

What Impacts Stallions' Sperm Output?



Stallion sperm output in the winter is about half of what it is in late spring and summer.

Not all stallions are created equal and neither is the amount of sperm they produce. The most sought-after stud in the area, for instance, could produce minimal amounts of semen, while a less desirable horse might produce more than his breeders ever need. So what are the deciding factors when it comes to sperm production?

Ed Squires, MS, PhD, Dipl. ACT (hon.), reviewed some of those factors at the 2015 World Equine Veterinary Association Congress, held Oct. 8-10 in Guadalajara, Mexico. Squires is a professor at the University of Kentucky's Gluck Equine Research Center, in Lexington.

"It is important for both veterinarians and stallion managers to know the factors that affect sperm output in stallions," Squires said.

Those key factors include stallion age, season, testis size, ejaculation frequency, and sex drive.

Veterinarians, he said, can evaluate these factors during breeding soundness exams and recommend adjustments to help improve a stallion's sperm output. Managers, on the other hand, can use these factors to determine how many mares the stallion can realistically breed in a season. Squires reviewed each factor in detail:

Age Most stallions enter stud when they're 3 years or older, Squires said, and reach sexual maturity by the time they're 5 or 6. At some point, the stallion's testis begin to degenerate. But, like aging in general for horses, the point at which this occurs depends on the individual horse.

"The timing for testicular degeneration varies in stallions and may occur as early as 12 to 15 years or, in some stallions, after 20 years of age," Squires said.

But the bottom line is that, in general, stallions' semen output will

decrease as he ages. Thus, it's important to re-evaluate a stud's book each year to ensure he's not being stretched too thin.

Season At many Kentucky Thoroughbred farms, the breeding sheds open in mid- to late-February. At farms in more northern locations, the breeding season might not start until late spring or even early summer. But while stallions are expected to impregnate mares at multiple times during the year, the season can have a significant impact on how much sperm they produce.

"Sperm output in the winter is about half of what it is in late spring and summer," Squires explained. "This seasonality is controlled by the length of daylight."

He said breeders can increase stallions' sperm counts in February and March by keeping them under artificial light for longer periods, starting in mid-December. However, he explained that managers generally do not place stallions under lights because, even though the sperm output will increase earlier in the year, sperm numbers will also decline earlier. This could pose a problem for late-season breeding. He warned breeders against overbooking stallions for the early parts of the breeding season, as decreased sperm output could be a concern.

Testis size Size matters when it comes to a stallion's testis, and veterinarians can garner important information by evaluating these structures.

"Testicular volume can be used to determine whether the stallion has

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Stallion Sperm Output

normal size testicles for his age and whether he is providing the expected number of sperm in the ejaculate based on his testicular volume,” Squires said.

Practitioners can use either ultrasound or calipers to measure testicular size, he added.

Ejaculation frequency A stallion can only produce so much sperm, so it stands to reason that breeding him too frequently could reduce his sperm counts. For best results, Squires said, researchers have determined that stallions in artificial insemination programs should be collected every other day during the breeding season.

“For natural mating, the primary factor determining how many times a stallion can be bred per day is the stallion’s sex drive,” he said. This generally

amounts to one to three coverings spread throughout the day, he added.

Sex drive So what controls a stallion’s sex drive? Unfortunately, Squires said, researchers and veterinarians aren’t sure.

“We do know that factors such as using a stallion heavily as a 2-year-old, being kicked during mating, pain during mounting, an inappropriate artificial vagina, or the height of the phantom can all negatively affect sex drive,” he said.

Take-Home Message

When it comes to managing a breeding stallion, many factors can negatively impact his sperm production. Understanding these factors can help managers and veterinarians take steps to improve the stallion’s fertility. **UK**

> Erica Larson is the news editor of *The Horse: Your Guide to Equine Health Care and TheHorse.com*.

Manifestations of Equine Herpesvirus-1

Equine herpesvirus-1 (EHV-1) is one of five herpesviruses commonly found in horses. EHV-1 infections manifest in three syndromes: respiratory, reproductive, and neurologic.

Like other herpesviruses, EHV-1 can establish latent infections, making it possible for outbreaks of disease to occur in herds that are considered closed. While quarantine of new arrivals; segregation

of young stock, breeding stock, and show stock; and vaccination are important management tools in the prevention of EHV-1 infections, complete protection is not possible. Vaccination confirms relatively short-term immunity (four to five months) and immunity is not entirely protective, meaning that even well-vaccinated horses can develop disease.

The respiratory form of EHV-1 is generally mild and self-limiting. Clinical signs are indistinguishable from other viral causes of respiratory disease, such as equine influenza and EHV-4. Horses

Masthead

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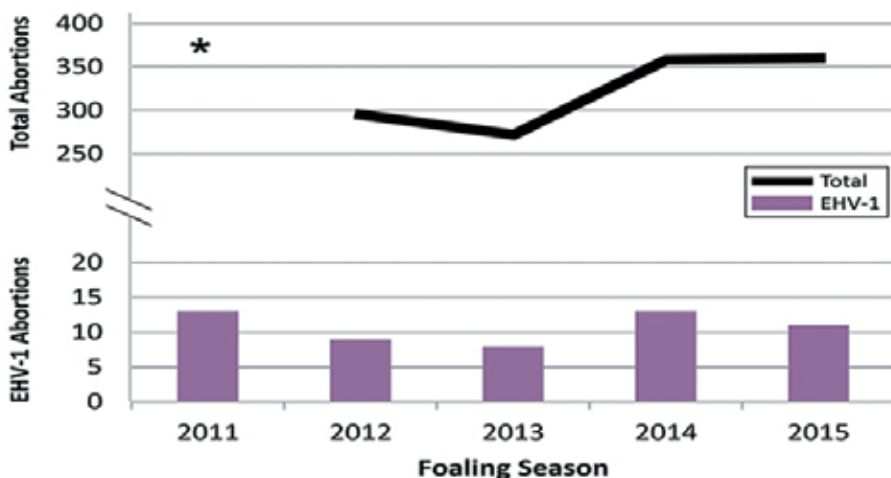
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The Horse: Your Guide to Equine Health Care

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Figure 3. Abortions Submitted to UKVDL, 2011-2015



* Submissions for 2011 were subsidized resulting in an inflated number of cases.

Equine Herpesvirus-1

generally exhibit a fever, cough, serous nasal discharge, and mild lethargy.

Reproductive disease is generally considered to be the most economically important manifestation of EHV-1. Infection with EHV-1 causes abortion in the last trimester of gestation. Affected foals are occasionally born alive but are generally very weak and succumb within days of birth, often with secondary disease conditions. The virus infects the mare through the respiratory tract and then enters the bloodstream (called viremia), traveling to and infecting the fetus. Infection in the mare is generally inapparent and abortion occurs without any signs of impending parturition. The fetus is aborted fresh, in contrast to other causes of abortion such as leptospirosis where the fetus might be significantly decomposed.

Following any abortion, the mare should be isolated, fetal tissues should be contained and submitted to a diagnostic laboratory, and in-contact mares should not be moved nor should new mares be brought in until a diagnosis has been rendered. Fetal tissues and uterine fluids should be considered infectious, and contaminated areas should be cleaned with detergent and disinfected. Contaminated bedding should be bagged and discarded and not spread on pastures.

In the case of EHV-1 abortions, the fetal tissues and fluids contain high concentrations of virus; infected foals and mares also shed virus via the respiratory route. The virus is transmitted via the respiratory route and fomites. However, since it is an enveloped virus, herpesvirus is readily inactivated by thorough cleaning with detergents followed by disinfectants. Biosecurity and restricted movement of horses are important in containing EHV-1 infections.

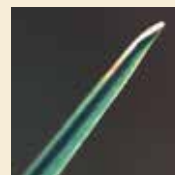
Laboratory diagnosis relies on gross and histologic examination in conjunction with laboratory testing. Gross lesions can include and peritoneal effusion (fluid accumulation in the chest and abdomen, respectively), over-expanded lungs with rib impressions, and small white foci scattered throughout the liver. However, there are many cases in which lesions are not identified at necropsy. Histologically, EHV-1 produces necrotizing lesions in a number of organs, most notably the lung and liver. Characteristic

The Grass Guide: Kentucky Bluegrass (*Poa pratensis* L.)

Bluegrass is synonymous with Kentucky and for good reason. It's well-adapted to the cool, humid growing conditions of Kentucky, the transition zone of the eastern United States, and most northern states. It does well in a wide variety of soils. Kentucky bluegrass is very winter hardy but does not tolerate hot, dry summers further south. Kentucky bluegrass is low-growing and, therefore, low-yielding. Because of this, it is not ideal for hay but is excellent for horse pastures. It is highly nutritious, very palatable, and tolerant of close, frequent grazing. Kentucky bluegrass also forms a tight sod, providing good pasture footing. It is slower to germinate than most cool season grasses (seven to 21 days).

Detailed seeding dates and rates can be found in the Grain and Forage Crop Guide for Kentucky (AGR-18) at uky.edu/ag/forages or through your local county extension office. **UK**

Life Cycle: Cool-season perennial
Native to: Europe
Uses: Pasture
Identification: Boat-shaped leaf tip



Kentucky bluegrass is easily identified by dark, narrow leaves with tips shaped like a boat's bow.



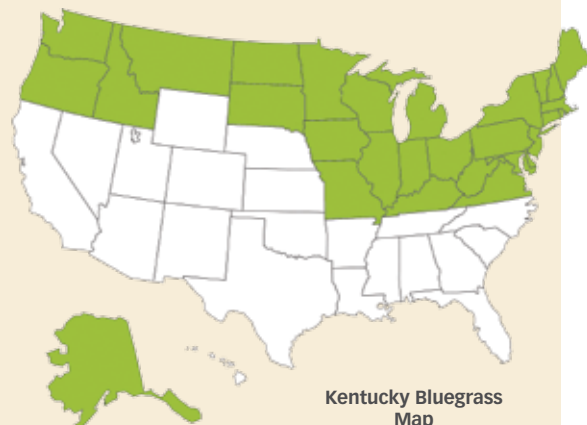
Kentucky bluegrass is a low-growing, sod-forming cool season grass.



UK-AG EQUINE PROGRAMS

The seedhead of Kentucky bluegrass.

>Krista Lea, MS, assistant coordinator of UK's Horse Pasture Evaluation Program in the Department of Plant and Soil Sciences.



Kentucky Bluegrass Map

intranuclear inclusion bodies are frequent. Common ancillary tests for detection of the virus include fluorescent antibody testing, virus isolation, and polymerase chain reaction testing.

Equine herpesvirus-1 abortions can occur singly or can spread rapidly in a susceptible population, leading to the classic "abortion storm." With improved management and readily available EHV-1 vaccines, the number of cases of EHV-1 abortion has declined dramatically over the past 30 years, with the vast majority of cases being single events. Confirmed EHV-1 abortions diagnosed at the University of Kentucky Veterinary Diagnostic Laboratory are shown in the figure on page 2. During that time, EHV-

1 neonatal deaths were diagnosed in 2011 (one), 2012 (two), and 2014 (one).

Respiratory and reproductive manifestations of EHV-1 are well-documented and have long been recognized. While viral latency and the production of a vaccine that produces long-term immunity and confirms better protection continue to be studied, these syndromes are well understood.

A manifestation of EHV-1 that is less understood is equine herpesvirus myeloencephalopathy (EHM). This neurologic disease manifests with acute onset ataxia or paresis, often accompanied by weakness, urinary incontinence, poor tail and anal tone, and tail elevation, either singly or in combination.

Equine Herpesvirus-1

Myeloencephalopathy can occur as a sporadic case of neurologic disease, but often manifests as an outbreak within a single population of horses. Outbreaks are often identified in dense populations of horses, such as at racetracks, horse shows or show barns, riding stables, etc. Generally, these horses are well-vaccinated and vaccination seems to be neither protective nor a risk factor.

While EHM's pathology is well-understood, the production and development of disease is not and is the subject

of continued research. Preventing EHM outbreaks relies on close observation of horses, including monitoring rectal temperatures, swift isolation of affected horses, and quarantine of premises.

A constant presence in the horse world, EHV-1 is well known, but many challenges remain. **UK**

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This is an excerpt from Equine Disease Quarterly, funded by underwriters at Lloyd's, London, brokers, and their Kentucky agents.

UK College of Agriculture, Food and Environment and Lloyd's of London Partnership Continues

The well-established and successful partnership between Lloyd's of London and the University of Kentucky (UK) College of Agriculture, Food and Environment continued when representatives from Lloyd's recently presented a \$50,000 check to UK.

"Next year, Lloyd's will celebrate a quarter century of financial support for the University of Kentucky's research dedicated to equine health," said Julian Lloyd, chair of Lloyd's Livestock Committee and bloodstock underwriter at the Amlin Syndicate. "The excitement of seeing the first Triple Crown winner in 37 years reminds us of the global appreciation of the Thoroughbred industry, and we are proud of our partnership's dedication to equine health."

The partnership supports Lloyd's *Equine Disease Quarterly*, a research-based publication dedicated to equine health, produced by the UK Department of Veterinary Science.

"The College of Agriculture, Food and Environment is grateful to Lloyd's of London for this long-standing and unique support of the veterinary science department in general since 1985, and of the *Equine Disease Quarterly* since 1992," said Nancy Cox, PhD, UKAg dean and director. "We appreciate Lloyd's long-standing confidence in the impact of our *Equine Disease Quarterly*."

The award-winning publication includes articles written by prominent researchers from around the world and provides timely and authoritative reports on some of the most important issues facing the equine industry. The *Quarterly* reaches more than 18,000 readers in 102 countries. Available in paper and online, its articles are regularly reprinted in numerous scientific and lay equine publications worldwide.

Lloyd's *Equine Disease Quarterly* is available to subscribers at no charge. It is co-edited by Roberta Dwyer, DVM, MS, Dipl. ACVPM, Peter Timoney, FR-CVS, PhD, and Alan Loynachan, DVM, PhD, Dipl. ACVP, from the Department of Veterinary Science.

The most recent *Quarterly* is online at www2.ca.uky.edu/gluck/q_oct14.asp. For

GRAD STUDENT SPOTLIGHT

NAME: CHANHEE MOK

From: Seoul, South Korea

Degrees and Institute where received:

MS in animal sciences, University of Kentucky

BS in animal science and environment, Konkuk University

Present position: PhD student in veterinary science, University of Kentucky



ChanHee Mok focused on swine nutrition while pursuing her bachelor's degree and was able to conduct research during her undergraduate career. Mok decided to continue her education in research and pursue new opportunities. She chose equine science, specifically equine nutrition, as her emphasis area because there are no equine nutritionists with a master's or doctoral degree in South Korea, even though horse racing is a growing industry.

Due to the lack of equine graduate programs in South Korea, Mok decided to study abroad to pursue her degrees. She said the University of Kentucky was her first choice because of the quantity of faculty members conducting research and the quality of the research and publications.

"By studying equine nutrition here for the past two years, I was able to gain more understanding of the horse species," Mok said. "Now I recognize the importance of musculoskeletal physiology in horses, and I will be completing my doctoral degree in that area."

During her master's program Mok studied threonine, an amino acid, and requirements in feed for adult horses using the indicator amino acid oxidation method. Kristine Urschel, PhD, an associate professor at the University of Kentucky, was Mok's advisor during her master's program. She is currently at the beginning of her doctoral program with Jamie MacLeod, VMD, PhD, a professor at the University of Kentucky, and has not determined the focus of her research project on musculoskeletal physiology yet.

"Specific threonine requirements in mature horses were not determined, but I was able to narrow the range where the actual threonine requirements might be," Mok said. "This research suggests a possibility that threonine might not be a limiting amino acid in mature horses fed a typical diet (timothy hay and soy/corn/oat-based concentrate)."

Mok said she appreciates both the research experience and the general horse knowledge she has learned during her graduate program. She gained practical experience working in the field and was surrounded by knowledgeable professors and students. After completing her doctoral degree, Mok plans to remain in academia to conduct equine research and to teach. **UK**

> Hannah Forte is a communication intern with the UK Ag Equine Programs and Gluck Equine Research Center and undergraduate student majoring in community and leadership development at UK.

Lloyd's Partnership

more information about the Department of Veterinary Science and the Maxwell H. Gluck Equine Research Center visit www2.ca.uky.edu/gluck.

Lloyd's of London is a 327-year-old insurance market whose members underwrite risk on a direct and reinsurance basis in more than 200 countries. As a global leader in specialty insurance, Lloyd's remains committed to supporting equine research and providing the

insurance coverage essential to the well-being and prosperity of bloodstock interests worldwide. **UK**

> Aimee Nielson is an agriculture communication specialist in the UK College of Agriculture, Food and Environment.

Disaster Education From Extension Programs



During recent floods and wildfires, it took people 15 minutes to an hour per horse to respond to disaster.

More than 100 land-grant colleges and universities have Extension educators who bring research-based information to agricultural producers and the public, including horse owners.

Over the last decade, the university specialists and educators involved with both equine science and disaster education (preparedness, mitigation, response, and recovery) have made significant collaborative strides in developing and publishing resource information. These efforts include materials on three different platforms: eXtension (the national Extension website), My Horse University (a collaborative effort between university equine specialists), and the Extension Disaster Education Network (EDEN,

a collaboration of disaster educators across the United States).

Webinars on animal disaster preparedness and biosecurity are available on eXtension and My Horse University (enter "disaster" in the search engines), along with a wealth of other equine and livestock information. The EDEN website is an extensive information hub that has disaster-specific information (e.g., drought, hurricanes, tornadoes, animal disease), as well as resources for communities, families, and children dealing with disasters.

A notable effort has been the EDEN Strengthening Community Agrosecurity Preparedness (S-CAP) program, which is a two-day course that facilitates emergency managers and agriculture/ livestock owners

to evaluate vulnerabilities within counties and develop enhanced agrosecurity plans to address local needs. This process almost always includes establishing response and evacuation guidelines for equine owners. To date, 48 S-CAP workshops have been conducted, which represent 24 states, 285 counties, and 23.7 million residents.

Universities and partners are incorporating rural readiness into disaster readiness curricula, which includes specific materials focused on equine issues before, during, and after disasters strike. Beneath the surface of many of the partnerships you will find delegates from EDEN developing, publishing, and collaborating on new materials on a regular basis.

It is imperative that information and resources for horse managers during

disasters is both research-based and refereed by experts and civic authorities for validity. With the popular nature of horses internationally, valid information that is readily available is critical when crucial incidents are impending or ongoing.

In most cases equine managers will have an average of 30 minutes to two hours to prepare for a disaster, although in some cases it can be as little as 15 minutes. During two floods and seven wildfires in the western United States it took an average of 15 minutes per horse to respond to disaster if the responders were already equipped and organized. If not ready, the average was closer to one hour per horse.

For those reasons equine managers should have a disaster plan, equipment, personnel, evacuation routes, emergency supplies, first-aid kits, and emergency contact information ready at all times. The eXtension, My Horse University, and EDEN resources can help utilize the hard-earned, factual knowledge developed by professionals to reduce impacts from disasters. Remember: Having a plan can save human and animal lives. **UK**

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This is an excerpt from Equine Disease Quarterly, funded by underwriters at Lloyd's, London, brokers, and their Kentucky agents.

UK Hosts Role of Immunology in Equine Health Symposium

The University of Kentucky Gluck Equine Research Center hosted the Role of Immunology in Equine Health Symposium on Nov. 21 at Embassy Suites, in Lexington. More than 100 attendees heard talks focused on the immune system in equine diseases caused by viruses, bacteria, and parasites.

Speakers included:

- Robert Mealey, DVM, PhD, Dipl. ACVIM, and Don Knowles, DVM, PhD, Dipl. ACVP, of Washington State University;

- Renaud Leguillette, DMV, MSc, PhD, Dipl. ACVIM, of the University of Calgary;
- Robert Causey, DVM, PhD, of the University of Maine;
- Peter Moore, DVM, PhD, of the University of California, Davis; and
- Amanda Adams, PhD, Udeni Balasuriya, BVSc, MS, PhD, Frank Cook, PhD, David Horohov, PhD, and John Timoney, MVB, PhD, DSc, MRCVS, from the UK Gluck Center.

The symposium was partially funded by a USDA-NIFA-AFRI grant titled "Identification of genetic factors responsible for establishment of equine arteritis virus carrier state in stallions." **UK**

>Jenny Evans, MFA, is the interim executive director of the Gluck Equine Research Foundation and marketing and promotion specialist senior at the Gluck Equine Research Center.

Follow us on social media!

The University of Kentucky College of Agriculture, Food and Environment has several equine-related social media pages featuring the latest news and events information. Follow UK Ag Equine Programs on Twitter @UKAgEquine and the Maxwell H. Gluck Equine Research Center @UKGluckCenter. Got Facebook? Like these pages administered by us:

University of Kentucky Ag Equine Programs: UK Ag Equine Programs is an overarching framework for all things equine at UK, including the undergraduate degree program, equine-related student organizations, equine research, and outreach activities.

University of Kentucky Maxwell H. Gluck Equine Research Center: The mission of the Gluck Center is scientific discovery, education, and dissemination of knowledge for the benefit of the health and well-being of horses.

University of Kentucky Horse Pasture Evaluation Program: The University of Kentucky Horse Pasture Evaluation Program is a service program offered to Kentucky horse farms with the goal of overall improved pasture management. Regardless of breed or discipline, the program's goals are to: provide detailed pasture management recommendations to horse farm owners and managers; help improve pastureland to increase pasture quality and quantity as a feed source and reduce the need for stored feeds such as hay and grain; and assess the potential risk of fescue toxicity of individual pastures to pregnant broodmares.

Saddle Up SAFELY: Saddle Up SAFELY is a rider safety awareness program sponsored by UK HealthCare, UK College of Agriculture, Food and Environment, and community organizations. It aims to make a great sport safer through education about safe riding and horse handling practices. **UK**

Upcoming Events

January 29, 1-5 p.m.

5th Annual UK Equine Showcase, <http://2016ukshowcaseshortcourse.eventbrite.com>

January 30th, 8:30 a.m.-4:30 p.m.

7th Annual Kentucky Breeders' Short Course, <http://2016ukshowcaseshortcourse.eventbrite.com>

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2016 UK Equine Showcase and Kentucky Breeders' Short Course

5th Annual UK Equine Showcase

January 29, 1 – 5 p.m.

A program highlighting the university's current equine programs and findings relevant to the industry, focusing specifically on the equine athlete

7th Annual Kentucky Breeders' Short Course

January 30, 8:30 a.m. – 4:30 p.m.

An in-depth program on equine reproduction and horse management issues

Register online at:

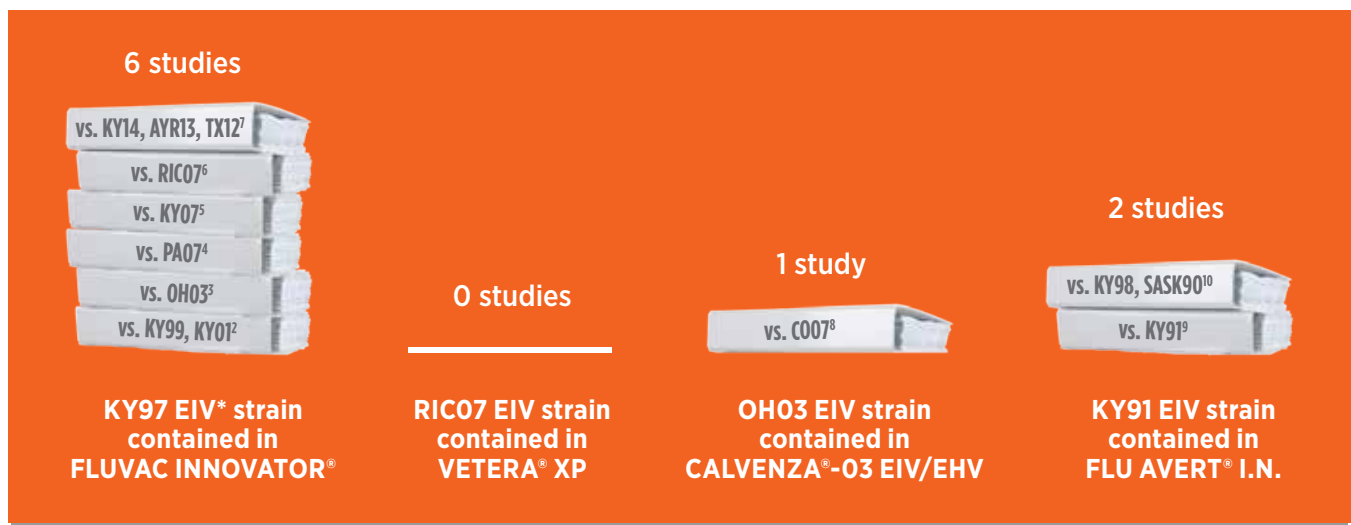
<https://2016ukshowcaseshortcourse.eventbrite.com>

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¹ West Nile-Innovator and Fluvac Innovator MDI Sales Data as of 12/31/14. Zoetis. Dec. 2014.

²⁻⁷ Data on file, Study Report No. 671-02-001R, 671-08-004.R, 766-09-002.R, 100REQBIO-01, 140REQBIO-1 and 15EQRGBIO-02, Zoetis Inc.

⁸ Calvenza vs. CO07 ACVIM 2011 abstract reference.

⁹ Townsend HGG, Penner SJ, Watts TC, Cook A, Bogdan J, Haines DM, Griffin S, Chambers T, Holland RE, Whitaker-Dowling P, Youngner JS, and Sebring RW: Efficacy of cold-adapted, intranasal, equine influenza vaccine: challenge trials.

¹⁰ Chambers TM, Holland RE, Tudor LR, Townsend HGG, Cook A, Bogdan J, Lunn DP, Hussey S, Whitaker-Dowling P, Youngner JS, Sebring RW, Penner SJ and Stiegler GL: A new modified-live equine influenza vaccine: phenotypic stability, restricted spread and efficacy against heterologous virus challenge.

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