The Modern Equine Vet

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Rethink Protein In Insulin Dysregulation

Radiographic Abnormalities in Sports

Cheaper Alternative for Endocrine Care?

Practice Management: Racetrack Records

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ASK THE Infectious Disease Expert

This column, brought to you by Merck Animal Health, features insightful answers from leading minds.

How quickly does pelleted diclazuril reach therapeutic levels in cerebrospinal fluid, and why is that important for the treatment of EPM?

Great question. With a progressive neurological disease like equine protozoal myeloencephalitis (EPM), the faster you begin treatment the better the outcome, especially in acute cases. Final test results can take a few days, or up to a week, so it is crucial to begin empirical treatment before they are available. Diclazuril is a first-line antiprotozoal agent against *Sarcocystis neurona*, but until now we haven't had definitive data to understand when its concentration in cerebrospinal fluid (CSF) reaches the minimum inhibitory concentration (MIC) for this parasite. In other words, how quickly does it begin working?

A recent pharmacokinetic study conducted by our team at North Carolina State University fills that gap and offers practical guidance for equine practitioners.

The study involved six healthy adult horses that were neurologically normal and negative for EPM. We measured diclazuril levels in both plasma and CSF following a single oral dose administered at the labeled dose of 1 mg/kg top-dressed on sweet feed. Blood and CSF were collected at baseline then 1, 4, 8, 12, 16, 24, 48, 72, 96, 120, 144, 168 and 192 hours post-administration.

KEY STUDY FINDINGS

A standout finding of this research is the speed at which diclazuril reached therapeutic levels in the CSF:

- **MIC achievement:** Diclazuril concentrations in the CSF surpassed the MIC of *S. neurona* (1 ng/mL) in all horses by 12 hours post-administration.
- **Peak concentrations:** The CSF concentrations peaked at 24 hours, while plasma concentrations peaked later at 48 hours. A horse with active EPM carries the parasite in the nervous system, which is why CSF concentrations are more valuable than blood levels alone.
- **Prolonged therapeutic effect:** Not only did diclazuril reach the MIC quickly, but it also remained well above the MIC through 8 days, suggesting a sustained therapeutic effect.

A standout finding of this research is the speed at which diclazuril reached therapeutic levels in the CSF.

HOW DO I APPLY THIS TO EPM CASES IN MY PRACTICE?

The proven ability of diclazuril to reach therapeutic levels within 12 hours of one oral dose allows for prompt treatment of horses suspected to have clinical EPM. This can be especially critical in acute cases where time is of the essence. The study provides practitioners with added confidence in prescribing diclazuril as a first-line option for treating EPM.

When delivering an EPM diagnosis, it's common for owners to feel anxious and impatient. Communicate that although clinical improvement may lag behind drug exposure, diclazuril rapidly establishes therapeutic levels in the horse. Emphasizing this swift onset can encourage owner compliance and patience during the initial treatment period. It remains important to follow the full treatment regimen, as indicated, for optimal therapeutic effect in horses with clinical EPM.

BOTTOM LINE

In acute cases, initiating diclazuril therapy early can give your patient the best possible head start against rapidly progressing disease. This concrete pharmacokinetic data can help you confidently guide EPM treatment protocols.

This research was presented at the 2025 International Veterinary Emergency & Critical Care Society Meeting.

ABOUT THE AUTHOR

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Dr. Hepworth-Warren grew up in Indiana and graduated from Purdue University in 2010 with her DVM. Following graduation, she did an internship in Florida and then moved back to the Midwest for an equine internal medicine residency at Iowa State University. After achieving board certification she stayed on for a year at ISU and then spent four years in private practice in New Jersey. In June of 2019, she accepted her current position at NC State University and moved south. Her favorite type of cases are neonatology, respiratory disease and neurology.

WANT TO ASK A QUESTION? EMAIL THE EDITOR.

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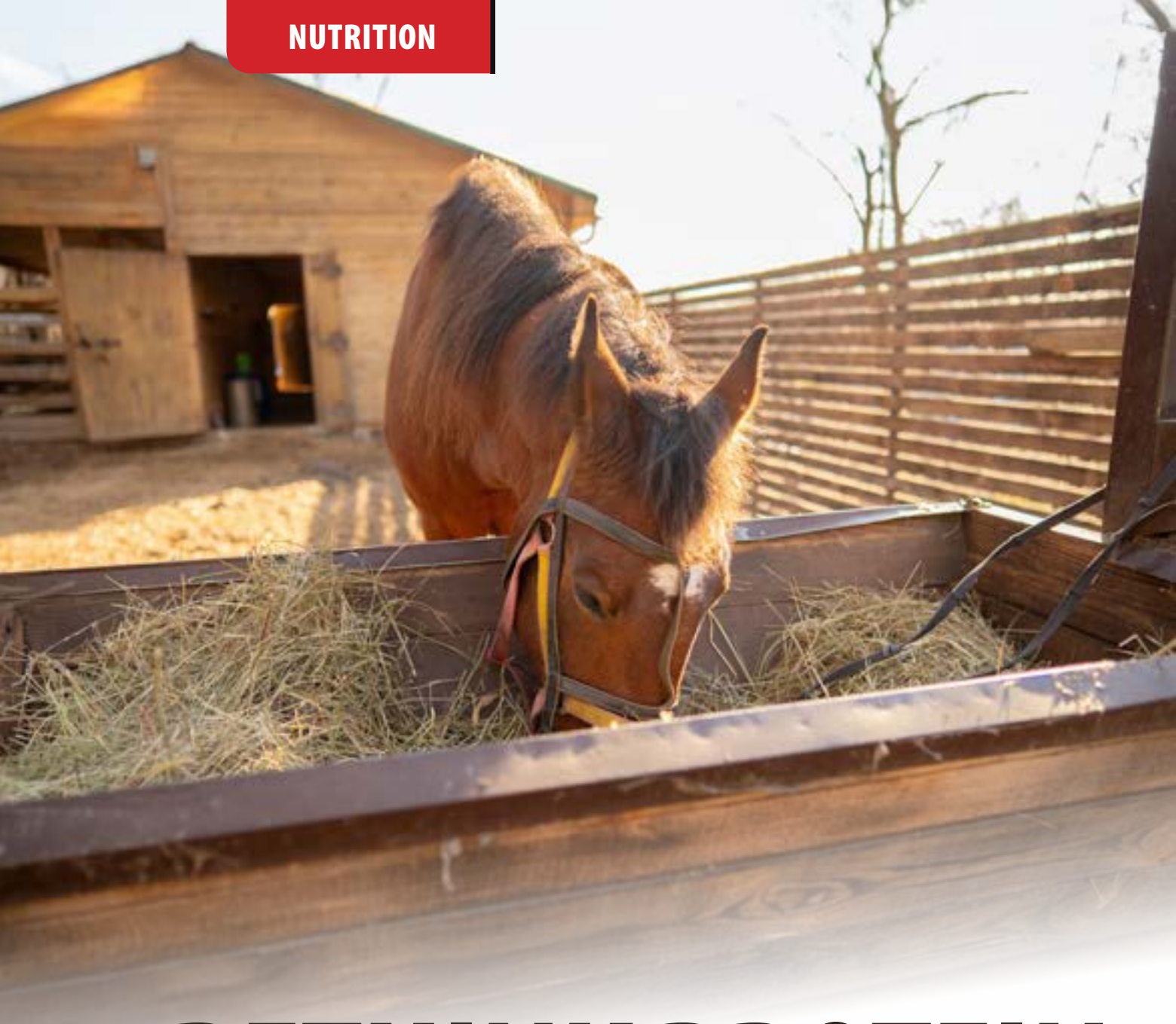

RETHINK PROTEIN
IN YOUR INSULIN-DYSREGULATED HORSES

By Paul Basilio

When feeding horses with insulin dysregulation (ID), high-protein ration balancers have historically been the go-to treatment recommendation, even though the influence of dietary protein on disease control is not well understood.

Recent evidence, however, suggests that high-protein meals may exacerbate postprandial hyperinsulinemia in equids with ID, according to **Allison T. Palmer**, DVM, an equine internal medicine resident at The Ohio State University College of Veterinary Medicine. The new evidence is compelling enough to call into question the safety of this nutritional intervention in patients with ID.

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2 GOALS TO FEEDING HORSES WITH ID

1. Encourage weight loss
2. Minimize insulinemia

Feeding the ID Equid

"Current recommendations for feeding horses with ID principally focus on 2 primary goals," Dr. Palmer said during a presentation sponsored by Purina at the 69th Annual AAEP Convention in San Diego. "The first goal is to encourage weight loss where appropriate, and the second goal is to minimize insulinemia. The amount of hydrolysable dietary carbohydrates in the diet is frequently manipulated to achieve these aims."

Most current dietary strategies for equine ID patients involve feeding low-nonstructural carbohydrate (NSC) forage and low-NSC, high-protein ration balancers to minimize the risk for trace mineral and vitamin deficiencies over time. NSCs include starch, monosaccharides like glucose and fructose, disaccharides, and fructans.

Pasture grass, cured hay and other forages can contain high levels of NSCs, which are associated with postprandial hyperinsulinemia.

"Most of the research effort [in this area] in humans is focused on the role of dietary protein and amino acids in improving systemic insulin sensitivity, encouraging weight loss and improving gain of lean muscle mass," Dr. Palmer said.

Several studies in people have shown that high-protein diets in patients with type 2 diabetes mellitus result in significantly enhanced insulin secretion over time, independent of weight loss.

That's great for humans who want to reduce their dose of exogenous insulin, but that's not quite so great for horses with ID, where a principal therapeutic goal is minimizing hyperinsulinemia, according to Dr. Palmer.

"Actually, the opposite is almost always the goal in horses," she explained. "We want to minimize this postprandial insulin secretion. Hyperinsulinemia is the most important risk factor for endocrinopathic laminitis."

Equid-Centric Research

Despite the difficulties in extrapolating human studies to an equid population, relatively little attention has been given to the effect of dietary protein on insulin and glucose dynamics in equids. However, this is starting to become an active area of investigation for several research groups.

"While NSC appears to be a principal nutritional factor driving the equine postprandial response, high-protein meals have also been associated with exacerbated insulin responses in horses with ID," Dr. Palmer noted.

One such equid-centric study found that when the insulinemic responses to a high-protein meal (31% crude protein fed at 4 g/kg) was fed to healthy horses and ID horses, there was a 9-fold greater insulin response in the ID horses over a 4-hour period (*Vet J.* 2019;251:105341 https://www.sciencedirect.com/science/article/abs/pii/S1090023319300760?via%3Dihub).

Another study that's being prepared for publication appears to echo these results. In that study, 7 metabolically healthy horses were fed a high-protein meal as part of a feed trial. Later, those same 7 horses underwent induction of experimental insulin dysregulation via 7 days of oral dexamethasone at 0.08 mg/kg. The feed trial was repeated while the horses were dysregulated, according to unpublished data from Dr. Palmer's research.

"Those horses had a much more exaggerated insulin response when they were insulin dysregulated as compared to their baseline state," Dr. Palmer stated, adding: "These studies strongly suggest that high-pro-

Prevalence of ID in horses varies from 18% to 27% depending on the breed.

tein ration balancers may exacerbate insulinemic responses in the setting of equine ID."

Enter mTOR

When evaluating the role of feed in equine metabolic disease, Dr. Palmer said that it is important to understand that dietary protein and amino acids are robust activators of mechanistic target of rapamycin (mTOR) at the tissue level. mTOR plays a huge anabolic role in a horse's response to nutrient ingestion, but prolonged mTOR activation can also cause local and systemic insulin resistance.

"mTOR activation has also been associated with changes in the epithelial phenotypes in horses," Dr. Palmer said. "Activation of mTOR signaling has been demonstrated within the digital lamellae in horses subjected to experimental models of all 3 forms of equine laminitis: sepsis-related, hyperinsulinemia-associated, and support-limb laminitis."

The role of dietary protein and amino acids in laminitis does require further investigation, but she said that preliminary studies have validated the concern.

A feed trial can be performed to evaluate the degree of post prandial hyperinsulinemia in response to diet components.

CHECK OUT

Read more about nutrition here.

Clinical Next Steps

"When managing a patient whose insulin dysregulation is poorly controlled in the face of a low-NSC diet, other aspects of the patient's diet should be scrutinized to assess the influence on the animal's persistent hyperinsulinemia," Dr. Palmer explained.

She added that a feed trial can be performed to evaluate the degree of postprandial hyperinsulinemia in response to certain components of the diet, including the ration balancer. This test can be similar to an oral glucose test.

In 1 example, she said that a horse can be fed 1 flake of grass hay the night before the test and then muzzled afterward. In the morning, a baseline blood sample can be collected, and then the horse could be fed the specific dietary component (e.g., the ration balancer at the manufacturer's recommended dose).

Additional blood samples can be drawn at 60 and 90 minutes (or longer) postprandially to determine the insulinemic response.

"If they have an exaggerated response, that could warrant modification of that portion of the diet," she said. "Patients receiving high-protein ration balancers whose insulin dysregulation is currently poorly controlled should have this facet of their management critically evaluated." **MeV**

AVMA Endorses USDA Plan to Enhance Workforce

The American Veterinary Medical Association (AVMA) endorses the Rural Veterinary Action Plan by the Department of Agriculture (USDA) to strengthen the rural veterinary workforce and protect America's food supply.

The Rural Veterinary Action Plan would:

Enhance veterinary grant programs by adding money to the program—up to an additional $15 million for the Veterinary Medicine Loan Repayment Program;

- Analyze rural veterinary shortages by producing a report for policymakers to address veterinary shortage situations;
- Recruit and retain USDA veterinarians by exploring opportunities to increase pay and bonuses for federal veterinarians and revitalize existing programs; and
- Catalog federal resources available to veterinarians for starting a practice.

"The AVMA applauds the USDA for recognizing and working to address the immediate need to recruit and retain veterinarians in rural and underserved communities," said **Michael Q. Bailey**, DVM, DACVR, AVMA president. "Strengthening the nation's animal health infrastructure and agricultural economy relies on the expertise of livestock and public health veterinarians. Through the Rural Veterinary Action Plan, animal and human welfare will be maintained, our food supply will be protected, and public health will be safeguarded."

The AVMA urged Congress to pass the Rural Veterinary Workforce Act, which is a bipartisan bill that would expand the reach and maximize the allocated funding of the highly successful VMLRP. The program helps attract veterinarians to USDA-designated veterinary shortage areas by assisting with veterinary school debt. **MeV**

For more, see the Rural Veterinary Action Plan.

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RADIOGRAPHIC ABNORMALITIES

NOT LINKED TO POOR PERFORMANCE IN JUMPING HORSES

By Michael DePeau-Wilson

Mild radiographic abnormalities of the thoracolumbar spine did not appear to negatively affect the performance capabilities of Warmblood jumping horses, according to findings published in the *Journal of Equine Veterinary Science*.

In an observational study of 100 competition-level horses, the presence of radiographic abnormalities did not correlate significantly with the horses' current level of competition, age or their number of years competing ($P>0.05$), the researchers reported.

"Mild radiographic abnormalities of the back in jumping horses are common and do not necessarily

Image courtesy of

A radiograph of the back of a horse that is successfully competing at 1.4 m showjumping.

negatively affect performance," said coauthor **Sarah le Jeune**, DVM, DACVS, DACVSMR, CVA, Cert vet Chiro, of the UC-Davis School of Veterinary Medicine, in an interview with *Modern Equine Vet*.

Notably, the researchers found that every horse in the study showed some radiographic abnormalities.

"It was surprising to see that none of these horses had a completely normal back," Dr. le Jeune said, adding that "back radiographs need to be interpreted with caution."

Overall, the researchers noted that these findings are "vital for veterinarians when interpreting radiographs of spinous processes in clinical patients and on prepurchase examination."

The researchers found that every horse in the study showed some radiographic abnormalities, but most were mild.

The Study

For this observational study, the researchers evaluated 100 Warmbloods, including 25 mares, 69 geldings and 6 stallions. The average age of the horses was 10.6 years.

Eligible horses competed in at least 10 classes of either show jumping or hunter competitions at the 2018 HITS Coachella Desert Circuit. The researchers noted that the competition jumping heights varied among the horses from 0.90 m to 1.60 m (median, 1.35 m).

For the study, 4 observers analyzed and graded 1,770 interspinous spaces for the presence of narrowed interspinous space, sclerosis, lucency and enthesopathy. Using the Intraclass Correlation Coefficient to assess reliability, the authors noted the observers had good consistency in their collective assessment of interspinous space, sclerosis and lucency, but poor agreement in their assessment of enthesopathy.

Overall, 64 horses had narrowed interspinous spaces (median, 4 narrowed interspinous spaces [range 0-11]), 47 had sclerosis (median, 1 sclerotic spinous process [range 0-9]), 10 had lucencies, and 88 had enthesopathy. Narrowed interspinous processes and sclerosis were mostly observed between T15 and L1, while enthesopathy was typically found at the withers (T8-T13).

While every horse showed some abnormalities, the researchers noted that the total radiographic score of the study population ranged from 0.01 to 0.64 (median, 0.15), which suggested the overall severity of radiographic signs was mild.

While the researchers found no significant correlation between individual radiographic findings and the current level of performance, they did show some positive correlations between abnormalities and performance, as indicated by Pearson correlation coefficient estimates.

For example, highest career level was positively correlated with narrowed interspinous spaces (r=.21; P=0.037) and sclerosis (r=.21; P=0.034). Overall radiographic score also was correlated positively with current performance level (r=.20; P=0.047) and highest career level (r=.24; P=0.016).

The study had some key limitations. The researchers noted that the clinical examinations performed on the horses were cursory, which may have led to the missed detection of actual back pain in the study horses.

Since most Warmblood jumping horses undergo radiography during their prepurchase examinations, the researchers noted that horses with severe radiographic abnormalities likely fail those assessments. Those outcomes could explain the low prevalence of severe radiographic abnormalities in this population, so they recommended that similar studies be conducted with different demographics, such as discipline or geographic location, before drawing further conclusions.

"A thorough clinical examination is necessary to determine whether radiographic abnormalities of the back are clinically significant or not," Dr. le Jeune said. **MeV**

For more information:

Kerbert MP, le Jeune SS, Philips KL, et al. Mild radiographic abnormalities of thoracolumbar spinous processes are not associated with decreased performance in 100 Warmblood jumping horses in active competition. *J Equine Vet Sci.* 2025;147:105366.

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References: 1. Sundra T, Kelty E, Rendle D. Five versus seven-day dosing intervals of extended-release injectable omeprazole in the treatment of equine squamous and glandular gastric disease. Equine Vet J. 2023. 2. Rendle, D.I. & Gough, S.L. (2024) Pharmaceutical treatment of equine glandular gastric disease: A contextualized review of recent developments. Equine Veterinary Education, 00, 1-10.

A Cheaper Alternative for Metabolic Care?

By Adam Marcus

Here's a good reason to let the cat back in the barn—or stable, anyway.

A new study suggests a feline formulation of the drug bexagliflozin can effectively regulate insulin in equids with minimal side effects.

Bexagliflozin belongs to a family of drugs called sodium-glucose cotransporter 2 (SGLT2) inhibitors, which promote the excretion of glucose in the urine, and which equine veterinarians—and physicians—use to control insulin in their patients. However, these agents can be expensive, prompting some clinicians to look for cheaper alternatives.

Caitrin Lowndes, MVB, a research fellow in the endocrinology laboratory at the University of Pennsylvania's New Bolton Center, said she and her colleagues were inspired to conduct the new study after seeing an increase in the number of veterinarians treating horses with bexagliflozin, which has been approved for use in cats but not horses.

According to Dr. Lowndes, the drug costs about half as much to use as other SGLT2 inhibitors—$4 to $5 per day for a 1,000-pound animal versus $8 to $10 per day for compounded ertugliflozin—making it a compelling, if off-label, option.

Ertugliflozin is a human medication. No insulin-regulating drugs are currently labelled for equine use, and the FDA has approved only a few products for use in veterinary species, she said. However, ertugliflozin is used off-label to treat insulin dysregulation and related conditions in horses and ponies.

"We do some outside testing as a fully functioning endocrine laboratory, and we'd heard some vets were using this formulation as a more cost-effective alternative to other SGLT2 inhibitors," said Dr. Lowndes, who presented the findings at the 2025 ACVIM Forum, held in Louisville, Ky.

Assessing Efficacy

To assess the effectiveness of the medication, Dr. Lowndes and her colleagues conducted a randomized, placebo-controlled crossover trial in 10 Arabian horses (age range, 5-18 years) with a diagnosis of naturally occurring insulin dysregulation that was not caused by treatment for another condition.

In the first phase, which lasted 10 days, half of the animals received placebo and half received bexagliflozin 15 mg once per day. After a 4-day washout period, the animals switched arms and were again observed for 10 days, followed by another washout period of 12 days. In the final phase, 8 of the horses received bexagliflozin 30 mg for 7 days.

"We based the initial dose on what people were using clinically," Dr. Lowndes said.

To monitor the effects of the drug, the researchers performed an oral sugar test using 0.15 mL/kg of corn syrup at the beginning and end of each treatment phase. They also measured insulin concentrations at rest and after the oral sugar test, as well as levels of triglycerides before and after treatment.

Treatment with the SGLT2 inhibitor was linked to a mean reduction in resting insulin of 15 µIU/mL for the 15-mg dose and 21 µIU/mL for the 30 mg dose, the researchers found. Resting insulin was unchanged for animals receiving placebo.

Insulin levels following a glucose tolerance test fell by 30 µIU/mL and 46 µIU/mL for the small and large doses, respectively, and similar changes were observed for insulin area under the curve. Concentrations of serum triglycerides at rest increased with both the 15-mg and 30-mg doses of bexagliflozin versus placebo. Still, this effect did not appear to be associated with short-term harm, Dr. Lowndes said. "These increases were also lower than those reported with other SGLT-2 inhibitors," she added.

Long-Term Safety Data Needed

The new study and research on other formulations of SGLT2 inhibitors in horses demonstrated effectiveness with no major signals of harm, Dr. Lowndes said. However, she noted, the long-term safety of the agents in equids is not well understood, as the studies typically have a follow-up period of about 45 days. At least 1 group has reported elevations in certain liver enzymes in animals taking the medications, although whether the drugs caused the issue is unclear, she noted.

"I think it is fair to say in this study, bexagliflozin performed similarly to results reported in other studies investigating SGLT-2 inhibitors, and maybe was more effective than metformin or pioglitazone for treatment of insulin dysregulation, but further comparison studies are needed," Dr. Lowndes said.

Despite the range of medical options for controlling insulin, Dr. Lowndes said drugs should be the last option, not the first. "Our advice is these are basically rescue drugs for horses that are experiencing laminitis or that are severely hyperinsulinemic," she said.

"You should not replace diet and exercise" as the front-line approach, particularly in overweight or obese animals, she added. **MeV**

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How Supplied
• GASTROGARD (omeprazole) Paste for horses contains 37% w/w omeprazole and is available in an adjustable-dose syringe. Each syringe contains 2.28g of omeprazole. Syringes are calibrated according to body weight.

Indications
• For treatment and prevention of recurrence of gastric ulcers in horses and foals 4 weeks of age and older.

Dosage Regimen
• For treatment of gastric ulcers, GASTROGARD should be administered orally once-a day for 4 weeks at the recommended dosage of 1.8 mg omeprazole/lb body weight (4 mg/kg). For the prevention of recurrence of gastric ulcers, continue treatment for at least an additional 4 weeks by administering GASTROGARD at the recommended daily maintenance dose of 0.9 mg/lb (2 mg/kg).

Directions For Use
• GASTROGARD for horses is recommended for use in horses and foals 4 weeks of age and older. The contents of one syringe will dose a 1250 lb (568 kg) horse at the rate of 1.8 mg omeprazole/lb body weight (4 mg/kg). For treatment of gastric ulcers, each weight marking on the syringe plunger will deliver sufficient omeprazole to treat 250 lb (114 kg) body weight. For prevention of recurrence of gastric ulcers, each weight marking will deliver sufficient omeprazole to dose 500 lb (227 kg) body weight.
• To deliver GASTROGARD at the treatment dose rate of 1.8 mg omeprazole/lb body weight (4 mg/kg), set the syringe plunger to the appropriate weight marking according to the horse's weight in pounds.
• To deliver GASTROGARD at the dose rate of 0.9 mg/lb (2 mg/kg) to prevent recurrence of ulcers, set the syringe plunger to the weight marking corresponding to half of the horse's weight in pounds.
• If, after dosing, the syringe is not completely empty, it may be reused on following days until emptied. Replace the cap after each use.

Warning
• Do not use in horses intended for human consumption. Keep this and all drugs out of the reach of children. In case of ingestion, contact a physician. Physicians may contact a poison control center for advice concerning accidental ingestion.
• The safety of GASTROGARD has not been determined in pregnant or lactating mares.

Adverse Reactions
• In efficacy trials, when the drug was administered at 1.8 mg omeprazole/lb (4 mg/kg) body weight daily for 28 days and 0.9 mg omeprazole/lb (2 mg/kg) body weight daily for 30 additional days, no adverse reactions were observed.
• To report suspected adverse drug events, for technical assistance, or to obtain a copy of the Safety Data Sheet (SDS), contact Boehringer Ingelheim Animal Health USA Inc. at 1-888-637-4251. For additional information about adverse drug experience reporting for animal drugs, contact FDA at 1-888-FDA-VETS, or online at www.fda.gov/reportanimalae.

Efficacy
• **Dose Confirmation:** GASTROGARD, administered to provide omeprazole at 1.8 mg/lb (4 mg/kg) daily for 28 days, effectively healed or reduced the severity of gastric ulcers in 92% of omeprazole-treated horses. In comparison, 32% of controls exhibited healed or less severe ulcers. Horses enrolled in this study were healthy animals confirmed to have gastric ulcers by gastroscopy. Subsequent daily administration of GASTROGARD to provide omeprazole at 0.9 mg/lb (2 mg/kg) for 30 days prevented recurrence of gastric ulcers in 84% of treated horses, whereas ulcers recurred or became more severe in horses removed from omeprazole treatment.
• **Clinical Field Trials:** GASTROGARD administered at 1.8 mg/lb (4 mg/kg) daily for 28 days healed or reduced the severity of gastric ulcers in 99% of omeprazole-treated horses. In comparison, 32.4% of control horses had healed ulcers or ulcers which were reduced in severity. These trials included horses of various breeds and under different management conditions, and included horses in race or show training, pleasure horses, and foals as young as one month. Horses enrolled in the efficacy trials were healthy animals confirmed to have gastric ulcers by gastroscopy. In these field trials, horses readily accepted GASTROGARD. There were no drug related adverse reactions. In the clinical trials, GASTROGARD was used concomitantly with other therapies, which included: anthelmintics, antibiotics, non-steroidal and steroidal anti-inflammatory agents, diuretics, tranquilizers and vaccines.
• **Management Considerations:**

Safety
• GASTROGARD was well tolerated in the following controlled efficacy and safety studies.
• In field trials involving 139 horses, including foals as young as one month of age, no adverse reactions attributable to omeprazole treatment were noted.
• In a placebo controlled adult horse safety study, horses received 20 mg/kg/day omeprazole (5x the recommended dose) for 90 days. No treatment related adverse effects were observed.
• In a placebo controlled tolerance study, adult horses were treated with GASTROGARD at a dosage of 40 mg/kg/day (10x the recommended dose) for 21 days. No treatment related adverse effects were observed.
• A placebo controlled foal safety study evaluated the safety of omeprazole at doses of 4, 12 or 20 mg/kg (1, 3 or 5x) once daily for 91 days. Foals ranged in age from 66 to 110 days at study initiation. Gamma glutamyltransferase (GGT) levels were significantly elevated in horses treated at exaggerated doses of 20 mg/kg (5x the recommended dose).

Reproductive Safety
• In a male reproductive safety study, 10 stallions received GASTROGARD at 12 mg/kg/ day (3x the recommended dose) for 70 days. No treatment related adverse effects on semen quality or breeding behavior were observed. A safety study in breeding mares has not been conducted.

For More Information
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Revised 05/2019

Boehringer Ingelheim

A Kinder, Gentler Antibiotic?

By Adam Marcus

The antibiotic cephalothin appears to be kinder to the gut microbiome than other first-line antimicrobial agents, researchers in Japan have found, suggesting it may be a good choice to avoid inducing diarrhea.

"Cephalothin sodium is an antibiotic that we have used for many years in Japan, especially at our facilities," said **Yuta Kinoshita**, DVM, PhD, of the Equine Research Institute at the Japan Racing Association, in Tochigi. "From our clinical experience, we've long known that it causes few gastrointestinal issues. Our study provides scientific data to support this observation."

In a recent study, Dr. Kinoshita and his colleagues compared the effects of IV cephalothin and other antibiotics on the gut microbiome in 62 horses. Of those horses, 39 were clinically normal; 16 had received antibiotics—cephalothin (n=5), minocycline (n=5) and metronidazole (n=6)—for 5 days each; and 7 had had at least 1 bout of colitis.

The horses that received minocycline and metronidazole experienced significant changes in the diversity of their gut bacteria, including the number of organisms and the variety of species; however, those given cephalothin did not appear to experience such a disruption. While horses that experienced colitis exhibited "severe" disruptions in a panel of 52 gut bacteria, giving cephalothin did not appear to exacerbate these changes. This suggests "its gut-microbiota–friendly characteristics," the researchers reported.

"Notably, *Verrucomicrobia* subdivision 3, associated with mucosal integrity, remained stable in the cephalothin group, whereas its relative abundance significantly decreased in the minocycline, metronidazole and colitis groups (P <0.05)," they added.

"*Verrucomicrobia* is known to be an important bacterial group for maintaining a healthy gut barrier and balance," Dr. Kinoshita explained. "The fact that this group was maintained in horses treated with cephalothin suggested that the drug is less likely to weaken the gut's natural defenses."

However, he noted, determining the direct effect of a single bacterial group is complicated. "To use other species as reliable markers for gut health, we need more research that combines data on what these bacteria do and their population sizes and relative abundance in a wide range of horses," he said.

The findings "provide a strong scientific reason for veterinarians to choose cephalothin" as a first-line agent, "especially for horses at high risk for gut problems," such as those under stress or after surgery. "Our own choice of antibiotics hasn't changed much, as we have a long history of using this drug. However, we have heard that other veterinary clinics in Japan have started using cephalothin as a first-choice treatment in appropriate cases," Dr. Kinoshita added.

He stressed that cephalosporins are used mainly for gram-positive infections, such as those caused by *Staphylococcus* and *Streptococcus*.

"We use minocycline, which has a broader spectrum, for suspected mixed infections that might include gram-negative bacteria. Metronidazole is used for infections caused by anaerobic bacteria like *Bacteroides* or *Clostridioides difficile*," he said.

Preventing dysbiosis does not begin and end with the antimicrobial agent, he said. "We think it's important to remember that many things can cause dysbiosis—not just antibiotics, but also surgery, pain and diet changes. Our approach is to minimize and separate the factors that can cause dysbiosis," he added. "The risk increases when multiple factors happen at the same time. So, we try to reduce the impact of each factor and avoid having them overlap—by managing pain well before surgery, not making sudden diet changes and avoiding unnecessary antibiotic use." **MeV**

For more information:

Kinoshita Y, Niwa H, Ueno T. Minimal disruption of equine gut microbiota by intravenous cephalothin treatment. *J Vet Med Sci*. 2025;87(6):690-696. doi: 10.1292/jvms.25-0105
https://www.jstage.jst.go.jp/article/jvms/87/6/87_25-0105/_article

Amino Acids Hold Clues to Infection Status in EPE

By Adam Marcus

Horses with either clinical or subclinical proliferative enteropathy experience changes in certain amino acid concentrations that could help equine veterinarians better identify active infections.

The findings come from a retrospective analysis of blood samples collected from farms in Japan that had been affected by outbreaks of equine proliferative enteropathy (EPE), which is caused by infection with *Lawsonia intracellularis*.

"This research helps illuminate the possibility that blood amino acid patterns—specifically involving alanine, citrulline and tryptophan—could serve as additional indicators [of EPE], especially when clinical signs are subtle or absent," said **Hidetomo Iwano,** DVM, PhD, a professor at the Rakuno Gakuen University School of Veterinary Medicine, in Japan, who helped conduct the research. "We believe that amino acid profiling could help identify which horses are infected and assess the extent of spread within a group—particularly at an early stage of the disease—when *Lawsonia* infection is suspected in a population."

The results could point to a new way to manage equine proliferative enteropathy.

Dr. Iwano and his colleagues published their findings in a recent issue of the *Equine Veterinary Journal*.

For the study, the researchers analyzed blood samples from 135 horses from 59 farms; 46 horses had been diagnosed with clinically evident EPE. Healthy horses (n=26) from farms where EPE had not been diagnosed served as the control group.

Blood samples were analyzed using the Phenomenex EZ:faast test, which uses gas chromatography to measure concentrations of amino acids.

Several amino acids were present in substantially greater concentrations among exposed horses versus healthy controls. These included aspartic acid, glutamic acid and glycine. Other molecules were scarcer in exposed animals than in their healthy counterparts—among them glutamine, isoleucine and asparagine. Upregulation of alanine and downregulation of citrulline and tryptophan were observed in horses with clinically apparent EPE.

Taken together, the researchers said, the test revealed a pattern that could indicate which animals have been exposed to *L. intracellularis* and which have not, even in the absence of symptoms of the infection.

Dr. Iwano stressed that infection with *L. intracellularis* leads to gastrointestinal illness, not metabolic disease. "Therefore, the primary focus must remain on appropriate antimicrobial treatment and identification and isolation of affected animals," he said.

However, infections can damage the gastrointestinal mucosa, which in turn can lead to hypoproteinemia, hypoalbuminemia and systemic nutritional deficits. "The early changes in amino acid levels observed in this study may reflect a compensatory response to such deficits, and the fact that these changes occur early is particularly noteworthy," he said.

Although more research is needed to validate the findings, the results could point to a new way to manage EPE in horses, said **Yuya Mizuguchi**, DVM, of the Mitsuishi Animal Medical Centre and the Hokkaido Agricultural Mutual Aid Association, who led the study.

"From a standpoint of amino acid theory, excessive amino acids are not stored in the body unless insufficient ones are not supplied," Dr. Mizuguchi told *Modern Equine Vet*. "Although it is our conjecture, supportive care with specific amino acids combined with appropriate antibiotic treatment will hasten recovery from the clinical disease and negate or prevent development to a severely devastating state."

Both Drs. Mizuguchi and Iwano said amino acid analysis is too expensive for widespread use. "I believe costs will likely decrease in the future as amino-acid–based diagnostics become applicable to a wider range of diseases, allowing for economies of scale," Dr. Iwano said. "In the context of high-value animals, such as racehorses, the cost-benefit balance may already be justifiable, especially when early diagnosis and intervention could impact long-term health and performance." **MeV**

For more information:

Mizuguchi Y, Niwa H, Inoue H, et al. Blood amino acid changes associated with *Lawsonia intracellularis* infection in horses. *Equine Vet J*. Published online May 22, 2025. **https://beva.onlinelibrary.wiley.com/doi/10.1111/evj.14533**

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Spike Protein Mutations Can Fuel Outbreaks of Western Equine Encephalitis

By Jake Miller

Small shifts in the molecular makeup of a virus can profoundly alter its ability to infect animals and humans, according to a series of studies led by **Jonathan Abraham**, MD, PhD, an associate professor of microbiology in the Blavatnik Institute at Harvard Medical School, and his team. The goal of the studies was to better understand the risk for western equine encephalitis virus (WEEV) and related viruses. The work, which was supported by federal funding, was published in *Cell*.

Small shifts in the molecular makeup of a virus can profoundly alter its ability to infect animals and people.

WEEV circulates mainly between mosquitoes and birds. Since the turn of the century, it has disappeared as a pathogen in North America, and it occasionally spills over to infect small numbers of mammals in South America. However, in 2023, WEEV caused the first major human outbreak in 4 decades in South America, involving thousands of horses and more than 100 confirmed human cases.

How did the virus lose its ability to infect humans in North America, and why did it persist as a pathogen in South America and re-emerge to cause a major outbreak? According to the new study, the secret lies in alterations in the virus' molecular makeup.

Using an advanced imaging technique, the researchers determined how the spike proteins on the surface of WEEV strains interact with the PCDH10 cell receptor, which is shared by humans and birds.

The virus enters its host and causes infection by attaching 1 of its spike proteins to a receptor on the surface of the host cell. The spike protein and receptor need to fit together for an infection to occur.

In a strain from 1958, when deadly WEEV outbreaks occurred regularly, the virus was a good fit for both human and bird cell receptors. In a North American WEEV strain isolated from mosquitoes in California in 2005, the virus was a good fit for bird cell receptors but not for mammals.

The researchers found that a single mutation in the virus's spike protein was enough to prevent it from attaching to horse and human cells. The mutation, however, still allowed the virus to enter and infect cells using the bird receptor.

Strains isolated in South America during the past century, including the 2023-2024 outbreak strains, had never acquired the single mutation that would prevent them from attaching to the horse and human cell receptors.

The researchers also observed that a single change in the viral spike protein enabled WEEV strains to attach to a different receptor called VLDLR, which is found on mammalian brain cells. This same receptor is shared by WEEV's cousin, eastern equine encephalitis virus (EEEV), the most virulent alphavirus and one that has continued to cause outbreaks in North America. In the past, the highly virulent ancestral forms of WEEV were capable of invading host cells through VLDLR.

When researchers blocked this key receptor using a decoy VLDLR protein, animals infected with the older, more dangerous WEEV strain were protected against the deadly brain inflammation caused by these virulent strains.

The virus's ability to rapidly shift from a harmless reservoir in insects and wild birds to a dangerous human pathogen highlights the importance of surveillance efforts to monitor for potential outbreaks and emerging diseases.

"The more we understand about this important group of emerging viruses before a serious threat emerges, the better," Dr. Abraham said. **MeV**

For more information:

This article was originally published on the Harvard Medical School website. It has been edited for style and length.
https://hms.harvard.edu/news/how-small-number-mutations-can-fuel-outbreaks-western-equine-encephalitis-virus

Fan X, Li W, Oros J, et al. Molecular basis for shifted receptor recognition by an encephalitic arbovirus. *Cell*. 2025;S0092-8674(25)00347-2. doi: 10.1016/j.cell.2025.03.029 **https://www.cell.com/cell/fulltext/S0092-8674(25)00347-2**

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1. Zycosan® Freedom of Information Summary NADA 141-559
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UC Davis Opens All-Species Imaging Center

The UC Davis William R. Pritchard Veterinary Medical Teaching Hospital recently opened the All-Species Imaging Center.

The center includes 4 diagnostic imaging suites, 2 control rooms, a patient holding room, a radiologist's image interpretation room and office space for technical staff. The center is outfitted with the latest in advanced imaging technology. The 4 imaging suites include high field magnetic resonance imaging (MRI) for both small and large animals, positron emission tomography (PET) and computer tomography for both small and large animals, and a dedicated large bore equine CT.

The center also serves as home to the world's largest advanced radiology training program. With 12 residents and 8 board-certified radiologists, the hospital's Diagnostic Imaging Service is the premier training ground for veterinarians seeking board certification in imaging. **MeV**

High-field MRI, with a 3T (Tesla) magnetic field, has a 75 cm bore—the widest bore available on a 3T magnet.

The Large Bore Equine CT scanner (Left) allows better diagnostic capabilities for horses and other large animals. This scanner is integrated onto a complex platform that can be moved both vertically and horizontally allowing head and distal limb scans to be performed on standing horses using only sedation.

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It is a pale yellow to brownish yellow, clear, sterile solution.
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CONTRAINDICATIONS: Horses with hypersensitivity to pentosan polysulfate sodium or any of the inactive ingredients in Zycosan should not receive Zycosan. Do not use Zycosan concurrently with other anticoagulant drugs. Do not use in horses with clotting disorders or within 24 hours of surgical procedures (see Warnings and Precautions).
WARNINGS AND PRECAUTIONS:
User Safety Warnings: Not for use in humans. Keep out of reach of children. Pentosan polysulfate sodium is a weak anticoagulant. Caution should be used when administering Zycosan if you are taking an anticoagulant. **In case of accidental self-injection, seek immediate medical attention. If product comes into contact with skin, rinse skin thoroughly with water and seek medical attention if needed.** To obtain a Safety Data Sheet (SDS), contact Dechra at (866) 933-2472.
Animal Safety Warnings and Precautions:
Zycosan has been shown to prolong coagulation parameters up to 24 hours after injection, therefore caution should be used when administering this drug before or after strenuous activities (see Target Animal Safety). Due to the anticoagulant effects, this drug may exacerbate Exercise Induced Pulmonary Hemorrhage (EIPH).
The concurrent use of NSAIDs with Zycosan has not been evaluated. Due to the anticoagulant effects of Zycosan and known anticoagulant effects of some NSAIDs, caution should be used if NSAIDs are concurrently administered. Horses concurrently treated with Zycosan and NSAIDs should be monitored for hemorrhage or other clinical signs of abnormal bleeding (e.g., petechiae, ecchymosis, or epistaxis). The safety of long-term repeat use of Zycosan has not been evaluated. Pigmentary changes in the retina (pigmentary maculopathy) have been reported in human patients following long-term oral use of pentosan polysulfate sodium. It is not known if a similar finding occurs in horses. The safe use of Zycosan has not been evaluated in breeding, pregnant, or lactating horses.
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Injection site reactions were the most frequently reported adverse reactions in the field study. Injection site reactions were associated with clinicopathology changes in some cases. Other adverse reactions reported in more than one horse were prolongation of coagulation parameters (activated partial thromboplastin time (aPTT) and prothrombin time (PT)), lethargy, behavior changes, and colic.
To report suspected adverse events, for technical assistance or to obtain a copy of the Safety Data Sheet (SDS), contact Dechra at (866) 933-2472 . For additional information about adverse drug experience reporting for animal drugs, contact FDA at 1-888-FDA-VETS or online at http://www.fda.gov/reportanimalae.
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Don't Race Through Your Horse's Records

By Tom Rosenthal

Equine veterinarians who treat horses at the racetrack must comply with all the medical record-keeping requirements shared by their colleagues in other practice types. Still, the unique nature of horse racing places specific demands on practitioners working at the track, said **Jeff A. Blea,** DVM, the equine medical director at the University of California, Davis, School of Veterinary Medicine.

Recordkeeping at the racetrack poses unique challenges because of the volume of patients seen daily, having to deal with the racehorses' trainers instead of directly with the horses' owners, and meeting mandated reporting requirements of the local regulatory agencies, Dr. Blea said at the 70th Annual AAEP Convention in Orlando, Fla.

Dr. Blea strongly urged equine veterinarians who practice at racetracks to familiarize themselves with the regulations issued by both their state veterinary board and their state racing commission, as the requirements may differ.

A significant difference between racetrack practice and in-clinic practice is the requirement for client consent. Client consent is incredibly important, according to Dr. Blea, and "it's becoming more important on the racetrack."

Who's the Client?

Identifying the client is an important consideration on the track. Every veterinarian needs to know who speaks for the animal and who will pay for that animal's care. Before 2024, under the California state practice act, the client was considered the owner of the animal. However, he noted, "if you practice on the racetrack, you never see the owner of the animal."

In 2024, the definition of client changed in California. Now, the client is the person who deals with the veterinarian, Dr. Blea said. That will be different depending on where you practice.

He stressed that veterinarians who practice at the track should have the horses' trainers sign a form stating they are the representatives of the horse's owner. "You must have a veterinarian-client-patient-relationship form. Put that in the record. You're covered. Very simple," Dr. Blea said.

He added: "Recordkeeping is not sexy. It's not something that's in neon lights, but it needs to be in neon lights. Know your state practice act."

There is a legal presumption of what all records should contain, including accuracy and completeness. "That's the basis of where you want to start with your records," Dr. Blea said.

Records must be contemporaneous, he said. "In other words, they have to be completed within 24 hours," Dr. Blea said. "Some states give you a little bit of leeway for holidays and weekends. Again, check your local practice act in your state or the state you practice in to see what contemporaneous means."

That deadline is onerous, but it is essential to abide by it. "It's tough. Believe me, I understand," he said.

In addition, records for each patient must remain at the "facility," but how do you keep your records at the racetrack when you have no office there? "You can't take your records home," he said.

Dr. Blea recommended the use of electronic records and technology to facilitate effective record-keeping at the track. Writing the records for each horse on paper and then submitting them to the office at the end of the week "won't fly" because of the contemporaneous recordkeeping requirement, he explained.

Voice dictation software can benefit racetrack veterinarians. There are several options available, and they are continually being upgraded to enable veterinarians to work more efficiently.

"You have to develop good habits throughout the day," Dr. Blea said. "That's easy to say, more difficult to do." He advised veterinarians to develop good recordkeeping habits with their assistants and technicians. "Set some time aside throughout the day and try to get all those records done and complete. Once you go to electronic records, you'd wish you'd done it 25 years ago."

Electronic records enable veterinarians at the track to ensure their records are accurate for any treatment, particularly for cases involving emergency surgery. The records also address the issue of illegible handwriting, and they provide the required proof that the records were not altered. Electronic records also assist in maintaining the required log of controlled drugs dispensed while moving from horse to horse at the track.

Electronic records also allow for the preservation of conversations with clients via text message. "In this day and age, a lot of communication on the racetrack is done via text," Dr. Blea said. All that information can be transferred to the record, so if there is any question later, the veterinarian has a record.

On a typical day at the racetrack, everyone is busy running around. Trainers are here for a while, then they leave and you work with the assistant trainer. "Just upload the texts to your record," he added. "It's a real beneficial tool to have whenever you get a complaint or a threat of a lawsuit." **MeV**

PRACTICE MANAGEMENT

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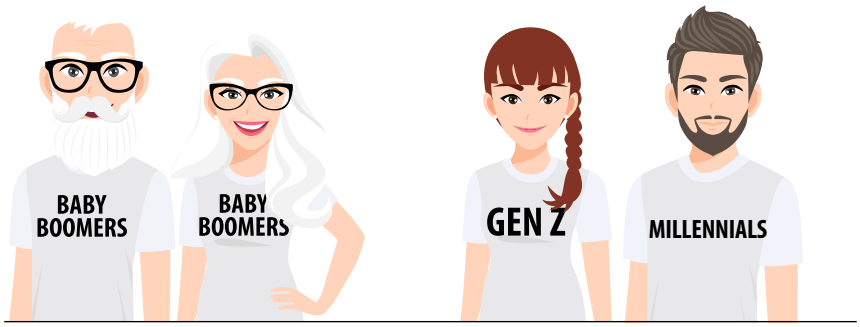
VET Stats

Debunking a Myth

The idea that younger workers are unreliable because they hop from 1 job to another has been debunked by a new report by the National Institute on Retirement Security. The job-changing patterns of Millennial and Generation Z workers are similar to previous generations at comparable ages. Retention and quit rates appear to depend on the economy and job market, more than age.

MEDIAN JOB TENURE



Baby Boomers (25-34 in 1983):
3 years

Gen Z and Millennials (25-34 in 2024):
2.7 years

COLLEGE EDUCATED WORKERS

In 2016,
75% of Millennial men
74% of Millennial women
worked at least 13 months

In 2000,
72% of Gen X men
70% of Gen X women
worked at least 13 months

THE GIG ECONOMY

16% of Americans earn income as gig workers.

31% report its their full-time job

Only 3% of them are 18 and older

35- TO 44-YEAR-OLD EMPLOYEES' median tenure remained consistent from 1983 to 2024.

BABY BOOMERS HELD AN AVERAGE OF 12.7 jobs over their careers—nearly half when they were 18 to 24.

FOR MORE VET STATS, CHECK OUT OUR WEBSITE AT WWW.MODERNEQUINEVET.COM

Source: **https://www.nirsonline.org/reports/debunkingjobhopping/**

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