended for mares bred by live cover to a carrier stallion.

In an effort to promote greater national control of EVA, and bearing in mind the important role that the carrier stallion plays in the dissemination of EAV, the American Horse Council formed a working group in September 1996 to develop guidelines for breeding a mare to an EVA-shedding stallion. The working group included representation from the following breed organizations: the American Quarter Horse Association, the U.S. Trotting Association, the Tennessee Walking Horse Breeders & Exhibitors Association, the International Arabian Horse Association, the Appaloosa Horse Club, the Federation of North American Sport Horse Registries, and the Jockey Club. The group also included Dr. Ralph Knowles, of the Maryland Department of Agriculture and chairman of the United States Animal Health Association's Committee on Infectious Diseases of Horses; Dr. Don Lein, director of the Veterinary Diagnostic Laboratory at Cornell University; and Dr. Don L. Notter, Kentucky State Veterinarian.

The overall goal of the working group was to develop a voluntary, industry-driven protocol to assist breeders in preventing the spread of EVA. The guidelines, released in August 1997, were subsequently endorsed by the American Association of Equine Practitioners and the United States Animal Health Association. They are available at the American Horse Council's Website (www.horsecouncil.org). Click on the Equine Health Advisory button.

Action To Be Taken in the Event of an Outbreak of EVA

When dealing with a suspected outbreak of EVA, you should make every effort to restrict spread of the virus and minimize potential economic losses from the disease. Take the following measures in the case of an outbreak on a breeding farm:

■ Promptly isolate all affected horses.

■ Notify your veterinarian immediately.

■ In consultation with your veterinarian, seek laboratory confirmation of a diagnosis as soon as possible.

■ In the case of abortion or death in a newborn foal, place the placenta, fetus, or foal in a leak-proof bag, keep cold (not frozen), and dispatch to the nearest qualified diagnostic laboratory.

■ Disinfect stall, any equipment, or other potentially contaminated facilities using a phenolic disinfectant. After treatment with disinfectant, dispose of any bedding by composting in an area away from other horses.

■ Using the antiseptic recommended by your veterinarian, wash down the hindquarters and tail of any mare that has aborted and isolate her from other horses for 4 weeks.

■ Restrict movement of horses onto or off the affected premises.

■ Suspend breeding operations until the outbreak is over and notify owners of mares on the affected premises. You can safely breed mares affected with EVA later in the same breeding season once they have fully recovered from the disease and there is laboratory confirmation the outbreak is over.

■ Vaccinate all at-risk horses.
■ Notify the State Veterinarian or appropriate regulatory agency of the outbreak.

Measures to be taken in the event of an outbreak of EVA at a racetrack, equestrian event, or horse show are broadly similar to those recommended for dealing with an outbreak on a breeding farm. Place major emphasis on isolating affected animals, restricting movement in and out of the facility, and vaccinating all at-risk animals at the earliest opportunity as advised by your veterinarians, working in consultation with the State Veterinarian and other regulatory officials.

Immunization Against EVA

In sharp contrast to the vast majority of other equine infectious diseases, infection with EAV stimulates a very strong and durable protective immunity against EVA. This immunity can result from natural exposure to the virus or from vaccination against the disease.

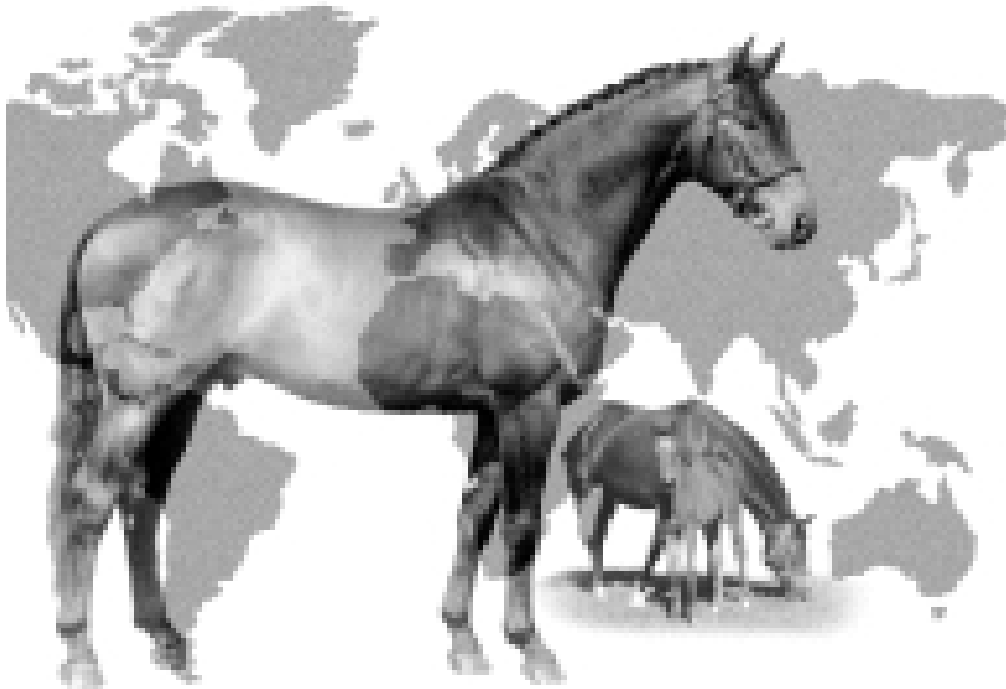
At the present time, there is only one commercially available vaccine against EVA in North America. ARVAC is a modified live-virus vaccine containing an experimentally derived, highly attenuated strain of EAV that is safe and very effective when used in accordance with the manufacturer's recommendations. Have your veterinarian administer the vaccine to stallions at least 4 weeks prior to the start of the breeding season. Extensive use of the vaccine since 1985 has failed to reveal any evidence that the vaccine virus is shed in the semen or that it can establish the carrier state in the vaccinated stallion. We do not recommend that you use the vaccine in pregnant mares or in foals less than 6 weeks of age unless the risk for natural infection with EAV is high, and then only on the advice of your veterinarian.

Horses immunized with the modified live-virus vaccine against EVA on two or more occasions develop high antibody titers to the virus equivalent to those observed in cases of naturally acquired infection. Protection afforded by vaccination is considered to last for at least several years.

Conclusions

We hope that the information in this brochure and in the companion video will help promote greater industry awareness of EVA and dispel much of the misinformation that has prevailed since the epidemic in Kentucky in 1984. EVA can be a source of considerable economic loss, especially for the horse breeding industry. It is high time, therefore, that a more rigorous effort be made to achieve greater control over this infection at the national level.

The success of any voluntary prevention and control program against EVA, however, will be critically dependent on your involvement and support and that of other members of the horse industry working in cooperation with veterinarians and Federal and State animal health officials. The organizations and individuals who produced this brochure and companion video did so to convince you of the need to participate in such a program and reduce the prevalence of what is a very controllable disease in the U.S. horse population.



SUGGESTED READINGS

Cole, J. R.; Hall, R. F.; Gosser, H. S., et al. 1986. Transmissibility and abortigenic effect of equine viral arteritis in mares. Journal of the American Veterinary Medical Association 189(7): 769–771.

Collins, J. K.; Kari, S.; Ralston, S. L., et al. 1987. Equine viral arteritis at a veterinary teaching hospital. Preventive Veterinary Medicine 4: 389–397.

Glaser, A. L.; de Vries, A.A.F.; Rottier, P.J.M., et al. 1996. Equine arteritis virus: a review of clinical features and management aspects. The Veterinary Quarterly 18(3): 95–99.

Golnik, W.; Michalska, Z.; Michalak, T. 1981. Natural equine viral arteritis in foals. Schweizer Archiv Fur Tierheilkunde 123: 523–533.

McCollum, W. H. 1970. Vaccination for equine viral arteritis. In: Equine infectious diseases II, proceedings of the 2nd international conference; 16–18 June 1969; Paris, France. Basel, SW: Karger: 143–151.

McCollum, W. H.; Swerczek, T. W. 1978. Studies of an epizootic of equine viral arteritis in racehorses. Journal of Equine Medicine and Surgery 2: 293–299.

McCue, P. M.; Hietala, S. K.; Spensley, M. S., et al. 1991. Prevalence of equine viral arteritis in California horses. California Veterinarian March–April: 24–26.

Scollay, M. C.; Foreman, J. H. 1993. An overview of the 1993 equine viral arteritis outbreak at Arlington International Racecourse. In: 39th annual convention, proceedings; 5–8 December 1993; San Antonio, TX. Lexington, KY: American Association of Equine Practitioners: 255–256.

Timoney, P. J. 1984. Clinical, virological and epidemiological features of the 1984 outbreak of equine viral arteritis in the Thoroughbred population in Kentucky, USA. In: Proceedings of the Grayson Foundation international conference of Thoroughbred breeders organizations on equine viral arteritis; 31 October – 1 November 1984; Dromoland Castle, Co. Clare, Ireland. Lexington, KY: Grayson Jockey Club Research Foundation: 24–33.

Timoney, P. J. 1999. Equine viral arteritis in perspective: fact vs. fiction. In: Proceedings of the sixth World Equine Veterinary Congress; 30 September–3 October 1999; Paris, France. Reims, FR: Boehringer Engelheim: 167–170.

Timoney, P. J.; McCollum, W. H. 1993. Equine viral arteritis. Veterinary Clinics of North America: 295–309.

Timoney, P. J.; McCollum, W. H.; Murphy, T. W., et al. 1987. The carrier state in equine arteritis virus infection in the stallion with specific emphasis on the venereal mode of virus transmission. Journal of Reproduction and Fertility 35: 95–102.

Timoney, P. J.; McCollum, W. H.; Roberts, A. W. 1987. Detection of the carrier state in stallions persistently infected with equine arteritis virus. In: Proceedings of the annual meeting of the American Association of Equine Practitioners; 29 November–3 December 1986; Nashville, TN. Lexington, KY: American Association of Equine Practitioners: 57–65.

Timoney, P. J.; McCollum, W. H.; Vickers, M. L. 1998. The rationale for greater national control of EVA. Equine Disease Quarterly 7(1): 2–3.

Timoney, P. J.; Umphenour, N. W.; McCollum, W. H. 1988. Safety evaluation of a commercial modified live equine arteritis virus vaccine for use in stallions. In: Powell, D. G., ed. Equine infectious diseases V. Proceedings of the 5th international conference; 7–10 October 1987; Lexington, KY. Lexington, KY: The University Press of Kentucky: 19–27.

U.S. Department of Agriculture, Animal and Plant Health Inspection Service. 2000. Equine viral arteritis (EVA) and the U.S. horse industry. N315.0400. Ft. Collins, CO: U.S. Department of Agriculture, Animal and Plant Health Inspection Service, Veterinary Services, Centers for Epidemiology and Animal Health, National Animal Health Monitoring System. 34 p.

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