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COMMENTARY

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LLOYD'S

"CRITICAL THINKING" IS THE PROCESS OF evaluating the merit and reliability of a stated fact and deciding whether the fact should be accepted or rejected.

In other words, don't believe everything you read. Be a critical thinker and a critical reader!

In doing some background research for a riding safety article, I came across a 1995 *Emergency Radiology* journal that stated there were 30 million horseback riders in the United States. Intriguing. Surely the footnote would refer me to a statistical source. Surprisingly, the reference was to another horseback riding injury article in the Center for Disease Control and Prevention's Morbidity and Mortality Report of May 1990. I found that article online, which indeed stated "...an estimated 30 million persons ride horses." Their reference was a 1987 article in the *American Family Physician* journal that also stated the 30 million figure but actually referenced a believable source, the American Horse Council's 1985 Horse Industry Directory. Wanting to see the actual data (30 million is a lot of riders, even in 1985), I have searched but am still trying to find a hard copy to see the actual data!

Referenced facts should lead directly back to their original source.

Lesson learned—Evaluate the "age" of referenced information.

Or consider the evening CNN news, a fairly respectable source of information, or so I thought. They reported a news item that appeared in the *National Inquirer*, a tabloid noted for sensationalism. Was there independent corroboration of the story by CNN? Who knows?

Lesson learned—Consider the information source in critically evaluating the news.

Last year while in Ireland, I read the November 17 *Irish Independent* newspaper. One article reported an outbreak of the deadly botulism virus in cattle. Newsworthy, yes; incorrect, absolutely. *Clostridium botulinum* is a bacterium, not a virus. Although a doctor from the Department of Agriculture in Northern Ireland was quoted, he likely was not allowed to proofread the article for accuracy. Either the writer or a diligent editor should have caught the errors that botulism was referred to twice as a bacterium (correct) and six times as a virus (incorrect) in the same short article. Who knows if there were other more substantial factual errors?

Lesson learned: Questionable details, question the whole.

People are human, and we all make mistakes. However, in this age of instant information, fact-checking has often taken a back seat to writers and reporters wanting to get the breaking "news" out to the public. It behooves us all to critically think about what we read, see and hear. There very well may be 30 million horseback riders in the US today, but those data are 25 years old, and is a horseback rider one who rides once a year or once a week? It makes a huge difference when analyzing horseback rider injury data. The devil is in the details!

Become more of a critical thinker!

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INTERNATIONAL

Fourth Quarter 2009*

THE INTERNATIONAL COLLATING CENTER, Newmarket, England, and other sources reported the following disease outbreaks.

Contagious equine metritis (CEM) was reported in France (one case), Germany (two cases) and the United Arab Emirates that involved a non-breeding Thoroughbred stallion detected on pre-export testing.

Outbreaks of equine herpesvirus-1 (EHV-1) related diseases were reported from Argentina, Australia, Germany, Japan, S. Africa, the UK and the US. Cases of herpesvirus abortion were diagnosed on three premises in Argentina; on two premises the mares were unvaccinated. Australia reported eight abortions in mares on three farms in Victoria. Isolated cases were reported from Japan and the UK. An outbreak of EHV-1 abortions occurred on four premises in S. Africa. The US confirmed five EHV-1 cases of abortion in Kentucky. Sporadic cases of EHV-1 myeloencephalopathy were diagnosed in Japan, Germany and the US. Equine herpesvirus 4 related respiratory disease was reported from Australia, Germany, Korea, Turkey, the UK and the US.

Equine influenza was reported from France, Germany, Sweden, the UK and the US. The disease was diagnosed on five premises in France; the majority were unvaccinated horses. Limited evidence of infection was reported from Germany, Sweden and the US. Seven outbreaks of influenza were confirmed in England, Scotland and Wales.

Strangles was reported from Australia, France, Germany, Korea, Sweden, the UAE and the US. Some 31 cases on nine premises were confirmed in France; Sweden reported 20 affected premises. The UAE confirmed strangles in 14 Arabians imported from Europe.

France, Germany, Ireland, S. Africa, Spain, Switzerland, the UAE and US recorded outbreaks of piroplasmosis. With the exception of Ireland, Germany and the US, the remaining countries considered piroplasmosis endemic. Ireland confirmed *Theileria equi* infection in 50 horses on 6 premises. The majority of 48 positive horses in Germany were infected with *T. equi*; many were imported animals. The overall seroprevalence of infection in Switzerland was 7.7 percent. The US reported 357 horses seropositive for *T. equi* in 12 states; 289 on the index premises in Texas. An additional 13 horses were confirmed positive for *T. equi* in New Mexico, epidemiologically unrelated to Texas premises.

Belgium, Germany, the UK and the US confirmed cases of equine infectious anemia. The disease occurred on several premises in Germany where the source of infection was not determined. Isolated cases of the disease were reported from Belgium and the UK in horses imported from Romania.

Eastern equine encephalomyelitis was confirmed in the US with 47 cases, primarily in southern states. Outbreaks of West Nile Virus infection were reported from Italy (38 cases) and the US (77).

Cases of leptospirosis were reported from Germany, Turkey and the US. A total of 18 sporadic cases of abortion were confirmed in Kentucky. The US confirmed 23 cases of *Lawsonia intracellularis* infection in foals, the vast majority in Kentucky. Several cases of Hendra virus infection were reported in Queensland, Australia; all but one were fatal. Sadly, one attending veterinarian also succumbed to Hendra virus infection.

** Third Quarter Report for Australia*

Equine Disease Quarterly

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NATIONAL

US Rabies Cases 2008

THE CENTERS FOR DISEASE CONTROL and Prevention published 2008 data on 6,841 confirmed animal rabies cases in 49 states and Puerto Rico. (Hawaii is rabies-free.) Of these, 93 percent were confirmed in wildlife; 7 percent in domestic species. These represent a fraction of the total number of rabid animals in the US since many cases are not observed and are undetected.

All states (except Hawaii) and Puerto Rico had confirmed cases of rabies in domestic and/or wild animals. Thirty positive horse/mule rabies cases were reported in 2008 from Alabama (1); Arizona (1); Delaware (1); Florida (2); Georgia (1); Kansas (2); Kentucky (2); Massachusetts (1); Maryland (2); Missouri (1); North Dakota (1); Nebraska (2); New York (1); Oklahoma (1); Puerto Rico (1); Rhode Island (1); South Dakota (2); Tennessee (1); Texas (4); and Virginia (2).

Rabies is a viral disease that affects mammalian species. In the continental US, the primary reservoirs of rabies are raccoons, skunks, foxes and bats (Figure 1). In Puerto Rico, the mongoose is the wildlife reservoir. Bat rabies was reported in all states except Hawaii, Alaska, New Mexico and Puerto Rico; however, within the past five years, rabid bats have been confirmed in all 49 continental states.

Two human cases of rabies were confirmed in California and Missouri, both attributed to the bat variant of rabies virus.

Because rabies is a zoonotic disease, one rabid horse can expose many humans prior to diagnosis, necessitating post-exposure human rabies vaccinations costing thousands of dollars. No post-exposure rabies vaccinations exist for exposed animals. Rabies is one of the core vaccinations recommended by the American Association of Equine Practitioners. Any horse showing behavioral changes or neurologic clinical signs should be promptly seen by a veterinarian.

Blanton, JD, Robertson, K, Palmer, D., et al. (2009) Rabies surveillance in the United States during 2008. J Am Vet Med Assoc 235:676-689.

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Polymerase Chain Reaction: Benefits and Drawbacks

THE APPLICATION OF POLYMERASE CHAIN reaction (PCR) assays to veterinary medicine has revolutionized the way diagnosticians detect infectious agents and genetic markers of non-infectious disease. Confusion frequently encircles this technology due to its novelty and complexity. This article will briefly review the underlying basis of PCR, describe interpretation of results, and discuss its benefits and drawbacks over traditional methods of pathogen detection.

All living organisms contain unique sequences of genetic material that consist of deoxyribonucleic acid (DNA) and/or ribonucleic acid (RNA). These hereditary materials serve as templates (or codes) for cellular reproduction and orchestrate the construction of proteins that are essential to all biologic processes. Traditional methods of pathogen recognition (i.e., bacterial culture, fluorescent antibody tests, serologic tests, etc.) have focused on the presence of proteins for identification. Conversely, PCR tests are designed to amplify and detect segments of DNA or RNA that are very specific to a genetic sequence or organism.

Interpretation of positive and negative PCR results can be challenging. Similar to traditional pathogen detection techniques, PCR results must be strictly interpreted in conjunction with the history, clinical signs, and evidence of disease. A positive PCR result only indicates the detection of the target genetic sequence. It can not differentiate between the incidental presence of an organism, colonization without disease, transient infection, or active infection with disease.

In addition, a positive PCR test can't differentiate between living or dead organisms as genetic material can be present in both. Assays can be designed to differentiate pathogenic from non-pathogenic isolates but may not distinguish between vaccine strains and

wild-type pathogens. Knowledge of the vaccine (modified live versus killed; route of inoculation; and duration of vaccine persistence) in combination with clinical disease can greatly aid in the interpretation of whether a positive PCR is due to vaccine interference or vaccine failure. Equally important, false negative PCR results may arise due to PCR inhibitors found in clinical samples. Newer technology has greatly eliminated the influence of these inhibitors on PCR results.

PCR technology can provide many advantages over traditional techniques. Many PCR tests can be rapidly performed and interpreted the same day as sample submission. Large numbers of samples can be simultaneously completed. A major advantage of PCR over traditional techniques includes the ability to rapidly identify organisms that are difficult to culture, such as Lawsonia. Differential PCR assays can determine if an isolate is nonpathogenic or contains toxigenic properties (genes) necessary to induce disease. Lastly, PCR can amplify very small amounts of genetic material, thus it can detect very low numbers of organisms in a sample. The major drawbacks are a lack of antimicrobial sensitivity data, complexity of the assay, and the price of PCR equipment and kits.

Prices and availability of different PCR tests vary based on laboratory. Please call or visit your laboratory's website to see available tests, pricing, collection procedures, and shipping guidelines prior to sample collection.

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Legal and Ethical Veterinary Compounding

DRUG COMPOUNDING CAN BE DEFINED AS the art and science of mixing ingredients, which may be active, inactive or both, to create a specific dosage form to meet a specific patient's needs. Compounding can be performed by a veterinarian or by a pharmacist upon receipt of a veterinarian's prescription. A veterinarian must have a valid veterinarian-client-patient relationship (VCPR) to legally prescribe or prepare a compounded product. Federal regulations require that legally compounded drugs meet a number of criteria including:

- A valid VCPR must exist.
- There must be no Food and Drug Administration (FDA)–approved, commercially available animal or human drug that when used as labeled or in an extra-label fashion in its available dosage form and concentration will appropriately treat the patient.
- The product must be compounded by a licensed veterinarian or a licensed pharmacist on the order of a veterinarian within the practice of veterinary medicine.
- Veterinarians must comply with all aspects of the federal extra-label drug use regulations, including recordkeeping and labeling requirements.

Pharmacies specializing in veterinary compounding have been growing exponentially, aided by the ability to reach a larger number of consumers via the Internet. Many commercial websites market directly to the owner, offering subjective treatments based on testimonials and compounded therapies that are not permitted by the criteria established for compounded drugs. Currently, the FDA does not have the resources to enforce these regulations; however, veterinarians should be aware that abuse of these regulations can result in legal actions.

Compounded drugs are not the same as generic drugs. Generic drugs are FDA approved and must have bioequivalence to the "pioneer brand name" drug. Generic drugs can be identified by the Abbreviated New Animal Drug Application (ANADA) number on their label and by cross-checking in the FDA Green Book of Approved Animal Drug Products. In contrast, compounded drugs are spontaneously prepared products that lack FDA approval.

The idea is that compounded drugs with their possible inadequacies are better than no drug at all and suitable for a small patient population. Equine practitioners using compounded products are put in a position of evaluating the integrity of the compounding pharmacy as well

as the quality and consistency of the pharmaceuticals they produce. The FDA does not routinely inspect compounding pharmacies. This lack of regulatory oversight means that almost none of the veterinary compounding pharmacies follow Good Manufacturing Practices (GMPs) guidelines. GMP training and protocol are not required of compounding pharmacies because they are not authorized to "manufacture" drug products. In some instances, loose oversight has allowed negligent compounders to prepare products from unregulated raw materials with no quality standards. Many of these raw materials are chemical grade bulk products that were never intended for use in the preparation of legitimate pharmaceuticals. Other compounding pharmacies distribute medication without a valid prescription. Veterinarians are schooled on quality patient care, but few pharmacists receive training in quality control for pharmaceutical production.

Veterinarians who frequently use compounded products would be well advised to learn more about pharmacy issues related to veterinary medical therapy. For example:

• It is illegal to compound a specific product when there is an approved drug form of that specific product, except to make a different dosing form. However, the approved product must be used to make the compounded new dose form.
• It is illegal to mark up prices on compounded drugs.
• As a veterinarian, if you use a compounded product, you assume liability for any adverse effects or efficacy failure.
• Drug manufacturers are required to carry product liability insurance; pharmacies are not.
• It is illegal to have a drug compounded in order to obtain the drug at a lower price.

Compounding of drugs for use in animals is a necessary and beneficial component of veterinary practice. Licensed veterinarians may legally use or dispense prescription drug products only within the course of their professional practice where a valid VCPR exists. FDA Compliance Policy Guides permit licensed practitioners to manufacture, prepare, propagate, compound or process drugs during the regular course of business, as long as the compounded product is NOT a new animal drug.

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KENTUCKY

Foal Heat Breeding

WHETHER BREEDING MARES FOR BUSINESS or pleasure, a variety of costs are associated with the venture. These costs may encompass several categories: (1) the daily maintenance cost of the mare, (2) mare replacement costs and insurance, (3) costs associated with breeding (i.e., veterinary services, transportation), (4) routine health and farrier work, and (5) the stud fee. Many of these costs will be incurred whether or not the mare produces a live foal. Mare owners seek to minimize these costs while ensuring the general health of the mare and her ability to produce a live foal.

With an average gestation length of approximately 340 days, mares must become pregnant within 25 days of foaling in order to continue to produce a foal at approximately the same time each year. If the 25 day window is surpassed, the mare will continue foaling later each year, until eventually she will have to miss a breeding season. This is commonly known as "falling off the calendar."

In most breeding operations, the majority of mares are pregnant at the beginning of the breeding season and must foal before being bred during the current breeding season. In order to minimize the length between foaling and breeding, managers may consider breeding the mare on her first ovulation postpartum, referred to as foal heat breeding. One benefit

of breeding on foal heat is that the mare will produce a live foal at approximately the same time the next year, assuming she becomes pregnant. However, studies in the 1980s and 1990s reported lower pregnancy rates following breeding on foal heat, compared to foaling mares bred on a subsequent cycle. Some studies even reported that mares bred on foal heat were less likely to produce a live foal.

The lower reproductive performance reported among mares bred on foal heat is likely related to insufficient time for uterine recovery post-foaling among many mares. Studies have reported mares bred on their foal heat ovulation (approximately 10 days or fewer postpartum) tended to have lower pregnancy rates than mares bred on foal heat more than 10 days postpartum. Mares under consideration for foal heat breeding should be examined for the presence of any uterine or cervical bruising, intrauterine fluid or vaginal discharge.

A second option to minimize the interval length from foaling to breeding is to administer prostaglandin F2α approximately one week following the first ovulation postpartum. The practice is often referred to as short cycling. This will reduce the length of time until the next ovulation, compared to waiting for the natural subsequent ovulation. This may be a good option for foaling mares ovulating fewer than 10 days postpartum or mares that need additional time for uterine recovery.

A study was undertaken among a cohort of Thoroughbred mares in central Kentucky during the 2004 and 2005 breeding seasons. Results found similar pregnancy rates 15 days post-breeding among foaling mares bred on foal heat at least 10 days postpartum, foaling mares short-cycled with prostaglandin F2 and foaling mares bred on a subsequent ovulation. However, mares bred on foal heat less than 10 days postpartum had lower pregnancy rates. In this study, mares were selectively bred on foal heat based on management and veterinary discretion. This finding suggests that, even with careful management, breeding mares fewer than 10 days postpartum is not advantageous.

Other more recent studies involving reproductive performance among foaling mares have also reported no differences in the pregnancy rates of mares bred on foal heat compared to foaling mares bred on a subsequent cycle. The improvement in the pregnancy rates on foal heat breeding in more recent studies may be related to improved veterinary management and treatment of mares postpartum.

In conclusion, breeding on foal heat can be a beneficial practice for improving the overall efficiency of a breeding program by maintaining consistent foaling dates over time. However, foal heat breeding should only be considered if ovulation occurs at least 10 days postpartum and veterinary examination reveals normal reproductive health. The health of the mare should be the primary consideration in all breeding decisions.

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Figure 1.

Distribution of major rabies virus variants among wild terrestrial animal reservoirs in the United States and Puerto Rico, 2008.

Adapted from JAVMA, Vol 235, No 6, Sept 15, 2009, p. 677.