

CENTER FOR EQUINE HEALTH

# HorseReport

SCHOOL OF VETERINARY MEDICINE • UNIVERSITY OF CALIFORNIA, DAVIS

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## Vaccines



**UC DAVIS**  
**VETERINARY MEDICINE**  
Center for Equine Health

## DIRECTOR'S Message

In this issue of the *Horse Report*, we discuss a topic currently on everyone's minds thanks to the COVID-19 pandemic, vaccines! Whether your horses stay at home or are racking up the frequent flyer miles, it is essential to coordinate a vaccination program tailored to their individual needs to ensure optimal health.

The scientific consensus is that vaccines are safe and effective at fighting infectious diseases. Although undesirable reactions can occur, they are usually mild and pale in comparison to clinical signs and long term effects of disease. Alternative approaches are available for horses with histories of adverse reactions to minimize discomfort while ensuring protection. At minimum, most horses should receive the "core vaccines", as designated by the American Association of Equine Practitioners.

The international equine community is currently reeling from an outbreak of the neurological form of equine herpesvirus-1 (EHV-1) in Europe that has canceled major events and highlighted a downside of our increasingly mobile global equine population. Although currently available vaccines for EHV-1 do not prevent the neurologic form of the disease, they may reduce viral shedding. This is an example of why it is important to implement vaccination programs in conjunction with [biosecurity protocols](#). Our thoughts are with all of those impacted by these tragic circumstances.

Equine vaccination is a vast topic, and we are grateful to our collaborator, Dr. Nicola Pusterla, for his expertise in helping us select the most relevant and up-to-date information to share with you.

We often emphasize the need to work closely with your veterinarian to ensure your horse's health and well-being. This is especially vital when it comes to vaccinations, not only for the health of your horse, but for the greater equine community.

Carrie J. Finno, DVM, Ph.D., Diplomate ACVIM  
CEH Director

## Thanks to Our Collaborator

We are grateful to [Dr. Nicola Pusterla](#) for sharing his extensive expertise on the topic of vaccines. Dr. Pusterla, a diplomate of the American College of Veterinary Internal Medicine, is a professor in the School of Veterinary Medicine's Department of Medicine and Epidemiology. His research focus is on equine infectious diseases with an emphasis on molecular epidemiology.



Dr. Nicola Pusterla

# A Lesson Learned: Boone's Bout with **WEST NILE VIRUS**

When Brooke Martin bought Boone, a five-year-old Quarter Horse, she was told that he had “received all his shots”. Assuming that meant the same vaccines that her cattle ranching family gives to all of their horses, she did not specifically ask which shots. She started to rope and brand off of Boone, who she described as a “good, quiet horse” and was excited to take him out for his first trip to gather calves.

When they arrived, he stumbled out of the trailer, but it seemed as though he had just crossed his legs and lost his balance. He was fine otherwise, until Martin got on to ride. As they rode out to gather the calves, Boone's hind end fell out from under him a couple of times. He was transported to a local veterinary clinic, where neurological deficits became apparent. An infectious disease was suspected, so he was transferred to UC Davis.

“By the time we got down the road on our way to Davis, he had laid down in the trailer,” said Martin. “I was thinking, ‘I’ve only had this horse for four months and now something is really wrong.’”

Upon arrival at the UC Davis veterinary hospital, Boone's clinical signs included muscle tremors, an agitated expression, weakness, ataxia, and dull mentation, which are fairly typical signs of [West Nile virus \(WNV\)](#) infection. The former owner was contacted, and it was discovered that Boone had received a five-way vaccine that spring, but no WNV vaccine. He was treated with anti-inflammatories, DMSO, and West Nile virus hyperimmune plasma, in addition to supportive care (IV fluid therapy, nutritional management, deep bedding). According to Dr. Gary Magdesian, who diagnosed this case, the prognosis for survival is approximately 67%. Fortunately, Boone could be counted in that number.

Boone spent some time recovering at the layup facility at the UC Davis Center for Equine Health, and then got to go



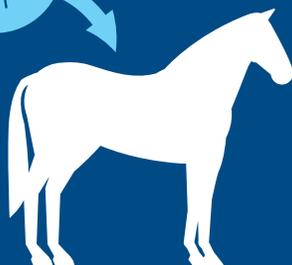
Boone is happy, healthy, and back to work with his grateful owner.

home. “You guys got him through it,” said Martin of Boone's experience at UC Davis. “I was really grateful.”

Today, Boone is happy, healthy, and back on track with his training. He shows no residual signs of his bout with WNV. He will receive regular WNV vaccinations, just like Martin and her family already do for the rest of their horses. She reflected that this has been an eye opening experience for all of them.

“Going forward, when we buy horses we're going to make sure we ask exactly which shots they've had,” said Martin. “From one person to another, it's not always the same.”

West Nile virus is a recommended core vaccine by the American Association of Equine Practitioners. “It is nationwide,” says Magdesian. “Every horse should be vaccinated annually as part of core vaccinations.”



## WEST NILE VIRUS

**West Nile virus** is a mosquito-borne virus that affects humans and other animals, of which horses represent 97% of reported non-human cases. Introduced to the United States in 1999, WNV is now found in all of the contiguous 48 states. Wild birds are the natural hosts for WNV. The virus is only transmitted through mosquitoes; humans and horses cannot give it to each other. The best way to protect horses from WNV infection is by including a WNV vaccine as an annual core vaccine. It is also important to practice good mosquito control and minimize horses' exposure to mosquitoes.



# EQUINE VACCINES:

## Breaking Down the Basics

### ***What is a standard vaccination program for horses?***

It would be convenient to have a one-size-fits-all, black and white schedule for equine vaccinations. However, as we all know, horses are individuals (and rarely concerned with what's convenient), which results in a lot of gray areas. As such, there is no standard equine vaccination program. The need for specific vaccines depends on many factors, including risk of disease, horse age, location, and if they travel. It is important to weigh the consequences and costs of each specific disease against the costs of vaccination and potential vaccine reactions.

The American Association of Equine Practitioners (AAEP) provides [guidelines for a set of core vaccines](#), which are “vaccinations that protect from diseases 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.” Equine vaccines that meet these criteria are for [Eastern/Western equine encephalomyelitis \(EEE, WEE\)](#), [rabies](#), [tetanus](#), and [West Nile virus \(WNV\)](#).

Other available equine vaccines are “risk-based vaccines”. These include [equine herpesvirus](#) (rhinopneumonitis, or “rhino”, specifically EHV-1 or EHV-4), [equine influenza](#), [strangles](#), and others.

Organizations, venues and boarding facilities may require some of these vaccines prior to entry or competition.

### ***Why is it important to monitor my horse after a vaccination?***

Horse owners, barn managers, and other caretakers should be aware of possible vaccine reactions. While mild, often localized, reactions are not uncommon, severe, systemic reactions are fortunately extremely rare. Monitor your horse(s) for at least 72 hours after any vaccination so you and your veterinarian can respond promptly to any complications.

Potential adverse reactions depend on a number of factors, including the route of vaccine administration (intramuscular (IM) or intranasal (IN)). Local reactions, such as muscle soreness and swelling, or the formation of an abscess around the injection site, can occur. Some horses may exhibit a mild fever, which can contribute to inappetance and lethargy. In other words, your horse may not feel like themselves the day after a vaccination and it is often advisable to avoid any strenuous exercise, including riding (handwalking is usually okay).

Systemic reactions occur throughout the body and are not restricted to the administration site. These can include hives, colic, swelling of the limbs and abdomen (purpura hemorrhagica), difficulty breathing, and anaphylaxis.

Although mild reactions often resolve on their own, all adverse reactions should be reported to

your veterinarian who will share pertinent information with the vaccine manufacturer and/or the United States Department of Agriculture (USDA) Center for Veterinary Biologics. Since adverse reactions may be unpredictable, it is recommended to avoid vaccinations within two to three weeks of a competition, sale, or travel to ensure time for treatment, should the need arise.

***Does my horse have to be vaccinated every year? What happens if my horse misses a year of vaccinations?***

As with many questions about equine vaccines, the need for a horse to be vaccinated every year should be evaluated on a case-by-case basis. The answer depends on the risk that the horse will come in contact

***Your horse may not feel like themselves the day after a vaccination and it is often advisable to avoid any strenuous exercise, including riding.***

with that particular pathogen. Is the disease common to that specific location? Is it a vector-borne (i.e. transmitted by another animal or insect) disease that depends on seasonal activity of mosquitoes or other insects? Does the horse travel for competitions? Does the horse live near other horses that travel frequently? How contagious is the pathogen? Some vaccines are more effective than others, which also factors into the overall equation.

The implications of a horse missing a year of vaccinations depends on the immunization history of that animal. The lapse can have more significant consequences if it is during the primary course of vaccinations for young or naïve horses that have not yet mounted optimal immune responses, whereas it may be less significant in adults that have otherwise been routinely vaccinated.



# EQUINE VACCINES:

## Some Specifics



### **What are the advantages of having a veterinarian vaccinate my horse?**

It is recommended to have a veterinarian vaccinate your horse, instead of doing it yourself, for several reasons.

- Vaccines must be procured from reliable sources that can verify proper storage. Poor quality, contamination, and storage at the wrong temperature can reduce efficacy and increase risks of adverse reactions.
- It is critical to ensure proper dosing to maximize immunity and protect against vaccine failure.
- Some competitions require vaccines to be administered and documented by a licensed veterinarian. (See sidebar)
- Adverse reactions can be unpredictable. Although severe reactions are rare, prompt treatment is often required.
- Many manufacturers guarantee support, including coverage of treatment costs, only if the vaccine was administered by a veterinarian.
- Veterinarians usually perform physical examinations to ensure the horse is healthy enough for vaccination. If your horse has a mild fever, for example, vaccination should be postponed. These visits are also good opportunities to ask questions and assess your horse's overall health.

### **When should I consider spacing out vaccinations?**

It is important to properly vaccinate your horse, but it may be inadvisable to hit them with everything at once.

Many horses are unfazed by receiving several vaccines at the same time. This includes multi-way (multivalent) vaccines that protect against more than one pathogen. Horses with histories of adverse reactions, or those that are immunocompromised may benefit from time between vaccinations.

Administering multiple vaccines at once may increase the risk of adverse reactions. Veterinarians may recommend a three to four week interval between immunizations (another important reason to plan around travel and competitions). Non-steroidal anti-inflammatories (NSAIDs) may be recommended prior to vaccination, but this should be discussed with your veterinarian to ensure that medications will not affect the vaccine's efficacy or result in health concerns.

### **Can my horse be tested for antibodies to determine if vaccination is needed?**

Recently, the idea of “checking titers” to determine if a horse needs to be vaccinated has become popular. Although this sounds straightforward, the correlation between protection and serological response to vaccination has not been well established for most equine vaccine antigens.

Serological testing to determine levels of circulating antibodies (a.k.a. titers) to specific pathogens may be used when potential adverse reactions pose greater risks than consequences from disease or to assess potential non-responders (immunodeficient, diagnosed with [pituitary parse intermedia dysfunction](#), etc.).

However, it is important to remember that circulating antibodies are only part of the immune response. Immune responses can occur throughout the body, as evidenced by pathogen-specific antibodies in the blood, or locally, in which antibodies may remain in particular areas of the body and not be present in the bloodstream. As such, there are limitations to evaluating titers with respect to specific pathogens. The correlation depends on the specific disease, the route of vaccine administration, the type of vaccine, and the strength of the immune response. Titers correlate well with protection or susceptibility for some pathogens (tetanus, rabies), but cannot be easily quantified for others (WNV, equine influenza).

The AAEP's "[Guidelines for Serology in Horses with Adverse Events from Vaccination](#)" provides more information.

### **Is it OK to change vaccine manufacturers?**

It is unlikely that horses will receive the same vaccine products regularly throughout their lives, for many reasons (change of ownership, location, vaccine shortage, etc.). Products from different manufacturers are regularly used interchangeably. To date, research of impacts on immune response and subsequent protection is sparse.

The number of possible vaccine combinations is large, so it is difficult to provide conclusions for particular products. The answer essentially depends on how different or similar vaccines are to one another. In some cases, utilizing different products may induce a superior immune response. However, there are many factors to take into consideration, such as the age of the horse and time since last immunization.

UC Davis researchers reported results of a Center for Equine Health supported study that investigated immune response to equine influenza virus vaccines from different manufacturers in previously immunized, healthy, adult horses. The data showed similar antibody responses across groups, even after a booster, suggesting the specific equine influenza vaccine manufacturer should not be a primary concern.

## VACCINATION REQUIREMENTS for Competition



### American Quarter Horse Association (AQHA) –

Vaccination for equine influenza and EHV are required for AQHA championship shows. Details are provided on resources [pages for individual shows](#).

### Fédération Equestre Internationale (FEI) –

A veterinarian must administer the influenza vaccine within six months (but not less than seven days) of arrival at event sites. ([Articles 1002 and 1003](#))

### United States Equestrian Federation (USEF) –

Horses over 7 months of age must receive EHV and influenza vaccines within six months of entering competition grounds. It is recommended that vaccines be administered by a veterinarian. ([Rule GR845](#))



*\*Venues may require proof of vaccination prior to arrival or competition for unrated events.*

# EQUINE VACCINES:

## Diving Deeper

### ***Should I vaccinate my horse against strangles?***

There is no consensus on the use of vaccines to prevent [strangles](#), a highly contagious disease for which outbreaks can be difficult to manage.

Intramuscular (IM) and intranasal (IN) vaccines with moderate success rates and efficacy are available in the United States, but protection may be limited and serology testing may not differentiate between infected horses and vaccinated horses. The IM formulation is a purified antigen extract vaccine. Abscess formation at the injection site and purpura hemorrhagica have been noted in some animals. The IN application, an attenuated live vaccine, has been associated with abscess formation in the lower jaw and nasal discharge.



Since this is a live vaccine and accidental contamination of other sites can occur, issues have been reported when administering the IN vaccine at the same time as other IM vaccines. Invasive procedures, such as joint injections, should not be performed concurrently for the same reason.

Vaccination may be recommended if the bacteria is known to be endemic on the premises, or for horses that are otherwise at high risk of exposure. Vaccination during a strangles outbreak is not recommended as it increases the risk of adverse reactions and complications.

### ***Should I vaccinate my horse if there is a disease outbreak at my barn?***

Determining whether to vaccinate horses during a disease outbreak depends on the disease, the type(s) of vaccine available, the population, and the local environment. Emergency vaccination has been successful in reducing [equine influenza](#) transmission during outbreaks, especially if detected early. Horses that were previously vaccinated may also be revaccinated. In contrast, the benefit of emergency vaccination for [EHV-1](#) and [EHV-4](#) is controversial. Challenge studies are required to provide further direction.

Following proper biosecurity protocols, along with quarantine, isolation, and monitoring are often the most effective approaches to controlling outbreaks.

### ***Are there any new vaccines?***

Vaccines that you might not have heard much about include:

**Melanoma** – This is an extra-label use of a canine melanoma vaccine that targets the protein tyrosinase expressed by melanoma cells. It is safe and effective in horses and anecdotal reports indicate tumor shrinkage and no new melanomas in some cases. However, quantitative data is not yet available and the results are unpredictable. The vaccine is administered in the pectoral muscle of the chest. The initial course is four treatments given two weeks apart, followed by boosters every six months. The vaccine can currently only be obtained by veterinary specialists and the treatments may be costly.

### **Potomac horse fever (PHF)/equine**

**neorickettsiosis** – This is available in the United States as a single agent vaccine or in combination with a rabies vaccine. Reports indicate weak immune responses and inconsistent protection. This may be partly due to the fact that the vaccine contains a single strain of the *Neorickettsia risticii* bacteria but additional strains exhibiting significant variation have been identified in naturally-infected horses. A recent study found a further weakened response after administration of the combined PHF/rabies vaccine. Regular revaccination may be recommended for horses in endemic areas.

### **Pigeon Fever (*Corynebacterium pseudotuberculosis*)**

– This vaccine is available under a conditional license from the USDA. No side effects were observed in naïve horses (young horses with no previous exposure or disease) during the initial safety studies. Mild reactions, including localized swelling at the site of administration, inappetance, and lying down have been observed in some older horses with previous exposure to the bacteria. It is recommended to give this vaccine alone, not combined with other vaccines. Appropriate use of the vaccine in combination with good fly control can be used to prevent this disease.

**Snake bite** – There is currently one conditionally licensed rattlesnake vaccine (*Crotalus atrox* Toxoid) that may provide protection against venom of varieties of Western rattlesnake, sidewinder, timber rattlesnake, massasauga, and copperhead for horses that are at risk of exposure due to geographic location or travel. Horses six months or older receive a three-dose primary series (one month between each dose), with boosters every six months. It is recommended to ensure peak titers coincide with peak exposure times.





# 10 THINGS

## You Might Not Know About Equine Vaccines

**T**here's no one-size-fits-all when it comes to equine vaccinations. We collaborated with UC Davis infectious disease expert Dr. Nicola Pusterla to share ten things you might not know about equine vaccines.



**1 Vaccines stimulate the immune system to create antibodies that can recognize a disease-causing pathogen in the future and destroy it.** If the horse encounters the pathogen through natural infection, the immune system will be able to mount a strong, rapid response, limiting or preventing clinical signs and reducing the spread of disease.



**2 Protection provided by vaccines is not immediate and can fade over time.** It can take from days to weeks for horses to mount optimal immune responses following vaccination. Most vaccines require two or three initial administrations (spaced about 4-6 weeks apart) and boosters annually or every six months.



**3 Vaccination alone is not enough to prevent infectious diseases.** Effective infectious disease control relies on a combination of appropriate [biosecurity](#) protocols coupled with vaccination programs and management considerations.



**4 Vaccines are labeled for different levels of protection.** Levels-of-protection statements can be granted by the United States Department of Agriculture (USDA) based on product performance data. The highest level of protection label claim is “prevention of infection”, followed by (in declining order) “prevention of disease”, “aid in disease prevention”, and “aid in disease control”. Other claims, such as “reduced pathogen shedding”, may be made if data supports a significant clinical effect.



**5 There are specific vaccination guidelines for foals and pregnant mares.** Foals rely on maternal antibodies from colostrum to protect against diseases. Vaccination in pregnant mares should be timed for optimal protection of both the mare and foal. For example, an [EHV-1](#) vaccine for the prevention of abortion is often administered during months five, seven, and nine of gestation. An EHV-1/EHV-4 vaccine is then administered four to six weeks prior to foaling to decrease the risk of respiratory disease in the foal. Since maternal antibodies decline over time, foals begin the primary series for recommended vaccines around four to six months of age. This should start sooner if the mare was not appropriately vaccinated or if there was failure of passive transfer.





## 6 Intramuscular (IM) vaccines should be given in the neck, pectoral muscles, or hamstrings.

When choosing a vaccination site, it is important to consider potential adverse reactions. For example, if an abscess were to develop, sites that facilitate gravitational drainage, such as the hamstrings, will have swifter resolution and less tissue damage than sites that present challenges for drainage, such as the gluteal muscles.



## 7 Vaccinated horses can still get sick, but they will be less sick, and at less risk of exposing others, than if they did not receive a vaccine.

Vaccines cannot provide 100% protection under all circumstances. Although some may be able to prevent disease, others only claim to reduce the severity of disease (see #4). With the latter, vaccinated horses that become infected have milder clinical signs than infected horses that have not been vaccinated. Studies have also shown that vaccinated horses can exhibit reduced pathogen shedding into the environment, reducing risk of infection for naïve horses.



## 8 Not all diseases need a vaccine.

It is expensive and time-consuming to gain approval and bring a new vaccine to market. Diseases that are comparatively rare, do not result in severe or life-threatening clinical signs, or that are effectively controlled by alternative means such as management and biosecurity programs, are not likely to be good candidates for vaccine development. Alternatively, the “core vaccines” were developed to protect against high-risk diseases that have important health significance.



## 9 Horses should be vaccinated even if they are “home bodies”.

All horses should receive the “[core vaccines](#)” recommended by the AAEP, which are for diseases that have high mortality rates and high likelihood of exposure. Some pathogens exist in the environment, and vectors such as the mosquito and wild animals like raccoons can transport these pathogens to your horse’s location. Work with your veterinarian to determine if risk-based vaccines are recommended based on your specific situation.



## 10 It is important to vaccinate at the right time of year to ensure protection during peak exposure.

Vaccine administration should be timed to ensure protective immunity coincides with, and lasts through, periods of likely exposure. For example, vaccination against vector-borne diseases such as [West Nile virus](#) should be administered prior to the beginning of mosquito season.



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## Here to Stay: West Nile Virus

**W**est Nile virus (WNV) is a mosquito-borne virus that affects humans and other animals, of which horses represent 96.9% of non-human cases. Introduced to the United States in 1999, WNV is now found in all of the contiguous 48 states.

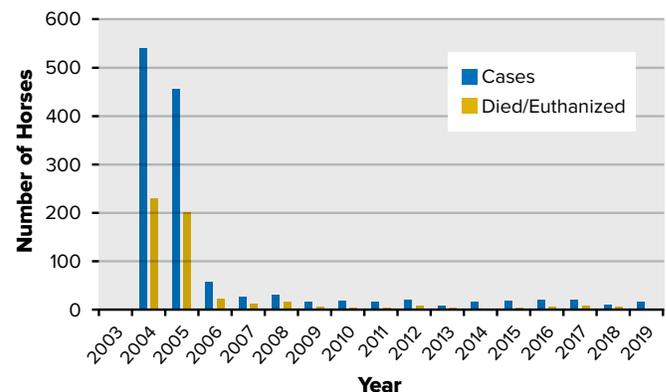
The California Department of Food and Agriculture (CDFA) works with federal, state, and local agencies to monitor WNV in horses and minimize its impacts on the equine industry. West Nile virus is a reportable disease in California – cases must be reported to the CDFA within two days of discovery.

First diagnosed in a horse in California in 2003, the state became the WNV disease epicenter in 2004, with 540 confirmed equine clinical cases. The virus is now endemic, so it is here to stay.

Vaccines have proven effective in protecting horses against infection and cases have declined since 2005. The American Association of Equine Practitioners (AAEP) recommends WNV as a core vaccine. Work with your veterinarian to ensure that your horse is properly vaccinated. Owners and facilities can further protect horses by practicing good mosquito control, including eliminating breeding sites by removing standing water, cleaning water containers and stocking water troughs with fish that feed on mosquito larvae. It is also important to minimize exposure to mosquitoes through use of repellents and by stabling horses at peak mosquito feeding periods (dawn and dusk).

### Equine West Nile Virus – CDFA Case Summary

Vaccines have proven effective in protecting horses against infection and cases have declined since 2005.



\*Data for 2013 was only recorded through August of that year.

