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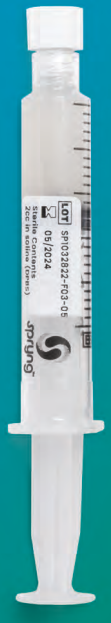

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[1] West Nile Virus Challenge Vaccine Efficacy, BI study number: V9 2009 WNV 12mo DOI
[2] Equine Influenza Challenge, BI study number: 01 V9 6mo DOI OH/03.
[3] Lack of Interference - Influenza Challenge, BI study number: 2012-001 Inf. Data on file at Boehringer Ingelheim.

A Turning Point

For those of you who didn't go to the 2022 AAEP Convention, you missed something special. Not just because of the outstanding lineup of presentations and speakers, but because it was a turning point.

For the first time since I began going to AAEP Conventions in 1980, the job of equine veterinarian was the focus. There were a plethora of horse health, research and business presentations. But the "job" of equine veterinarian took center stage.

What that job has looked like for the last 40-plus years of my career is what Amy Grice, DVM, MBA, has called "sacrificing yourself on the altar of veterinary practice." It has been the 24/7/365, always-available, "every horse owner is a potential client" (no matter how they treat you) kind of job.

Veterinarians of tomorrow will have the same passion for the horse and the "job," but they won't sacrifice themselves.

They are already saying this in the not-so-subtle way of rejecting the job of equine veterinarian. That's true whether they are coming out of vet school or are recent graduates. Even older equine vets are leaving at a rate faster than new ones can be recruited.

This turning point is necessary to change the job of equine veterinarian.

Now and into the future, equine veterinarians can create their own jobs. Your job might be working four days a week with no emergency. It might be *only* working emergency. It might be sharing the job of four full-time veterinarians with five people and a great support staff.

Many young practitioners are changing what the job of equine veterinarian looks like today and what it will look like in the future. That is what will save the industry. This doesn't mean there won't be ambulatory practices with emergency duty. It doesn't mean there won't be clinics and hospitals offering 24/7/365 care for horses. It does mean we can change the job description to attract and retain a wider variety of veterinarians who are passionate about horses.

The AAEP Commission

After researching and gathering data, the AAEP formed the AAEP Commission on Equine Veterinary Sustainability as part of a campaign to transform and sustain equine practice and "Change the Numbers." The commission will develop, oversee and assist with the execution of programs designed to increase the sustainability of equine practice for the betterment of equine vets and the welfare of the horse.

The commission consists of five subcommittees developed around the key areas affecting the sustainability of equine practice. The subcommittees are: Compensation, Emergency Coverage, Students, Internships and Practice Culture. Each subcommittee has co-chairs, an officer liaison and 12-15 members.

Learn more by reading an article by Grice on page 22 and on EquiManagement.com by searching for "The AAEP Commission for Equine Veterinary Sustainability."

Happy 100!

It's exciting to hit a milestone, and this was a big one. The Disease Du Jour podcast on horse health and research—brought to you by Merck Animal Health—broadcast its 100th show in January. If you haven't listened, check it out on EquiManagement.com or your favorite podcast network! EM

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By Carly Sisson

In addition to bringing you four annual print magazines, EquiManagement posts new web content daily covering everything from business to wellness to research. Here's a glimpse at what you will find on EquiManagement.com, where you can also subscribe to our two newsletters.

NEW: AAEP Commission for Equine Veterinary Sustainability Column

Dr. Amy Grice is heading up the content creation for a new column in each EquiManagement magazine and monthly on EquiManagement.com to talk about the AAEP Commission for Equine Veterinary Sustainability. The first article (page 20) focuses on the commission's top priority of retaining and attracting equine practitioners. In addition, she details the subcommittees the commission has developed. Make sure to check out the online version of this article to watch a video presentation that Grice composed on this topic. Then, come back monthly online for more updates on the Commission's important work (search for "AAEP Commission").

Research Reports

Every month, Dr. Nancy Loving contributes a handful of online-exclusive articles detailing emergent research on a variety of horse health topics. Her articles provide a comprehensive overview of the peer-reviewed research, as well as citations to the original studies if you want to read more. Recent topics have included the use of medical-grade honey for treating tenacious wound infections, CT scans of headshaking horses, and wound healing with maltodextrin/ascorbic acid gel. (Look for "Articles" in the website navigation bar and select "Research & Medical" in the dropdown menu.)

SEAN PAVONE/ISTOCK VIA GETTY IMAGES

Business Briefs

You are already familiar with the Business Briefs column in our print magazine, but did you know that EquiManagement.com features a unique Business Briefs article every month? Recent topics have included choosing an ambulatory practice vehicle, understanding non-compete clauses and effectively marketing new veterinary services. The Business Briefs column is brought to you by CareCredit and is written by Dr. Amy Grice. (Locate "Articles" in the navigation bar and select "Business Development" in the dropdown menu.)

AAEP Coverage

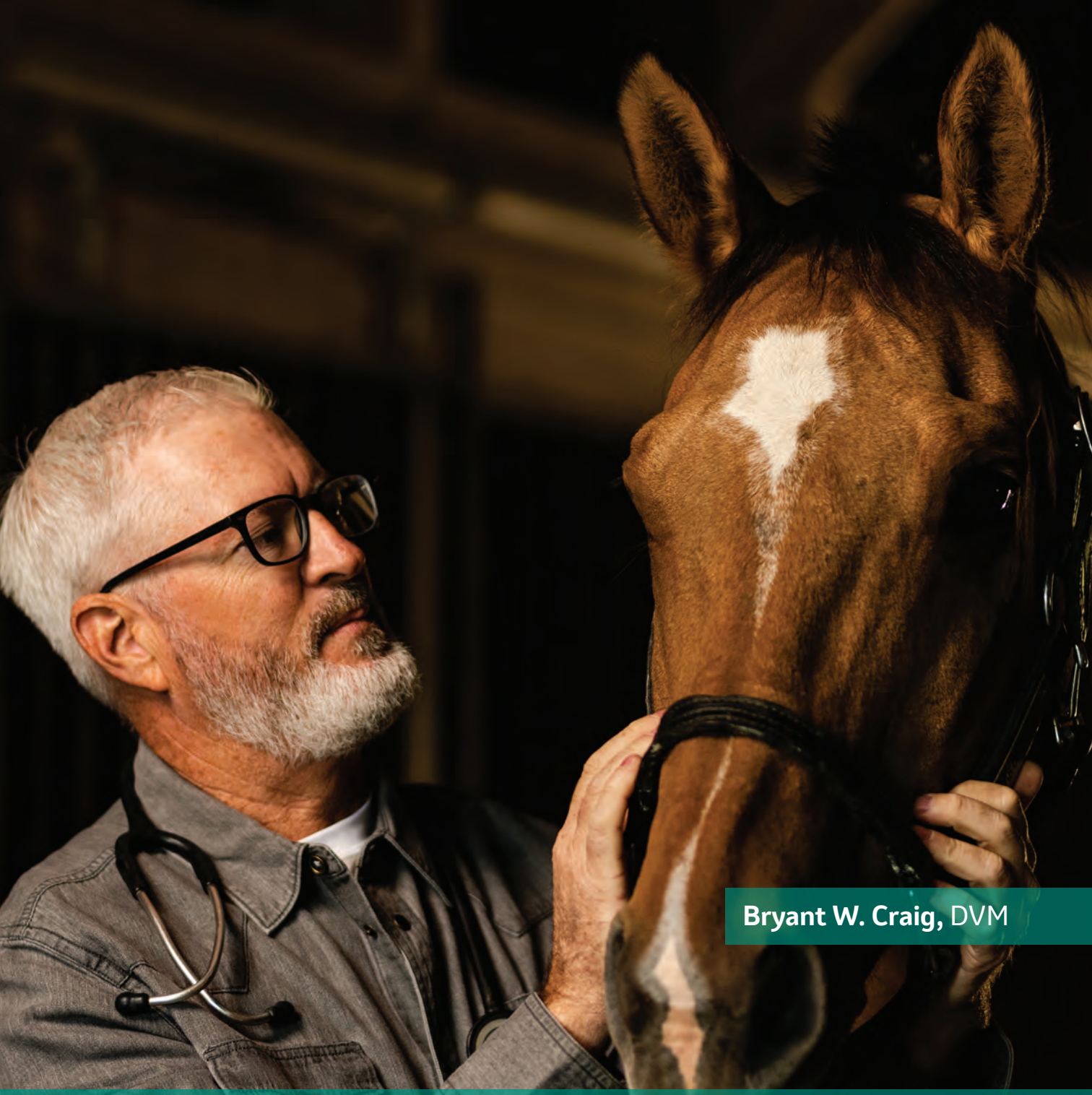
EquiManagement has been delivering detailed coverage of some of the most exciting and innovative presentations at the 2022 AAEP Convention in San Antonio, Texas. Our coverage kicked off during the event itself, with Dr. Stacey Oke's popular Bonus Coverage, brought to you by ADM Cellerator Advantage. Her Bonus Coverage series covered presentations such as antimicrobial stewardship, sex chromosome disorders, humane euthanasia and more. She also detailed the mental health resources available to equine veterinarians through the AAEP. (Search "2022 AAEP Convention Bonus Coverage.")

EquiManagement continued to cover AAEP presentation topics into the new year. From January through March, we posted two articles per month on health, business and veterinarian wellness topics from the Convention. Don't miss these great articles!

Dr. Nancy Loving covered the health presentations, with support from American Regent Animal Health. Some topics included rein lameness associated with the TMJ, colic surgery referral and the ridden horse pain ethogram. (Search for "AAEP Health Coverage.")

Dr. Amy Grice covered the business presentations with support from CareCredit. Topics included better utilization of vet techs, creating a positive culture in your equine practice and mentoring new veterinarians to keep them in equine practice. (Search for "AAEP Business Coverage.")

Grice also covered the veterinarian wellness presentations with support from Sentinel Feeds. In these articles she covered the keynote presentation, reasons why employees quit and mentoring new equine veterinarians. (Search for "AAEP Wellness Coverage.") EM



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By Nancy S. Loving, DVM

Injectable Omeprazole

At the 2022 British Equine Veterinary Association (BEVA) conference, Tania Sundra, BSc, BVMS, MANZCVS, director of Avon Ridge Equine Veterinary Services in Australia, discussed the use of long-acting injectable omeprazole (LAIO) and its efficacy if given at five- or seven-day intervals. The first reported use of LAIO in 2017 used a seven-day dosing interval. It has been established that the mucosa's median pH begins to taper off from >4 by Day 4-5 after administration.

A study evaluated 24 Thoroughbred racehorses given two doses of LAIO spaced seven days apart. The healing rate of equine squamous gastric disease (ESGD) was 100% and of glandular lesions 75%. In another study, 86% of 33 horses with ESGD healed by two weeks, and 86% healed by four weeks. Horses with equine glandular disease (EGGD) experienced an 82% healing rate.

A retrospective study (July 2020–November 2021) compared ESGD and EGGD healing with LAIO at either five-day or seven-day intervals. LAIO was given IM in the gluteal muscles.

Ulcer scores at the start of the study were ≥Grade 2 EGGD, with some horses also experiencing ESGD. Four doses at 4 mg/kg were given at either five- or seven-day intervals. Gastroscopy was performed at five to seven days after the last dose. Images were blindly graded using the equine gastric ulcer scale: Grade 0 = normal appearance; Grade 1 = some erythema acceptable. There was no significant difference in signalment, presenting complaint or lesion severity between the five-day or seven-day groups for glandular or squamous lesions.

Of 82 horses, aged 2–32 years in low-level pleasure and performance work, the most common presenting complaint associated with glandular lesions was a change in behavior. Treatment every five days had better outcomes of healing than an every seven-day dosing interval for glandular disease:

	Q 5 DAYS	Q 7 DAYS.
grade 0	69%	8%
grade 0/1	93%	63%

Of 60 horses diagnosed with squamous gastric disease, many also had concurrent EGGD. Healing rates when dosed every five days exceeded those dosed every seven days.

	Q 5 DAYS	Q 7 DAYS
grade 0	95%	81%

All horses with ESGD needed four injections due to concurrent EGGD. For ESGD, it is possible that only two doses are needed, said Sundra.

Complications included 1-2% of horses having localized swelling at the injection site, which rapidly resolved. Of the four injections given, three were administered by the owner.

It is noteworthy that available LAIO in the United States is a different formulation than used in Australia and the United Kingdom. The USA form has

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There is value in knowing what to expect if an owner accidentaly overdoses with pergolide.

resulted in 23% injection site reactions.

The study summarized that a five-day dosing interval of the Australian form of LAIO increases the rate of healing of EGGD. This is likely due to acid suppression that facilitates healing.

Previous studies recommend a 28-day treatment course for EGGD, but this study suggested healing is achievable in 20 days when suppression of acid secretion is consistent.

A shortened inter-dosing interval not only results in more rapid healing of EGGD lesions, but it is also associated with a lower cost to the owner and improved welfare to the horse. Of note is the fact that oral omeprazole +/- sucralfate yields only 20-68% healing of glandular lesions.

Pergolide Overdose

As horses age more gracefully in this era of excellent medical and surgical care, it is common to see the older horse affected by pituitary pars intermedia dysfunction (PPID). Equine practitioners commonly treat confirmed cases of PPID with pergolide (Prascend) at a typical dose of 0.5 mg/day. Dosage is adjusted relative to each individual response and follow-up ACTH lab data.

Some horse owners report unwanted side effects of medicating their horses with pergolide. These side effects include decreased appetite, anorexia, mild central nervous symptoms (such as lethargy and ataxia), and rare cases (one to 10 of 10,000 patients) of diarrhea and colic. The higher the dose administered, the greater the likelihood of side effects. There are reports of sweating, dyspnea, dry mucous membranes, dropping blood pressure and fainting, an irregular heart rhythm and agitation when a horse is initially given a high dose.

Because pergolide is used commonly in equine practice, there is value in knowing what to expect when an owner inadvertently overdoses a horse and how to manage such a case.

A case report described expected problems from an overdose in a pony mare as well as management [Schwarz, B.; Ihry, P. Accidental overdose of pergolide (Prascend) followed by loss of appetite, tachycardia and behavioral abnormalities in a 26-year-old pony mare. *Journal of Equine Veterinary Science* June 2020; https://doi.org/10.1016/j.jevs.2020.103181].

Pergolide is absorbed rapidly within two to three hours of ingestion. The pony accidentally received 110 times its prescribed dose (0.5 mg) of pergolide—55 x 1 mg tablets—approximately four hours prior to a veterinary emergency exam. The pony presented with tachycardia with a regular rhythm. Her appetite was diminished, and she suffered from some anxiety

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and hyper-reactivity to bright light and fast movements due to dopamine effects on the central nervous system. No other abnormal clinical signs were observed.

Besides nasogastric intubation with mineral oil and activated charcoal to limit further systemic absorption of pergolide, the pony was treated with several other medications, each with a short duration of action: a) 2.2 mg/kg IM azaperone as a dopamine antagonist, followed by four more reduced doses every six hours IM; and b) oral verapamil (0.22 mg/kg) to prevent arrhythmias, given every four hours for two days, then every six hours for five more days.

Prevention of ventricular arrhythmia can also be done with magnesium sulfate or lidocaine infusions. Metoclopramide is an alternative anti-dopaminergic drug, but it is best used in conjunction with ECG monitoring and blood pressure measurements.

The pony's heart rate became normal within 24 hours. No side effects were present from either the overdose of pergolide or the treatment medications. Medical therapy was discontinued after two days for azaperone and five days for verapamil.

Safety studies with pergolide indicate that up to a tenfold overdose is not associated with major side effects.

Novel Sarcoid Treatment

At the 2022 British Equine Veterinary Association (BEVA) conference, Anna Hollis, DACVIM, DECEIM, MRCVS, discussed treating equine sarcoids with tigilanol tiglate (TT). This is a medication used to treat mast cell tumors in dogs. The medication can actually be used to treat any type of tumor, but it does produce a severe, acute inflammatory response. The intense inflammatory response re-

MELISSA ANNE GALLERIES/ISTOCK VIA GETTY IMAGES

Dr. Anna Hollis reported during the 2022 BEVA conference on the use of tigilanol tiglate to treat equine sarcoids.

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For additional information, see brief summary of prescribing information on the following page.

References: 1. Zimeta® (dipyrone injection) [package insert], Rev. 12/2020. **2.** Morresey PR, et al. Randomized blinded controlled trial of dipyrone as a treatment for pyrexia in horses. *Am J Vet Res.* 2019;80(3):294-299.

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Research showed that the higher the level of bacterial diversity in young foals, the less their risk of later adverse health events.

cruits immune cells and causes vascular disruption. This leads to hemorrhagic necrosis and sloughing of the lesion with eventual re-epithelialization.

Hollis noted that this drug is not a DNA-damaging agent, so there are fewer concerns compared to using cisplatin or carboplatin to treat equine sarcoids. In addition, she said treatment of a sarcoid requires a sufficient bulk of tumor to facilitate an accurate intralesional injection.

She presented data from a study of 14 horses with 18 sarcoids. Five of the sarcoids were previously treated with radiotherapy, laser surgery, MMC, cisplatin, or electrochemotherapy with cisplatin. However, they failed to respond. Twelve of the 14 horses could be treated with TT under sedation and using a local anesthetic. The other two required general anesthesia due to sarcoid location or the horse's temperament.

Veterinarians are cautioned to not administer more than 4 mg per treatment due to the intensity of an inflammatory response. A typical dose ranges from 0.4 mg to 4 mg. It is injected with a single stick, then perfused in the tissue using a fanning technique.

Horses tend to be quiet and inappetent for 24-36 hours following treatment. With this in mind, adjunctive treatment using IV NSAIDs or dexamethasone as needed can mitigate the dramatic swelling and pain response.

Of 18 sarcoids treated with TT, six required two to four treatments. Five of the six were lesions previously treated unsuccessfully with other therapies.

Complications were varied and included jugular thrombophlebitis distant from the sarcoid; a very wide sloughing area; and local lymph node abscessation that resolved with supportive care.

Resolution occurred in 16 of 18 lesions (89%) with six needing more than one treatment. One lesion recurred at 11 months post-treatment, and two that had received previous treatment further required a combination of TT and strontium to achieve resolution.

The Microbiome in Early Life

Chris Proudman, VetMB, MA, RCVS, PhD, head of the School of Veterinary Medicine at the University of Surrey, spoke at the 2022 British Equine Veterinary Association (BEVA) conference. He discussed the impact of the microbiome in a foal's early life and its importance on the horse's health in later life.

A study tracked the health of horses over the initial three years of life using weekly health data about illness events and duration. The study evaluated 52 foals from five Thoroughbred racehorse studs in southeastern England. Fecal samples (n=445) and blood samples (n=178) were obtained weekly.

Proudman explained that in a foal's first month, fecal bacterial communities are primitive and immature, but they develop rapidly. After three months, they look similar to bacterial communities compared to the end of the first year of life and to adult horses.

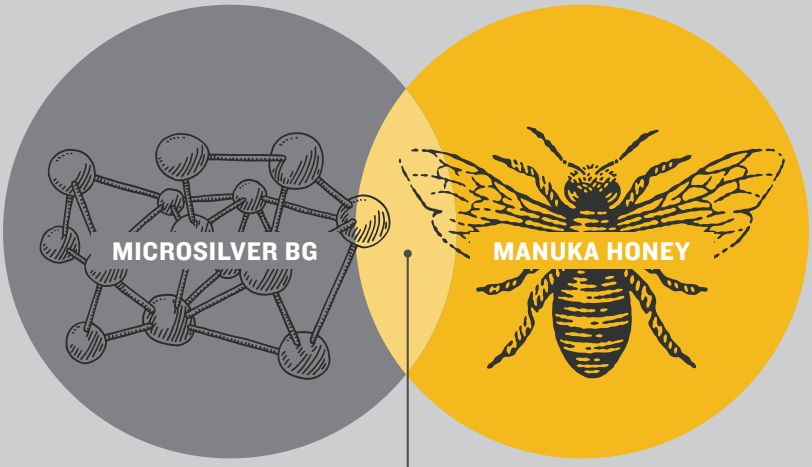
The diversity of bacterial communities (i.e., the number of unique species present) plateaus at three months of age. Dominant bacterial families change over the foal's first three months, with fiber-degrading bacteria increasing as a foal is weaned.

Health events—orthopedic, soft tissue, gastrointestinal and respiratory illness—were considered in the study. By one month of age, there is an association between the diversity of bacterial communities and subsequent risk of respiratory disease at any time in the future.

The higher the level of bacterial diversity, the less risk for later health events, including soft tissue/orthopedic, gastrointestinal and respiratory conditions.

Humans show a similar association, noted Proudman.

Management practices were not found to have an association with gut microbial populations. EM



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By Amy L. Grice, VMD, MBA

The Importance of Having a Budget

There are very few people who love to budget. However, having a projection of your revenue and expenses for the future can be very helpful for equine practitioners. Knowing how tight the difference is between your expected income and necessary outflow can incentivize you to pull back on discretionary spending before you get in a financial jam.

A budget is simply an estimate of income and expenditure for a set period of time. For most people, whether for business or personal use, setting an annual budget broken down into months is most helpful. Some expenses are variable on a month-to-month basis, so looking at each month individually is key.

For instance, some bills, such as those for professional liability or homeowner's insurance, are often due in a particular month of the year (unless you choose to pay them in installments). Heating bills are higher in the winter in northern states, and cooling bills are higher in the summer. New school clothes are a big personal expense in the fall for families, and holiday gifts require extra cash in December.

For practice owners, seasonal expenses could involve substantial year-end bonuses and expensive holiday parties for staff. It can also include increased overtime wages during the busiest months of the year.

Income for individuals includes wages and return on other work or investments. For practices, income is the collected revenue that is earned for providing services and selling medications or supplies. When revenue is not paid at the time of service, accounts receivable can climb. That alone can make it more difficult to meet expense obligations.

SIMPSON33/ISTOCK VIA GETTY IMAGES

You can easily predict your projected revenue for your budget by looking at how your practice performed over the past 12 months.

There are many tools to help you, including budget features in QuickBooks and apps for personal use like YNAB (www.youneedabudget.com) and Spendee (www.spendee.com).

If you prefer to make a spreadsheet for your personal spending, Google Sheets has simple template options for budgeting. Those include an annual budget template, a monthly budget template and an expense report. There are multiple video tutorials online if you run into difficulty. If you are familiar with Excel, you can readily make a budget on your own, or utilize one of the Office suite's templates. From QuickBooks Online or Desktop, you can readily export your P&L (Profit & Loss) report from the end of a calendar year into Excel. Then, you can use this spreadsheet to create a budget for the coming year. QuickBooks tutorials will lead you through this simple process.

If an economic downturn occurs—or you anticipate increased expenses (such as the lease of a new facility or the addition of a new associate or veterinary technician)—you can utilize your budget to work out various scenarios to stabilize your finances and protect your profits.

What happens to your bottom line if you raise fees by 10%? What happens if you decrease your expenses for discretionary items? Do you have enough earnings to pay a five-year loan on a new truck?

Having a budget can give you solid answers to questions you used to guess about (and simply hope for the best). Don't leave your finances to chance! EM

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Featured Picture: University of Minnesota, Piper Equine Hospital

By Amy L. Grice, VMD, MBA

Healthy Eating on the Run

A little planning can keep you eating healthier without getting the 'hangrys.'

Whether you work in a hospital/clinic setting or drive a vehicle doing ambulatory calls all day, it can be hard to eat a healthy diet, especially if you are stressed and behind schedule. Gobbling down a gas station hotdog or a limp piece of pizza when you are already crabby from hunger will do little to make your body feel better. Even if you have every intention to stop at that great little bistro that makes fabulous roasted vegetable wraps, that will surely be the day you get an emergency in the opposite direction.

A little planning when you head to the grocery store can help solve this problem.

Every week, buy seven to 10 servings of fruit that you can eat without a fork or making a mess—think grapes, bananas, apples, blueberries or other berries in season. If you have the energy to do some prep, buy a cantaloupe or honeydew melon that you can dice into bite-sized pieces for a week's worth of portions.

While you're at the market, pick up a few reusable containers that are the perfect size for your daily dose of fruit. You should also buy a six-pack-sized cooler in which to carry your food.

Since you might be eating breakfast and lunch on the road or at the clinic, buy some individual yogurts to have with your fruit.

If you struggle with mid-morning hunger, consider a box of peanut butter Ritz Bits to give you a protein boost when you begin feeling hypoglycemic and irritable. Trail mix, granona bars or nuts are other good choices to satisfy hunger.

Next, head to the cheese cooler. Spend the extra money to buy pre-sliced cheese that fits on crackers or sandwiches. Alternatively, choose your favorite flavor of hummus as a protein source. If you feel energetic, get cans of tuna that you can open and load into a container with whatever condiments you prefer (or buy pre-packaged, seasoned tuna).

ALUXUM/E+ VIA GETTY IMAGES

Make sure you get enough protein for an entire week. Decide what you want to eat with it—crackers, bagel crisps, pita bread or leaves of crunchy lettuce—and remember to get that, too. Avoid deli meats because they are typically high in fat, sodium and preservatives.

If you work in a clinic setting, consider packages of soup with a reasonable shelf life. Avoid canned soups with high fat and sodium. Single-serving, microwaveable soup mugs are available in most grocery stores. These make an easy meal option.

For vegetables, purchase baby carrots, mini cucumbers or grape tomatoes to munch on. Or you can bring leftover cooked green beans, broccoli or cauliflower from a previous night's dinner. And if you prefer to dip your vegetables in ranch dressing, get a little container to carry it in or purchase containers that have separate food spaces under one lid. Another great addition is a picnic set of salt and pepper to keep in your truck's center storage console or your desk drawer.

Many afternoons are not complete without something sweet, so consider buying a package of dried apricots, bananas or other dried fruit. A few Werther's hard butterscotch candies or Jolly Rancher candies can also help you get through a tough afternoon. Keep an emergency stash of nuts or trail mix to keep you going when the day unexpectedly gets long.

Lastly, make sure you drink water all day by bringing a refillable bottle and keeping it by your side. Even mild dehydration can cause fatigue and muscle weakness.

By developing healthier habits, you can feel better and perform better. EM

Editor's note: Taking care of yourself and your staff is critical to staying mentally and physically healthy in practice. Check out Dr. Amy Grice's new series of articles titled Vet Wellness Briefs in each magazine and monthly online for more tips on veterinarian wellness. This series is brought to you by Zoetis.

It's time to demystify deworming.

Help horse owners make sense of deworming by providing a strategy that treats the important parasites and helps fight resistance.[1]

The AAEP recommends moxidectin, the active ingredient in Quest® Gel and the primary active ingredient in Quest® Plus Gel, as the treatment of choice against small strongyles (including their encysted larvae). Quest® Plus Gel also includes a second active ingredient, praziquantel, for AAEP-recommended late grazing season treatment against tapeworms.[1]

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IMPORTANT SAFETY INFORMATION: Do not use Quest® Gel or Quest® Plus Gel in foals less than 6 months of age or in sick, debilitated and underweight horses. Do not use in other animal species, as severe adverse reactions, including fatalities in dogs, may result. Consult your veterinarian for assistance in the diagnosis, treatment and control of parasitism.

1. American Association of Equine Practitioners. AAEP Parasite Control Guidelines. https://aaep.org/guidelines/parasite-control-guidelines. Accessed August 2022.

zoetis

By Amy L. Grice, VMD, MBA

The Top Priority of the AAEP

Retaining and attracting equine practitioners has been trending downward over several years. Concern for the future has prompted the AAEP to make this the top priority of its strategic plan. After researching and gathering data, the AAEP formed the AAEP Commission on Equine Veterinary Sustainability as part of a campaign to transform and sustain equine practice and "Change the Numbers." The Commission is charged to develop, oversee and assist with the execution of programs designed to increase the sustainability of equine practice for the betterment of the equine vet and the welfare of the horse.

The commission has five subcommittees developed around the key areas affecting the sustainability of equine practice. The subcommittees include compensation, emergency coverage, students, internships and practice culture. Each subcommittee has co-chairs, an officer liaison and 12-15 members. The commission is governed by a steering committee that consists of the AAEP officers and the chairs of each subcommittee.

The subcommittees will concentrate on program development and implementation in order to transform equine practice by changing the numbers. This means increasing the number of graduates entering equine practice, the number of practitioners remaining in the equine space five years after entry, the compensation equine vets earn at entry and in their first five years, and the number of equine doctors who would recommend equine practice as a career to others. In addition, the goal is to decrease the burden of emergency care, minimize burnout and increase satisfaction with the internship experience. The subcommittees also will support the development of healthy practice cultures, professional boundaries and vet well-being.

The Compensation Subcommittee is charged with ensuring that members understand current financial numbers, the present market demands, and the actions they can take to increase their practices' salaries, benefits and overall compensation to be competitive and equitable. The goal is to make compensation more attractive to encourage more vets to pursue a career in equine practice. The key metric is to increase compensation for early career positions in private practice.

SEVENTYFOUR/ISTOCK VIA GETTY IMAGES

The Emergency Coverage Subcommittee is charged with cultivating and identifying creative solutions for handling emergency coverage, creating educational opportunities that highlight models used in all types of practices, and including examples of client communications. Veterinarians can then utilize these examples when creating co-ops or other networks for coverage. The key metric is to increase uptake on alternative service models for emergency coverage.

The Student Subcommittee is charged with reviewing all of AAEP's current student activities, including educational and chapter assistance programs; making recommendations to improve the student perceptions of equine practice; providing assistance to those who wish to evaluate externships and internships; determining the type of support that AAEP needs to provide to the chapters; and ensuring that AAEP is meeting student members' current needs. The key metric is to increase the number of students entering equine practice.

The Practice Culture Subcommittee is charged with defining those aspects that make up the "culture" of a practice. Such areas range from creative work schedules, internal practice communications and improved onboarding for new associates to policies relative to family leave and boundary setting. The ultimate goal is to create a mindset shift of choosing the health and welfare of colleagues over economics or client priorities. The key metric is to increase job satisfaction in equine practice.

The Internship Subcommittee is charged with fostering a transparent and ethical internship system that facilitates placing recent vet graduates into programs that are mutually beneficial to the intern and the practice, thus setting both up for long-term success in equine practice. The key metric is increased intern satisfaction in the internship program.

Dedicated volunteers are taking on this work with the help of AAEP staff. There is great enthusiasm and dedication to this effort, and the winds of change have begun to blow. EM

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There were multiple presentations at AAEP covering PPID diagnosis and treatments.

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AAEP 2022: Horse Health and Research

From PPID to PAAG and AMA to PRP, there were a lot of discussions of current and new treatments for our equine patients.

By Nancy S. Loving, DVM

A range of equine research and field medicine topics were discussed at the 2022 AAEP Convention. There were many live and on-demand presentations to choose from. In this article (and in six articles on EquiManagement.com), we bring you highlights of selected presentations.

Measure Insulin Dysregulation

Having the means to measure insulin is critical to the diagnosis and management of pituitary pars intermedia dysfunction (PPID, also known as Cushing's disease) and equine metabolic syndrome (EMS). At the 2022 AAEP Convention, Emily Berryhill, DVM, DACVM, of the University of California, Davis, described a new stall-side insulin test.

This stall-side application, called the Wellness Ready test, eliminates the many steps required for acquiring, preparing and sending samples to outside labs, then waiting for results. The Wellness Ready Test provides a quantitative measure of whole blood insulin after a 15-minute incubation period.

Editor's note: Make sure to visit EquiManagement.com for six additional articles covering equine health and research topics presented at the 2022 AAEP Convention. This horse health and research coverage is brought to you by American Regent Animal Health.

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1 Data on file.

2 Adequan® i.m. Package Insert, Rev 1/19.

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PP-AI-US-0629 (v2.0) 05/2022

ISTOCK

Having the means to measure insulin is critical to the diagnosis and management of PPID in horses.

A validation study compared this test to human insulin radioimmunoassay (RIA) testing using 99 samples from 51 horses. Some horses were fasted, some fed, and some underwent oral sugar tests.

The stall-side test had a good association between itself and RIA values, although there was an average of 10.4% higher readings on the stall-side test than the RIA measures.

For example, if the insulin concentration on RIA was 50, then the stall-side test readout was 53. Berryhill said this is not enough difference to impact a veterinarian's clinical decision-making. In addition, literature stated that the RIA tends to measure slightly lower than other assays.

In general, sensitivity ranges from 87-91% and specificity from 92-96% with the Wellness Ready test. These are useful values, especially at an insulin concentration cutoff of 65, reported Berryhill. Overall, the Wellness Ready test has good utility as a stall-side assay for equine practitioners evaluating horses for insulin dysregulation.

COURTESY WELLNESS READY

Wellness Ready is a stall-side insulin testing device.

Ertugliflozin for Managing Hyperinsulinemia and Laminitis

Tania Sundra, BSc, BVMS, MANZCVS (Eq), of Avon Ridge Equine Veterinary Services in Australia, reported on the use of ertugliflozin for the management of hyperinsulinemia. The drug, which is used off-label in the United States, is described as an SGLT2 (sodium-glucose linked transporter 2 inhibitor) developed to treat human diabetes. This medication works at the level of the kidneys, where SGLT2 is responsible for 90% of glucose reabsorption. Ertugliflozin increases urinary glucose output to decrease blood levels of glucose, which in turn decreases insulin concentrations.

A retrospective study from January 2021-February 2022 evaluated 51 horses of median age 17 years with post-prandial hyperinsulinemia and laminitis. Neither diet nor management changes for at least six weeks were able to improve the endocrine or hoof abnormalities in these horses. As part of the study, they received 0.05 mg/kg of ertugliflozin once daily for 30 days.

Within 30 days of treatment, reductions in insulin concentrations and lameness were evident. On Day 0, insulin concentrations were 300. By Day 30, they were 43, and by Days 60-240, insulin concentrations plateaued around 32. Triglycerides increased significantly at Day 30 to 1,400 mg/dl, but by Day 60 were decreased to 1 mg/dl.

Many horses were able to discontinue NSAIDs within seven to 14 days of ertugliflozin treatment. Laminitis improvement occurred despite chronic radiographic changes. Horses also lost weight, likely due to lipolysis, with the most obese individuals losing the most weight. Ten horses exhibited polyuria-polydipsia, likely due to chronic osmotic diuresis from excretion of urinary glucose. Due to a potential for volume depletion from excess urination, treated horses need access to water, remarked Sundra. There were no signs of urinary tract infection.

Sundra stressed the importance of monitoring for hyperlipidemia and hepatic lipidosis with this treatment. If the horse is fasting or feed is withheld, then ertugliflozin should be stopped. The diet should contain less than 10% NSC plus a ration balancer. Following the 30-day 0.05 mg/kg, once-daily dose, horses can be maintained on a low dose of 0.025 mg/kg once daily.

Long-Term Response to Pergolide Treatment in PPID Horses

FDA-approved pergolide medication has been on the market for at least a decade.

ISTOCK

Research on long-term use of pergolide showed that increased doses might not be necessary and treatment resulted in client satisfaction.

Yet, there is limited data on long-term responses with pergolide treatment of PPID horses. Harold Schott, DVM, PhD, DACVIM, of Michigan State University, discussed a study that reviewed several pertinent questions:

- Does treatment improve quality of life?
- Will the dose need to be increased?
- Does the treatment prolong life?
- Are clients satisfied with the treatment outcome?
- Are there potential adverse effects with long-term treatment?

In 2009, a study with 28 horses and two ponies averaging 23 years of age provided initial safety information about treatment with pergolide in the near term. Then, an FDA open field trial tested the efficacy of pergolide administered to 113 horses. The trial found that 76% achieved treatment success. A similar Michigan State University cohort study identified 60% success in 30 client-owned horses during that time period.

This led to an extended-use study of the 30 horses enrolled in the initial Michigan State study to evaluate efficacy and adverse events over a 12.5-year period. Reduced appetite occurred in 15-20% of horses. A few had intermittent diarrhea and laminitis flare-ups, although pergolide is not specified as treatment for laminitis. Seasonal effects of elevated ACTH persist even when horses are on pergolide. Schott mentioned that it might be appropriate to bump up the dose by adding ½ mg pergolide from the end of August through December.

In general, most horses treated with 1 mg of pergolide per day did well for four to five years with normal endocrine test results. For seven individuals that demonstrated clinical signs of PPID or failed dexamethasone suppression testing after four to five years, the dose was increased to 2-4 mg/day. A horse's initial status had no effect on survival, with median survival time of 3.3 years (ranging from 0.6-12.5 years).

By 5.5 years into the study, 13 horses were still alive, and owners noted continued clinical improvement, with normal endocrine test results in 75%. By 9.5 years, only six horses in the study were still alive, yet only two of the six had normal endocrine test results.

Ten years into the extended-use study, 86% of clients were satisfied. Seventy-one percent strongly agreed and 25%

agreed that treatment improved the horse's quality of life. Asked if they would do this treatment again, 44% strongly agreed and 44% agreed. Regarding the cost of pergolide treatment, 26% said they would pay $500/year; 56% would pay $1,000/year; 10% would pay $1,500/year; and 4% would pay $2,000 or $2,500/year.

Improvements were seen in energy level in 77% of horses in the initial weeks of treatment. Improvements in haircoat were seen in 71% of horses, and improvement to abnormal sweating in 41%.

Schott summarized the extended study findings:

- There might not be a need for progressive increases in pergolide dose.
- Endocrine test results can improve over prolonged periods.
- Treatment improves quality of life but does not prolong life.
- Client satisfaction is high with extended pergolide use.

Use of Polyacrylamide Gel (PAAG) in the Field

Joint management is one area in which most equine practitioners are involved. And this is not just for equine athletes but also for retired and/or elderly horses suffering from osteoarthritis. At the 2022 AAEP Convention, a number of sports medicine topics were discussed at length.

Polyacrylamide gel (PAAG) is a newer product for intra-articular injection in horses to help ameliorate pain and discomfort from osteoarthritis. There are two forms with different cross-linking materials: 4% (Noltrex) and 2.5% (Arthramid Vet). Each product has different properties, explained Scott McClure, DVM, PhD, DACVS, DACVMR, of Iowa-based Midwest Equine Surgery and Sports Medicine.

The 2.5% PAAG product targets and integrates with the synovium to increase joint capsule elasticity. It is absorbed within 48 hours and remains in the synovial membrane for full integration within four weeks. In contrast, the 4% PAAG product targets and adheres to damaged cartilage to help lubricate the joint surface through its low coefficient of friction. McClure noted that 4% PAAG persists for a longer time than hyaluronic acid (HA) because it isn't susceptible to degradation by metalloproteinases.

There are other differences between the two PAAG products discussed:

- It is OK to administer the 4% PAAG with corticosteroids and biologics. It is recommended to wait 30 days before injecting other treatment medications into the joint following 2.5% PAAG administration.
- Rest is recommended for 14 days following treatment with 4% PAAG and 10-30 days following 2.5% PAAG. The duration of rest depends on the severity of joint disease.

Complication rates for both are similar at 0.06%, which is better than the rate of complications seen with HA injection.

McClure stressed that it is important to recognize that there won't be an instantaneous response to PAAG treatment, unlike what is seen with inflammatory decreases from corticosteroids within 48-72 hours.

He explained, "Lameness following PAAG injection creeps down over 45-90 days. However, the horse obtains long-term benefits from PAAG."

He noted that prior to injecting with PAAG, it is important to control joint inflammation first with ice therapy, NSAIDs and/or topical diclofenac.

Intra-Articular Stanozolol

As an anabolic steroid, stanozolol can provide beneficial effects when administered into the joint, according to McClure. Studies have demonstrated that stanozolol IA:

- decreases inflammation and promotes anabolic processes on synoviocytes and chondrocytes;
- acts as local autocrine response to stimulate production of anabolic growth factors;
- decreases apoptosis in equine chondrocytes in vitro via stimulation of IGF-1 production and decreased nitric oxide production;
- decreases in vitro gene expression of MMP-13, MMP-1, IL-6, COX-2 in normal and IL-1-beta-exposed equine chondrocytes;
- increases TGF-B1 (transforming growth factor), which is associated with decreasing pain from osteoarthritis in humans;
- has no effect on cell viability; and
- is a strong anti-inflammatory medication.

From studies comparing dosages, McClure said that fast positive results are seen with 5 mg/joint weekly injections, with improvement achieved after two treatments. A micronized formulation was evaluated through a six-month follow-up of 50 Thoroughbred racehorses treated weekly for four weeks. Half the horses had osteoarthritis, one-third had subchondral bone disease and 13% had synovitis. None experienced adverse reactions, and 77% had beneficial or uncertain response to treatment. No benefit was seen in 22%.

In a double-blind study, 60 horses with osteoarthritis (OA) were split into weekly treatment groups. Forty horses received 5 mg/joint of stanozolol, while 20 horses were given a placebo. Lameness improved in 82.5% (33/40) with stanozolol compared to 10% (2/20) improvement of control horses. Six of the 40 horses treated with stanozolol developed mild distention of the joint that regressed spontaneously and rapidly. Lameness resolved completely in 56% (26/40). There was a better response of 71% in horses with acute OA compared

COURTESY AAEP

Drs. Amy Johnson (above), Kyla Ortved and Sherry Johnson pesented on surgical and medicine topics during the Kester News Hour at the 2022 AAEP Convention.

to 58% of horses with chronic OA.

Co-administration of stanozolol with a corticosteroid is contraindicated because that would inhibit the anabolic effect.

When 5 mg of micronized stanozolol was administered into the tarsocrural joint, stanozolol was found in the systemic circulation but was no longer detectable after 36 hours. That said, this medication is banned for FEI and for racing, and it requires a 47-day withdrawal for USEF.

McClure recommended its use in young horses with OCD lesions that have been scoped and treated with triamcinolone. Then, two to four weeks later, they can be started on IA micronized (in suspension) stanozolol series. The objective with stanozolol is to allow all joint structures to heal. With this in mind, it is not intended as a "quick fix" but rather should be accompanied by rest and rehabilitation.

Alpha-2 Macroglobulin for Joint Treatment

Alpha-2 macroglobulin (A2M) is an acute-phase protein that can inhibit four classes of proteases and influence modulation of cytokines. It inhibits the inflammatory cascade through a "bait and trap" mechanism to "capture" proteases that degrade cartilage. This arrests osteoarthritis at the molecular level. Once found and inactivated, the molecule is translocated out of the cell and excreted.

Christina Russillo, DVM, from Virginia Equine Imaging, explained that A2M can be isolated from circulating plasma to produce an injectate through a 60-minute procedure, making it a rapid option for treatment compared to ACS. One huge benefit is that the collection kit can be transported into the field. The injectate is stable for four hours at room temperature and for 12 hours if refrigerated. At minus 18° Celsius (-0.4°F), the product lasts for up to a year. A thawed sample must be used within 12 hours and can't be frozen a second time. She recommended storing the injectate in 4 ml aliquots in a capped 6-cc syringe with air to allow for expansion during freezing.

Prior to collection, alpha-2 agonist sedatives and analgesics should be withdrawn for three days, and NSAIDs should be withdrawn for five days. It is important to wait 24 hours following joint analgesia to inject A2M, and to wait two weeks following IA corticoste-

SHELLEY PAULSON

Several research studies were discussed at AAEP that could help equine vets choose options for treating horses with joint issues.

roid treatment before using A2M. She noted that A2M can be used in conjunction with shockwave, laser therapy or bisphosphonates.

Time to onset for lameness relief is similar to more traditional therapies, said Russillo. She noted that it is especially useful for treatment of multiple joints to address cartilage injury and to provide OA pain relief for horses with endocrinopathies that won't do well with corticosteroid treatment.

Withdrawal time for FEI competition is less than what is typical for other joint therapies.

In studies conducted at Russillo's clinic, lameness in bilateral coffin joints treated in 19 horses improved in 79% by one grade of the AAEP lameness scale. In distal hock joints, flexion improved in 86%, with 57% improving one grade and 11% improving two grades. Neck pain improved in 71.4%, with 43% improving two grades.

She reported that the benefits achieved with A2M as an orthobiologic in treating inflammatory synovitis are especially important for competition horses, reducing lameness and joint effusion, improving flexion tests and reducing pain with palpation.

Kester News Hour Reports

The Kester News Hour at the 2022 AAEP Convention featured surgical topics covered by Kyla Ortved, DVM, PhD, DACVS, DACVSMR, of the University of Pennsylvania, and Sherry Johnson, DVM, DACVIM, of Equine Sports Medicine and Rehabilitation. Amy Johnson, DVM, DACVIM, of the University of Pennsylvania, discussed medicine topics.

Bisphosphonates

There has been recent concern about lingering effects of bisphosphonates on equine bone. Ortved described an extremely long half-life of bisphosphonates of eight to 10 years. However, she reported that research has only detected it in the horse for 40 days.

There is a current attempt to develop a more sensitive assay with paired blood and urine samples [Riggs, C.M.; Thompson, S.L.; So, Y-M., et al. Tiludronic acid can be detected in blood and urine samples from Thoroughbred racehorses over 3 years after last administration. *Equine Vet J* 2021;53:1287-1295. DOI: 10.1111/evj.13395].

The study looked at 24 horses that had been administered Tildren over the past several years. Most received a one-time administration. However, three horses received multiple doses, one horse received multiple doses close together in time, and one received a 1/5 dose with regional limb perfusion.

Three years out from the injections, assays identified Tildren in blood and urine in all 24 horses. This has signifi-

cance for implementation of medication rules, especially in racehorses and for pre-purchase exam evaluations.

To date, there is no clear knowledge regarding long-term impact of bisphosphonates on bone health. It is also not clear whether high concentrations in urine and blood are representative of bone concentrations.

Timing for Gathering TRH-Stimulation Testing Samples

The thyroid-releasing hormone (TRH) stimulation test is helpful in diagnosing PPID (pituitary pars intermedia dysfunction or Cushing's disease) in suspect horses. It's also useful in identifying early cases. This test is used commonly in equine practice, especially as more horses are living longer. It is known that older horses are at higher risk of developing PPID.

A study looked at the timing of collection of the second blood sample at 10 minutes following administration of intravenous TRH [Thane, K.; Uricchio, C.; Frank, N. Effect of early or late blood sampling on thyrotropin releasing hormone stimulation test results in horses. *J Vet Intern Med* 2022 Mar;36(2):770-777. DOI: 10.1111/jvim.16362. Epub 2022 Jan 20].

Amy Johnson described the study of 24 horses aged 3-28 years with blood collected at nine, 10 and 11 minutes after the horses received IV TRH. At exactly 10 minutes, six were diagnosed with PPID (>200 pg/ml) and one horse was equivocal at 110-200 pg/ml. Horses with samples taken a minute early or later than 10 minutes resulted in five horses with a change in laboratory interpretation—moving from positive to equivocal, equivocal to positive, or normal to equivocal.

Small alterations in timing significantly altered test results, Johnson concluded. Early or late draws occurred in 75% of samples—these results differed by ≥10% compared to the exact 10-minute draw. Of these, 21% yielded a different diagnostic interpretation.

This study is relevant considering that with accurate TRH-stimulation testing, ACTH concentrations are reported to decrease in 88% of those treated accurately, including those monitored for treatment improvements.

Synovial Sepsis Following Intra-Articular Injection in Ambulatory Settings

It is common for field practitioners to inject joints in field settings when a horse is not able to be brought into a hospital. A study evaluated 1,122 horses with 3,866 intra-articular (IA) injections in 1,623 medication sessions [Krause, D.M.; Pezzanite, L.M.; Griffenhagen, G.M.; et al. Comparison of equine synovial sepsis rate following intrasynovial injection in ambulatory versus hospital settings. *Equine Vet J* 2022;54:523-530. DOI: 10.1111/evj.13485].

Ortved said of 643 field injections, 278 (42%) received antimicrobial drugs (AMD) with the IA medication, while 365 (57%) did not. In contrast, with 980 injections done in a hospital setting, 406 (41%) received AMDs while 574 (59%) did not. This comparison demonstrates a similarity between intra-articular injection strategies done in both field and hospital settings.

Only four of 1,122 horses developed joint sepsis, equivalent to 0.1% frequency, which is very low. One infection developed after IRAP, two after triamcinolone and one after PRP.

In summary, neither the injection setting nor the use of concurrent IA AMD impacted the infection rate.

Toxic Effects of Amikacin in Equine Joints

Ortved described the effects of amikacin on synoviocytes and chondrocytes even when the drug is given in low concentrations. Toxicity to these cells is not just isolated to amikacin but exists across many anti-microbial drugs used in joints [Pezzanite, L.; Chow, L.; Piquini, G.; et al. Use of in vitro assays to identify antibiotics that are cytotoxic to normal equine chondrocytes and synovial cells. *Equine Vet J* 2021 May;53(3):579-589. DOI: 10.1111/evj.13314].

Because of toxic effects of amikacin coupled with the study that demonstrated very low sepsis rates from IA injections, there is no indication to routinely add antimicrobial drugs when injecting joint or synovial structures. There is one exception to this: It is necessary to add amikacin to an intra-articular injection of PSGAG due to the risk for potentiation of *Staphylococcus* sp.

Use of Polymyxin B

Polymyxin B is commonly used in equine practice to bind endotoxin. Gentamycin is used as an antibacterial against gram-negative infections. A study examined the different side effects experienced with polymyxin B alone compared to polymyxin B combined with gentamycin [van Spijk, J.N.; Beckmann, K.; Wehrli Eser, M.; et al. Adverse effects of polymyxin B administration to healthy horses. *J Vet Intern Med* 2022 Jul;36(4):1525-1534. DOI: 10.1111/jvim.16470. Epub 2022 Jul 7].

Six healthy horses were used in a prospective, blinded, randomized crossover trial with two protocols: a) polymyxin B (6000 IU/kg IV every 24 hours for 7 doses); or b) polymyxin B at that dose for seven doses plus gentamycin (10 mg/kg IV every 24 hours for 4 doses). The horses were given a washout period of three weeks between trials.

All horses developed transient ataxia that worsened by two grades with cumulative doses of polymyxin B combined with gentamycin, reported Amy Johnson. Renal effects also developed with co-administration. The study

concluded that polymyxin B should be avoided in ataxic horses or those with underlying renal compromise.

Gentamycin Toxicity and Hearing Loss

Another side effect can occur with gentamycin use: induced auditory loss. It is reported that up to 47% of humans with a history of aminoglycoside treatment have hearing loss.

A study of 10 horses administered 6.6 mg/kg gentamycin daily for a week developed a variety of hearing loss issues. Auditory function was measured by brainstem auditory-evoked response testing at the end of the treatment week and one month later [Aleman, M.R.; True, A.; Scalco, R.; et al. Gentamicin-induced sensorineural auditory loss in healthy adult horses. *J Vet Intern Med* 2021 Sep;35(5):2486-2494. DOI: 10.1111/jvim.16221. Epub 2021 Jul 28].

Six of the 10 horses lost hearing, with two developing unilateral complete deafness and four developing unilateral partial deafness.

One month later, three horses were still affected. Four had regained their hearing, two were partially deaf, and one new horse in the group of 10 was completely deaf.

With this in mind, practitioners should be circumspect about potential auditory and renal risks when using gentamycin.

Effect of Exercise on Cytokine Concentration in IRAP Collection

In humans, exercise and surgical stress can adversely affect cytokine concentrations. It is desirable to have high concentrations of IL-1-Ra and low concentrations of TNF-alpha.

A study looked at the effects of equine exercise prior to collection of blood for autologous conditioned serum (ACS) production. The researchers evaluated the potential of finding decreased concentrations of specific cytokines (IL-1-Ra; IL-10) and increased TNF-alpha and IL-1-beta [Hale, J.N.; Hughes, K.J.; Hall, S.; et al. The effect of exercise on cytokine concentration in equine autologous conditioned serum. *Equine Vet J* 2022, 1-6. DOI: 10.1111/evj. 13586].

Whole blood was collected from eight Standardbred horses one hour and 24 hours after a single bout of exhaustive exercise pacing on a 1,000-meter sand track. Sherry Johnson explained that at one-hour post-exercise, IL-1-Ra concentrations had decreased and TNF-alpha concentrations had increased, the opposite of the desired concentration effect for treatment with ACS. There was no difference at any time point for IL-10 or IL-1-beta in relation to exercise. There was also no difference in cytokine levels between fit-to-race horses compared to those not fit to race.

In summary, a single bout of intense exercise appears to transiently decrease the favorable cytokines while increasing the bad cytokines when blood is obtained within an hour of exercise.

It is recommended to wait to collect blood for ACS for at least 24 hours following a single exercise bout.

Plasma-Rich Protein (PRP) Clears Staph aureus *Biofilms*

The bio-active fraction of PRP lysate (Bio-Ply) was used in a study to compare tarsocrural joint infection induced with *Staphylococcus aureus* and the response to treatment with amikacin alone or amikacin with Bio-Ply [Gilbertie, J.M.; Schaer, T.P.; Engiles, J.B.; et al. A platelet-rich plasma-derived biologic clears *Staphylococcus aureus* biofilms while mitigating cartilage degeneration and joint inflammation in a clinically relevant large animal infectious arthritis model. *Frontier Cell Inf Micro* 2022 May;12:1-18. Doi.org/10.3389/fcimb.2022.895022].

Horses were euthanized three weeks after treatment. Ortved said that in all joints, bio-floats (collection of biofilms) were present in synovial fluid one day following induction of infection.

Including Bio-Ply in the treatment decreased bacterial loads compared to amikacin alone. The authors noted there was complete bacterial clearance in 5/6 horses by the end of the study.

In addition, those with the combination treatment had significantly decreased pain scores starting on Day 4.

Inflammatory mediators were decreased in synovial fluid, and there was less cartilage and joint degradation with amikacin plus Bio-Ply compared to amikacin alone.

The researchers concluded that there are superior antimicrobial properties and preservation of joint healing when Bio-Ply is included in intra-articular joint treatment of sepsis. Commercialization of this product is now in the beginning stages.

Subchondral Bone Cyst Treatment with Absorbable Implant

Cystic subchondral bone lesions within a joint are variable in shape, size and location.

Ortved described a study that used an absorbable implant in 38 racehorses under 2 years old [Ravanetti, P.; Lechartier, A.; Hamon, M.; et al. A composite absorbable implant used to treat subchondral bone cysts in 38 horses. *Equine Vet J* 2022; 54:97-105. DOI: 10.1111/evj.13428].

The cystic lesions were drilled and curetted, and a screw was placed. Post-operatively, the horses received controlled exercise for 12 weeks.

At 120 days, radiologic evaluation showed that 77% had filling of the lesions. Ninety-five percent were sound at 120 days, and 71% went on to race.

The authors reported that there was no need for screw removal following use of the implant. EM

The business discussions at the 2022 AAEP Convention focused on getting paid, getting help and retaining staff.

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2022 AAEP Convention Business Coverage

From veterinarian retention to defensible records, here are highlights from business presentations at the 2022 AAEP Convention.

By Amy L. Grice, VMD, MBA

The 2022 AAEP Convention business sessions kicked off with the Business News Hour. This was co-hosted by Drs. Kelly Zeytoonian, Caitlin Daly and Jean-Yin Tan.

With inflation topmost in many people's minds, they started with a review of current national economic conditions. Tan explained, "Inflation comes from an increase in demand without a matching increase in supply—basically excess money in the system causing a rise in prices and a decrease in purchasing power."

She continued by reporting that the Consumer Price Index climbed from 0.1% in May 2020 to 8.2% in late November 2022. The last time there was such a big jump was in the 1970s.

Editor's note: Make sure to visit EquiManagement.com for six additional articles covering business topics presented at the 2022 AAEP Convention. AAEP Convention Business coverage is brought to you by CareCredit.


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Since the pandemic, there have been many economic changes in the world and in equine veterinary practice. These include rising costs of goods, difficulty finding employees and sales to corporate consolidators.

Because of inflation in veterinary medicine over the last year, wages have risen to attract and retain good people, with veterinary wages also a part of this trend. Mean weighted starting salary jumped from $90,722 in 2020 to $99,593 in 2021 when considering all veterinary graduates entering full-time employment, she reported.

Supply costs have also risen, she continued. The Producer Price Index reports price changes by industry. Tan shared that there has been a moderate 1.3% increase in veterinary pharmaceutical pricing but a 5.5% increase in biologics.

Biological drugs, commonly referred to as biologics, are a class of drugs that are produced using a living system, such as a microorganism, plant cell or animal cell. As a result of these increased practice expenses, a 10% increase in pricing was passed on to consumers in 2022 to offset the higher wages and supply costs.

Globally, recession fears are escalating, Tan reported. There are some early signs of an impact on the horse industry.

According to Blue Cross in the UK, there have been 144 requests for re-homing horses this year due to financial reasons, compared to 43 last year and 32 the previous year.

If a recession occurs, she opined, "Thoroughbred practices will have to start tightening their belts, while vets mostly seeing the Western disciplines may be relatively unscathed."

Her advice for business owners was to raise fees regularly, improve charge capture, review charge codes, increase efficiency and provide value.

Corporatization of Veterinary Practice

Daly shared that "while there may be a recession on the horizon, during the last couple of years practice owners have reaped the benefits of the veterinary sector doing so well during the pandemic. Just as homeowners capitalized on the sale of their home[s] during the COVID real estate frenzy, an increased number of practice owners have chosen to cash out, selling their practices to corporate consolidators for a steep financial gain."

She reported that in 2021, approximately 1,000 corporate purchases were made. Purchase prices continued to exceed 15 times EBITDA, with some practices selling for up to 20 times EBITDA.

An estimated 25% of all small animal practices are now owned by corporate entities, she said. That means nearly 50% of revenues in that sector are flowing to corporations.

What was once a trend restricted to small animal practices has accelerated in the equine sector, Daly said. However,

the two major corporate consolidators, NVA and Mars Inc., have gained attention from the Federal Trade Commission. It has required both consolidators to divest a number of veterinary practices prior to gaining approval for larger acquisitions. Divesting ownership of these practices reduces a corporate consolidator's ability to have a large concentration of practices within a particular region, consequently preventing the elimination of local competition.

"With an aging practice owner demographic of which less than 50% of practice owners have a succession plan, it makes sense that 40% of practice owners are considering selling," she added. "While this may be an easier and less complicated approach for practice owners, corporate consolidation can and does have a negative impact on younger generations of veterinarians, and more importantly the associate veterinarians who contributed to the practice's overall growth and value."

Daly continued by explaining that "because equine clients typically bond to their horse's doctor, rather than the practice, a high-grossing equine veterinarian with a large following of loyal clients can have a significant negative impact on a practice upon their departure."

She cited a 2017 Forbes article that said more than one-third of employees cite a lack of recognition as a major reason for departure from a company.

"Imagine working hard for years at a practice to help it expand and grow, expecting to become a partner, only to find out that it was sold to a corporate aggregator, leaving you with nothing while the owner walks away with millions. It wouldn't take but a nanosecond to plant a seed of resentment," Daly said.

She noted that according to calculations from a blog from Veterinary Business Advisors, "a 10-year associate who produces $700,000 per year on average for a veterinary practice grossing $2.1 million per year could (and should) receive a bonus of $150,000 when the practice sells for $3.5 million. That still leaves the practice owner with well over $3 million in his/her own pocket but acknowledges the associate's contribution."

PEOPLEIMAGES/ISTOCK VIA GETTY IMAGES

To increase efficiency and profitability of an equine practice, Dr. Caitlin Daly recommended using a veterinary technician.

Building Successful Teams

Zeytoonian shifted gears to practice and people management. She shared the advice given by Jennifer Robison in a recent article: Don't focus on what you can't know—focus on what you can do. Specifically, she said, "communicate often and clearly, develop your managers, and support well-being."

She then shared her favorite options for communicating with the team: "Regular staff meetings; use of Slack for daily communications that are searchable (more easily than a group text message); and the team favorite, a coffee break and one-on-one check-in."

She recommended the book *Radical Candor* by Kim Scott and the software service 15five to facilitate communication and reviews with employees.

Additionally, Zeytoonian said that establishing and respecting your own boundaries and those of your team helps to maintain a practice culture of mutual respect and balance. She added that "many practices are adopting the 'right to disconnect' concept that is a proposed human right regarding the ability of people to disconnect from work and primarily not to engage in work-related electronic communications such as e-mails or messages during non-work hours."

Efficiency and Profitability

To increase efficiency and profitability, Daly recommended using a veterinary technician. She said that veterinarians without staff are diverting their time and attention away from true revenue-generating opportunities to tasks that gross little to nothing at all.

"Utilizing even just one technician per doctor is proven to increase the salaries of veterinarians," she stated.

Equine technicians can be leveraged by having them perform procedures such as sheath cleanings, bandage changes, blood draws, catheter placement, anesthetic monitoring, shockwave and laser treatments, and radiograph acquisition. Technicians can also be utilized for invoicing, medical record dictation and client communication.

This can drastically reduce the amount of non-billable hours for a veterinarian.

She concluded, "If you're thinking about hiring another veterinarian, but you don't have a technician, you may want to consider that a valuable technician can better fill the gap until a growing practice is ready or able to hire a new veterinarian."

News in the Industry

Tan reported some new developments in the equine industry. One development was a joint venture between Rutgers Medical School and Cornell to develop a genomic hybrid capture assay that can detect *Borrelia burgdorferi* in a horse's spinal fluid that could not be detected using antibody tests or PCR.

In addition, it is now possible to recycle the plastic from an Equihaler by signing up online to get prepaid shipping labels, she said.

EquiTrace has now partnered with Bio-Thermo microchips, which measure body temperature within seconds. This can automate temperature charting and health records. This tool could be particularly useful in the racing industry.

The Thoroughbred sales industry had record-breaking results in 2022, Daly reported. At the August Saratoga sale, a total of 143 yearlings were sold for a sale-record gross of more than $66 million, up 21% from last year's total. Fourteen yearlings were sold for prices greater than $1 million. The top colt fetched $2.3 million, and the top filly followed closely behind at $2 million. The September 2022 Keeneland sales were the highest-grossing auction in Keeneland's history. Total sales reached over $405 million, with 30 yearlings sold for $1 million or more, the most since the 2007 September Keeneland Sale.

In other racing industry news, Zeytoonian shared that a veterinarian and a trainer pled guilty to charges of distribution of adulterated and misbranded drugs with the intent to defraud and mislead. These are just two individuals of two dozen charged in a large-scale horse doping scheme investigated by the FBI and FDA.

Meanwhile, in California an equine veterinarian's license was revoked by the veterinary medical board due to the disconnect between a small animal-centric recordkeeping law and the challenges of ambulatory equine medicine. The AAEP urged the California Veterinary Medical Board to reconsider its laws in light of the differences for equine practitioners.

DZMITRY DZEMODOVICH/ISTOCK VIA GETTY IMAGES

"Although the veterinarian's license has been reinstated and the board is opening up to discussions surrounding the laws specific to equine medicine, all equine practitioners should practice exemplary record-keeping, medication dispensing and VCPR establishment, whether we practice in California or not," she recommended.

Veterinarian Well-being

Well-being has been at the forefront of efforts to help veterinarians, as well as human medical providers. The U.S. Surgeon General's Advisory Report on healthcare worker burnout was published in 2022 and is available at https://www.hhs.gov/surgeongeneral/priorities/health-worker-burnout/index.html.

Zeytoonian advised that a myriad of tools to drive change in healthcare settings are available through the U.S. Public Health Services website addressing healthcare worker burnout. She stated that burnout is not an individual mental health diagnosis, but a workplace issue that calls for systems-oriented, organizational-level solutions.

She shared that the AAEP has launched The Healthy Practice Member Assistance Program, an AAEP-sponsored benefit that offers the support and resources needed to address personal or work-related challenges and concerns. The services are confidential and free to AAEP members and their household family members. It includes counseling, legal services, financial planning advice and online resources covering a variety of topics.

In addition, Daly added, 988 was introduced as the new U.S. suicide and crisis hotline number in 2022. One can call or text 988 at any time and be immediately connected to a trained counselor. Nearly 90% of callers get what they need on the phone, while the remaining callers are connected to additional support and care.

Even if we never need 988 ourselves, veterinarians might find it helpful to have at hand when involved with a client experiencing a mental health crisis.

Diversity, Equity and Inclusion

Tan shared information about diversity, equity and inclusion, including the formation of different task forces, commissions and committees across veterinary medicine. Those groups include the new DEI committee formed by the AAEP in 2022.

Regarding diversity, the AVMA

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Accounts receivable and payment at time of service go hand-in-hand in helping your practice have a better cash flow and a healthier bottom line.

reported in 2021 that 90% of the veterinary profession is white. AVMA noted concern for the profession since owners prefer to have the option to take their animals to people who look like and relate to them. "This often results in improved communication, greater client compliance, and it creates greater economic and social sustainability," she stated.

In equine veterinary medicine, 95% of equine veterinarians are white, compared to the general U.S. population, which is only 60% white, and horse trainers who are 84% white.

Reasons for lack of diversity in the large animal field, Tan said, included that underrepresented minority applicants had less animal/veterinary experience and spent less time directly with veterinarians before applying.

She added that application ranking for admission relies heavily on GPA, standardized test scores and hours of experience, which favors white and affluent applicants.

Continuing with facts about equity, Tan shared that a 2021 study from Cornell showed that among veterinarians who earn more than $200,000 per year, women earn on average $100,000 less than men. The study concluded that men earn more income at lower levels of experience than women and make progressively larger jumps in salary with every year of practice.

Veterinary-specific data on a combined racial and gender wage gap is not available, but among people with master's degrees, Black women are paid just 64% of the wage of a white or non-Hispanic man, she said.

Veterinary Attrition/Attraction

In response to high attrition and poor attraction rates in equine veterinary practice, the AAEP Board met with a group of practice owners and key opinion leaders in early 2022, reported Zeytoonian. The group discussed the primary causes of these issues and formed the AAEP Commission on Equine Veterinary Sustainability.

The commission is comprised of five subcommittees developed around the key areas affecting the sustainability of equine practice, as identified in previous research. Each subcommittee has co-chairs, an officer liaison and 12-15 members. The commission is governed by a steering committee that consists of the AAEP officers and the chairs of each subcommittee. The charge of each subcommittee is to develop actionable

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Veterinarians of all ages and stages of practice can be affected by stress, burnout and mental health issues. Become aware of the resources available to you through the AAEP and other organizations.

tools that support the change needed in equine medicine to improve our numbers.

"As a society, the pandemic has really changed employees' outlooks on their career and life goals," said Zeytoonian.

New graduates want to find jobs that offer them balance and the opportunity to feel like they are connecting with others and contributing in a positive way to society. But, she said, "While the culture of a practice and many of the intangible benefits are high priority, rising student loan debt and inflation are causing new grads to change their tune and refocus on starting salaries."

Daly added that the AVMA has documented a predilection for students with higher debt load choosing private practice with higher starting salaries. The data, coming from two decades of AVMA's annual surveys of graduating students (2001–2021), suggests that debt level is associated with new graduates' career choices, she said.

"The higher a student's debt, the more likely they will choose a job with a higher starting salary," said Daly. "We will continue to have an attraction issue if we don't get our starting salaries more aligned with small animal private practice."

Although graduates entering equine medicine still report salaries at least $20,000 less than their small animal counterparts, a recent unpublished survey administered on private equine veterinary Facebook groups by Dr. Amy Grice received anonymous responses from 388 equine associates. They had average salaries of $88,000 for 2017-21 graduates, said Zeytoonian.

Helping Students with Debt

Lincoln Memorial University is taking a new approach to reducing debt. That college will debut a shorter schooling requirement focusing on those wanting to enter into the equine veterinary sector.

Starting in 2023, students will receive 2.5 years of undergraduate education followed by the customary four-year veterinary doctorate program, said Zeytoonian. Students who maintain the minimum GPA requirements will save an average of 1.5 years of study and its associated student debt.

Daly added that increased efforts to help students currently in veterinary school are emerging. Decade One, a program dedicated to the success and vitality of young equine practitioners, has launched a spinoff program aimed at helping the aspiring equine practitioner called Starting Gate.

"The goal of Starting Gate is to provide veterinary students with the personal development skills and business education to not only become a success-

ful equine veterinarian, but an individual who has the confidence and knowledge to create a career and life tailored to their unique needs and aspirations," explained Daly. "Students from across the country will learn and bond together during their journey through vet school, leaving them with a strong peer support and networking system in place upon graduation."

In closing, the Business News Hour presenters championed the changes that are occurring across the equine veterinary industry that will keep the career strong into the future. The presenters expressed confidence that the world's horses will continue to receive excellent care by equine veterinarians in the generations to come.

Strategies for Managing Accounts Receivable

Because accounts receivable can have a big impact on practices' financial health, several presentations concentrated on this issue. Dr. Robert Magnus discussed "Accounts Receivable—Culture, Process and Impact."

He shared that even a robustly growing practice will struggle with cash flow if the accounts receivable (AR) are high. Cash is necessary to pay bills, invest in equipment and hire staff, he said. He challenged the attendees to take action upon going home.

Magnus talked about meeting with the owners of a practice where the veterinarians considered 80% of the biggest offenders in paying their bills to be "great accounts." The practice owners didn't want to ask them to pay.

"If you are passionate about the horse, you'll always be busy. And you deserve to work for people willing to pay you," Magnus said.

One of the biggest cultural changes that practices need, he shared, is to have a process that includes creating invoices within 24 hours, having one staff member in charge of AR, and having clear financial policies.

Developing a process of due diligence, with monthly aging of AR for each doctor and monthly average days of AR, will allow a list to be prepared for calls to clients with outstanding balances. These calls should be made by the doctor who did the work. Tying doctor compensation to collected revenue can assist in creating a culture where getting paid is a priority. Also, creating a monetary incentive for a staff member to collect old balances can be very successful.

Magnus continued by explaining the cash flow gap that occurs when a practice purchases pharmaceuticals and medical supplies for which payment is due at 30 days, but the invoices for the services which are performed using those supplies are not paid to the practice for 60-90 days. Because cash flow is an important aspect of a valuation, he said, high AR also can negatively affect practice value.

Next, Magnus recommended steps that all practices can take to deal with AR. Action items he suggested included weekly attention by the practice manager to AR, monthly tracking of average days of AR utilizing a practice-owner dashboard, and engaging all doctors in the effort to minimize overdue accounts.

In conclusion, he recommended that new clients sign a client agreement and be required to have a credit card on file. For clients who consistently pay poorly, he suggested asking for a retainer in order to continue providing services. Because having good cash flow is so important to having a healthy business, controlling AR is essential, he stated.

Payment at Time of Service

The next speaker in the account receivable (AR) session, Wendy Krebs, DVM, made a strong argument for instituting a payment at the time of service (PATOS) policy for equine practices.

She emphasized that veterinary staff and doctors deserve increased compensation. Having the cash flow to meet payroll requires minimum accounts receivable.

Payment at time of service creates increased cash flow, increased practice value and more accurate invoices without missed charges, she said. In her opinion, the most important metric for accounts receivable is Days Sales Outstanding, or DSO. By calculating the DSO, one can know how many days of revenue production are tied up in accounts receivable.

Days Sales Outstanding is calculated by multiplying the average accounts receivable in a time period (such as a month or a year) by the number of days in the time period, then dividing by the total gross revenue for the period. The result is the number of days of revenue for which the practice had not been paid.

Krebs recommended calculating DSO on a monthly basis.

To move to payment at time of service. Krebs recommended five steps.

- First, have staff members take responsibility and create a goal with a reward for them.
- Second, establish expectations for clients with a client agreement. For established clients, she suggested offering PATOS as a convenience, but she recommended requiring it for all new clients.
- Third, using technology to save credit cards in a compliant manner is essential. She suggested that fees be raised to account for the increased expense of merchant fees.
- Fourth, Krebs insisted that invoices must be completed the same day as the service is provided. She encouraged utilizing software templates and bundles.
- Fifth, she suggested eliminating any internal financing for clients. "Let the

banks do the banking," she said.

In closing, Krebs said that the key factor in improving a practice's profitability and increasing the ability to appropriately compensate veterinarians is to reduce accounts receivable. The most effective way to do so is to implement payment at time of service.

Accounts Receivable in Ambulatory Practice

Linda Hagerman, DVM, presented on "How to Decrease Accounts Receivable in Ambulatory Practice." She reiterated the message that payment at the time of service is essential for practice health. She said receiving prompt payment should be an important part of every practice's culture.

Hagerman recommended providing estimates and reminding clients of the practice's payment policies when scheduling before each visit. This will set client expectations. By getting approval for the estimate prior to the visit, clients are not surprised or confused.

The speaker recommended offering payment through multiple methods such as CareCredit, PayPal, credit cards and online options. If an invoice becomes overdue, she recommended contacting the debtor frequently by phone or text. If that is unsuccessful, take the person to small claims court to get a judgment.

She said it is risky to take checks from first-time clients. Use credit card readers in the field. Hagerman said practices should pay commission to associates only if payment is received within 30 days. Practices should be sure to have clients sign a legal document if any payment plan is offered.

In closing, Hagerman suggested that being known as an "expensive" practice can help clients prepare for payment. Being selective in taking on clients can protect the practice. Most importantly, measuring and monitoring accounts receivable should be undertaken regularly.

Keep Good Medical Records

The AVMA Professional Liability Trust reported an increase in claims for all species and for license defense. There also has been a 13% increase in professional liability claims, the highest ever recorded, stated Dr. Cynthia MacKenzie in the introduction of her presentation, "Review of Good Record Keeping: Will Your Documentation Defend You?"

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With many states introducing online submission of complaints from clients against veterinarians, there is increased risk, she said. Poor medical records have resulted in the biggest fines. Equine claims have grown 15% year over year and have the highest monetary payouts.

MacKenzie explained that the purpose of medical records is to allow any veterinarian to understand what has transpired previously with a patient. That should include documentation of examinations, treatment and communication. The documentation should provide for continuity of care.

In addition, consent forms, anesthesia logs, surgery reports, boarding sheets, recommendations that were accepted or declined by clients, lab results and estimate sheets should all be retained in the patient medical record. They must be accurate, clear and timely (within 24-48 hours), MacKenzie stated. Documents also must be legible and easy to follow.

Declined estimates are important to retain, as well as communication of all kinds.

"Quality of care is considered to be on par with the quality of the medical record," she said.

Medical records are legal documents and are required by the law of each state's practice act. These acts change frequently, so it behooves one to understand the requirements for records, she added. From a defense standpoint, "if it isn't written down, it didn't happen," she cautioned.

Licensing boards and attorneys prefer a subjective objective assessment plan (SOAP) format and expect any amendments to the records to be date- and time-stamped. There should also be a justification for the amendment.

MacKenzie noted that equine practitioners' medical records are historically less satisfactory in meeting the requirements of licensing boards. She encouraged doctors to focus more attention on keeping complete records.

MacKenzie concluded that in the heightened regulatory environment in recent years, equine practitioners need to be aware of all the medical, legal, regulatory and ethical reasons for producing and maintaining excellent medical records in practice. They must carefully meet the expected standards. She said anything less could have expensive consequences. EM

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* Freedom of Information Summary, Original New Animal Drug Application, approved by FDA under NADA # 141-427, for OSPHOS. April 28, 2014.

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Bisphosphonates affect plasma concentrations of some minerals and electrolytes such as calcium, magnesium and potassium, immediately post-treatment, with effects lasting up to several hours. Caution should be used when administering bisphosphonates to horses with conditions affecting mineral or electrolyte homeostasis (e.g. hyperkalemic periodic paralysis, hypocalcemia, etc.).
The safe use of OSPHOS has not been evaluated in horses less than 4 years of age. The effect of bisphosphonates on the skeleton of growing horses has not been studied; however, bisphosphonates inhibit osteoclast activity which impacts bone turnover and may affect bone growth.

Bisphosphonates should not be used in pregnant or lactating mares, or mares intended for breeding. The safe use of OSPHOS has not been evaluated in breeding horses or pregnant or lactating mares. Bisphosphonates are incorporated into the bone matrix, from where they are gradually released over periods of months to years. The extent of bisphosphonate incorporation into adult bone, and hence, the amount available for release back into the systemic circulation, is directly related to the total dose and duration of bisphosphonate use. Bisphosphonates have been shown to cause fetal developmental abnormalities in laboratory animals. The uptake of bisphosphonates into fetal bone may be greater than into maternal bone creating a possible risk for skeletal or other abnormalities in the fetus. Many drugs, including bisphosphonates, may be excreted in milk and may be absorbed by nursing animals.

Increased bone fragility has been observed in animals treated with bisphosphonates at high doses or for long periods of time. Bisphosphonates inhibit bone resorption and decrease bone turnover which may lead to an inability to repair micro damage within the bone. In humans, atypical femur fractures have been reported in patients on long term bisphosphonate therapy; however, a causal relationship has not been established.

ADVERSE REACTIONS: The most common adverse reactions reported in the field study were clinical signs of discomfort or nervousness, colic and/or pawing. Other signs reported were lip licking, yawning, head shaking, injection site swelling, and hives/pruritus.

POST-APPROVAL EXPERIENCE (December 2018): The following adverse events are based on post-approval adverse drug experience reporting. Not all adverse events are reported to FDA/CVM. It is not always possible to reliably estimate the adverse event frequency or establish a causal relationship to product exposure using these data.

The following adverse events are listed in decreasing order of reporting frequency: renal failure, polyuria, polydipsia, abdominal pain, anorexia, lethargy, hypercalcemia, behavioral disorder, discomfort, hyperkalemia, hyperactivity, recumbency, hyperthermia, injection site reactions, muscle tremor, urticaria, hyperglycemia, and fracture. In some cases, death has been reported as an outcome of the adverse events listed above.

INFORMATION FOR HORSE OWNERS: Owners should be advised to:

- NOT administer NSAIDs.
- Ensure horses have access to adequate water before and after administration of OSPHOS.
- Observe their horse for at least 2 hours post-treatment for signs of colic, agitation, and/or abnormal behavior.
- If a horse appears uncomfortable, nervous, or experiences cramping post-treatment, hand walk the horse for 15 minutes. If signs do not resolve contact the veterinarian.
- Monitor water intake and urine output for 3-5 days post-treatment.
- Contact their veterinarian if the horse displays abnormal clinical signs such as changes in drinking and urination, appetite, and attitude.

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Whether you are focused on equine reproduction or you have a broodmare or two with clients, there are some great tips in these articles.

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AAEP Convention Reproduction Wrap-Up

This article offers a summary of six reproduction-focused articles from the 2022 AAEP Convention.

Brought to you by VMRD

By Kimberly S. Brown

Many veterinarians have clients who breed horses and raise foals. Your practice might not specialize in equine reproduction, but as a general practitioner, you have to be ready to address reproduction questions and issues. This article offers you a wrap-up of the reproduction coverage from the 2022 AAEP Convention. Check out the six articles on EquiManagement.com that can offer you more in-depth information on each of these topics.

Kester News Hour: Reproductive Highlights of 2022

The 2022 AAEP Convention Kester News Hour reproduction update was led by Maria Schnobrich, VMD, DACT. She is with Rood and Riddle Equine Hospital in Kentucky. Schnobrich reviewed four studies, relaying the clinical relevance of each to the session attendees.

Taking Advanced Reproductive Techniques to the Next Level. To briefly review, Schnobrich said that ICSI is an assisted reproductive technique where veterinarians aspirate immature oocytes directly from a mare's ovary. Those

Editor's Note: Make sure to read the six original articles from the 2022 AAEP Convention reproduction-focused topics on EquiManagement.com, authored by Stacey Oke, DVM, MSc. All AAEP reproduction coverage brought to you by VMRD.

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The "really exciting repro paper of the year" involved research on pretreating semen prior to fertilization in assisted repro techniques.

oocytes are subsequently allowed to mature, then are fertilized by injecting a spermatozoan directly into the oocyte. The resultant blastocytes (embryos) are then transferred to the recipient mare.

As an alternative to ICSI, a team headed by the University of Pennsylvania's Katrina Hinrichs, DVM, PhD, DACT, found that if they took fresh semen and "pretreated" it, then capacitation-like changes of the sperm occurred that allowed it to achieve fertilization and produce embryos without ICSI. Due to time constraints and the complexity of the technique, Schnobrich did not delve into the details of the pretreatment, but details are available in the full-length study (Felix, M.R.; Turner, R.M.; Dobbie, T.; et al. Successful in vitro fertilization in the horse: production of blastocysts and birth of foals after prolonged sperm incubation for capacitation. *Biol Reprod* 2022;107(6):1551-64).

"This was the really exciting repro paper of the year," shared Schnobrich.

She explained that traditional ICSI boasts 100% of eggs fertilized, a maturation rate of 60%, and 20-25% embryos produced. Overall, traditional ICSI results in 1.5 embryos produced from 10 oocytes.

"Hinrichs' new technique, however, has a 90% fertilization rate and a 74% blastocyst rate, producing 6.6 embryos per 10 oocytes," Schnobrich enthused. "This is awesome."

(Editor's note: More information on this study and three other studies from the Kester News Hour are covered in an article on EquiManagement.com.)

AAEP Table Topic: Road Map to Pregnancy

This popular Table Topic featured co-moderators Ryan Ferris, DVM, DACT, from Summit Equine Inc. in Oregon, and Karen Wolfsdorf, DVM, DACT, from Hagyard Equine Medical Institute in Kentucky.

They started by asking what characteristics contribute to the diagnosis of a "problem mare." This means getting an extensive history on the mare. Ferris said learning why owners want to breed a mare is important, as well as understanding financial restraints.

Topics included obtaining a good history; culture and cytology; infusing misoprostol to potentially unblock the oviducts and identify bacteria; uterine biopsy; and treating, quitting or changing tactics.

Following are some key takeaways from the discussion.

On cytology and culture: Wolfsdorf said, "I don't do a cytology with normal maiden mares or mares that just require a culture for the breeding shed unless there is an abnormal finding on examination or a history of endometritis, not getting in foal, or losing a pregnancy. In these cases, doing a cytology gives you additional information down which path to proceed."

On infusing misoprostol: "By administering misoprostol, you're potentially activating bacteria, creating inflammation and producing intra-lumina fluid," explained Wolfsdorf. "With a low-volume lavage, culture and cytology, bacteria may be identified. The misoprostol application can be used in either estrus or diestrus, which is convenient."

Uterine biopsy: Ferris said, "I am using endometrial biopsy more than in previous years due to increased information gained on the mares I am managing. Every year I am surprised by my findings on endometrial biopsy that I would have missed with other diagnostics. I think this is a tool that we are not using enough."

Treat, quit or change: At the end of the day, attendees wanted to know when they should stop trying to breed a particular mare: When the breeding season ends?

When the owner runs out of money?

Ferris reminded practitioners that despite having all these options available, "Sometimes we can overdo our treatment strategies, and [fewer] treatments may be best. Additionally, the mare has zero chance of getting pregnant if the mare is not bred."

Fungal Endometritis in Mares

Endometritis caused by molds or yeast is an uncommon cause of infection, accounting for fewer than 7% of diagnosed endometritis cases. "These infections have a guarded prognosis, are expensive to treat and require a long duration of treatment with antifungals," said Tom Stout, MA, VetMB, PhD, DECAR, from the Department of Clinical Sciences, Faculty of Veterinary Medicine, Utrecht University, The Netherlands.

Stout advised practitioners to not "group all causes of fungal endometritis together. You can look for hyphal fungi (molds) such as *Aspergillus* spp., and yeasts such as *Candida* spp. But a wide range of organisms reportedly cause fungal endometritis."

He added: "Repeated intrauterine antibiotic therapies may also contribute to these opportunistic infections by disturbing the normal commensal flora of the vaginal and uterine microbiomes."

Battling Bacteria—Biofilms Within the Uterus

When acute uterine infections become chronic and fail to resolve with traditional treatment regimens, the vet should consider the presence of biofilms.

"The vast majority of bacteria are capable of producing biofilm by moving from a single (planktonic) bacterium to a community of bacteria trying to survive and live," explained Ferris. "Biofilms allow tolerance to antibiotics and protection from the host's immune system. When bacteria move from a single cell organism to a community, the established infection is much more difficult to eradicate."

Biofilm-associated endometritis causes refractory infectious disease in mares and frustration for equine practitioners. When infections associated with biofilms are suspected, numerous treatment options exist, but these should be used in conjunction with culturing and sensitivity testing.

Despite biofilms being an important cause of chronic uterine infection, Ferris warned practitioners not to over-diagnose them. "Biofilm-associated infections is still not a top differential for subfertility in mares," he said.

Biologic Research in Problem Mares Shows Promise

For more than a decade, experts have been looking into biologics to help treat endometritis to improve fertility rates. They might have found even more uses for these treatments in problem mares.

Marco Alvarenga, DVM, MS, PhD, from Sao Paulo State University in Brazil, said delayed post-breeding clearance of fluid from the mare's uterus and subsequent inflammation create a "hostile uterine environment for establishing pregnancy."

The key problem with inflammation in the uterus after breeding is an imbalance in cytokine expression. The "problem" mares express more pro-inflammatory than anti-inflammatory cytokines.

Alvarenga cited several research reports in his presentation, including one from Metcalf et al. in 2012 that looked at PRP to treat uterine inflammation.

His own study in 2017 found that mares treated with PRP before and after artificial insemination had improved pregnancy rates compared to controls.

How Antimicrobial Stewards Approach Bacterial Endometritis in Mares

The days of doling out antibiotics with wanton abandon for medical conditions—including post mating-induced endometritis (PMIE)—have ended. Today's practitioners must embrace ways of improving antibiotic stewardship using an evidence-based approach.

"First, we need make sure the mare has a uterine infection, and we need to reconsider the routine use of antibiotics post breeding," said Tamara Dobbie, DVM, DACT, from the University of Pennsylvania's New Bolton Center.

Sampling during estrus is ideal because the mare is better able to resist contamination (her note was that veterinarians don't want to contaminate the mare's uterus when collecting the sample).

When collecting uterine samples, Dobbie recommended obtaining them through a vaginal speculum or using a sterile chemise over the uterine swab.

Placing a "plug" within the vestibule will help prevent vestibular—and even caudal vaginal—contamination during rectal palpation and ultrasonography.

"Admittedly, the plug is cumbersome and time-consuming, but the effort is well worth it," advised Dobbie.

To perform the plug technique, Dobbie scrubs the mare and dries her. She then "pops" a rolled feminine hygiene pad into the vestibule. Practitioners can then perform rectal palpation and ultrasonography with the vestibular plug in place without fear of vestibular contamination.

The plug can be removed immediately prior to vaginal sampling and vulvar cleaning.

Dobbie also urged veterinarians to consider swab contamination when transferring the sample into the transport media.

"You are in the barn! It is dirty. I never do this transfer in the barn aisle. Find somewhere cleaner, like the tack room," Dobbie advised.

She offered many other tips for practitioners in the field during her presentation. EM

HOW TO CREATE A JOINT HEALTH PROFIT CENTER

Here are tips on making complete joint care a more important part of your bottom line!

By Stacey Oke, DVM, MSc

"I charge a baseline lameness exam fee for looking at any horse then another fee for blocking nerves or joints," said Dr. Ben Espy.

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"Developing a solid skill set in the basic fundamentals of a joint health program can be a gateway to practicing cutting-edge medicine," said Julie Settlage, DVM, MSc Vet Ed, DACVS (LA), and equine professional services veterinarian with Boehringer Ingelheim. "The choices for medications within a joint are growing every year and new publications are frequent. The basics of utilizing these treatments are the same, however. The combination of utilizing old skills with new knowledge is an exciting place to practice."

In this article, we look at the science and the business of equine joint health. Preserving and maintaining joint health improves equine welfare and mitigates economic losses and horse attrition. And with approximately 60% of lameness cases attributable to osteoarthritis (OA), the business of bones and joints is booming. Appropriate joint health care—both prophylactic and active management—not only helps your patient but also your practice's profitability … if you charge appropriately for your time, services, expertise and use the recommended multi-modal treatment approach.

"Joint therapy in the equine world is becoming routine care," said Ben Espy, DVM, DACT, owner of ProRodeo Equine Sports Medicine in San Antonio, Texas. "I have a thriving lameness practice and look at six or eight horses a day, so 30 to 40 a week. Those horses require comprehensive joint care, including joint injections. I don't perform joint injections needlessly, but for me those injections are as routine as pulling blood for a Coggins."

Kate Hodson, DVM, owner of Hodson Veterinary Services LLC located in Hebron, Indiana, also said her joint health profit center is thriving.

"Not only do I offer joint care to show horses but also the back yard horses when owners are looking to keep them comfortable and maximize quality of life in their golden years," Hodson said. "I offer joint injections when appropriate, injectable medications such as hyaluronic acid (HA) and polysulfated glycosaminoglycans (PSGAG) and advise what oral joint health supplements might be appropriate."

THE BASICS AREN'T BASIC

Are you charging appropriately to look at lame horses? These examinations can be extremely time consuming in some cases. Based on a roundtable discussion held during the 2022 AAEP Annual Convention, this is an area that veterinarians are not charging appropriately for their time. Several recommendations were made during that roundtable, such as charging a flat fee based on the "level" of work-up required. Others preferred charging per procedure.

Espy said, "I charge a baseline lameness exam fee for looking at any horse then another fee for blocking nerves or joints."

In addition to local blocks, embracing diagnostics such as radiographs and ultrasonography is good medicine to identify underlying pathology that needs to be addressed. We cannot assume joint discomfort always stems from OA. To better pinpoint a lameness for targeted treatment, some regions have nuclear scintigraphy or even magnetic resonance imaging (MRI) available. Increasingly veterinarians have the benefit of standing positron emission tomography (PET) device for imaging lower limbs.

INTRA-ARTICULAR MEDICATIONS

An industry-wide survey of equine practitioners regarding

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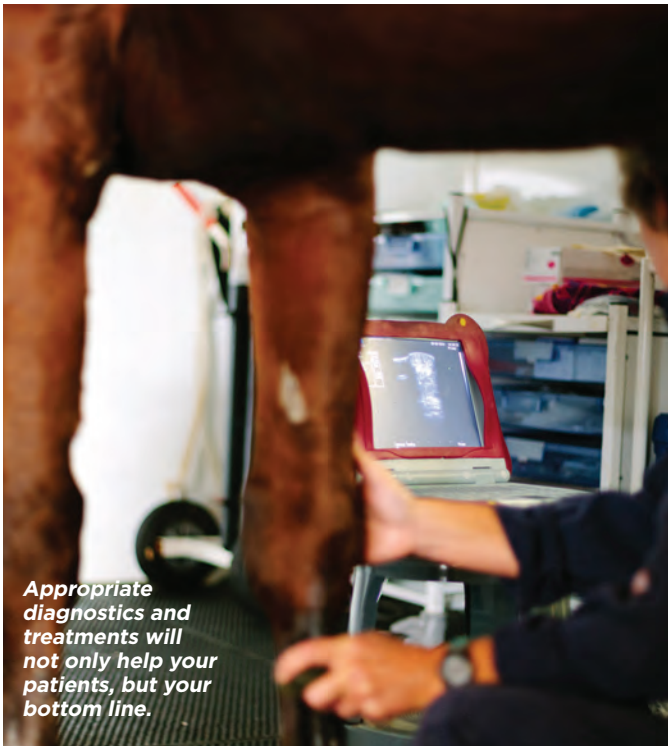
THE WHOLE HORSE

When horses are having their joints cared for, Ben Espy, DVM, DACT, owner of ProRodeo Equine Sports Medicine, in San Antonio, Texas, said that owners frequently bring up the fact that they require other routine, preventive health care such as dental work (e.g., floats) and vaccines. This is also a good opportunity to discuss deworming and performing fecal egg counts as recommended by preeminent parasitologist Martin Nielsen, DVM, PhD, DEVPC, the Schlaikjer professor of Equine Infectious Disease at the Gluck Equine Research Center.

These routine preventive care measures are not only important to the overall health of a horse, but they are the meat and potatoes of a financially flourishing practice.

To round out a horse's OA therapeutic plan, don't forget to recommend weight management, controlled exercise and appropriate shoeing.

—Stacey Oke, DVM, MSc



Appropriate diagnostics and treatments will not only help your patients, but your bottom line.

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the clinical use of various joint therapies and the role of new or recently developed joint therapies in everyday practice was recently performed. Those results were published in a 2020 edition of the *Equine Veterinary Journal* by Zanotto and Frisbie.

Following are some of the main concerns, recommendations and popular therapies currently embraced by equine practitioners.

For intra-articular injections, overtreating joints are a reported concern by 66.4% of the survey respondents. About half of the respondents inject joints only once every six months, whereas one-third of respondents are comfortably injecting joints every three months (four times a year).

In addition to corticosteroids (primarily triamcinolone and methylprednisolone), practitioners are commonly mixing amikacin and hyaluronic acid in the same syringe for intra-articular application.

Regenerative therapies are embraced by more than 80% of survey respondents, and practitioners feel their patients benefitted from these therapies when used intra-articularly. Those therapies include interleukin-1 receptor agonist protein/autologous conditioned serum (IRAP), with 83% of survey respondents using this therapy. Seventy-two percent use platelet-rich plasma (PRP), and 53% inject autologous protein solution (APS) and stem cells.

Espy said he uses five different products in varying combinations, but he never mixes corticosteroids with regenerative therapies.

"It is contraindicated to use anti-inflammatories and regenerative therapies concomitantly," he said. "If the joint is inflamed, I'll sometimes use a corticosteroid first then a month later come back and use a regenerative therapy, or vice versa. There is no industry standard."

Hodson added that "you really have to look at what is working and what isn't. Steroids with HA, HA alone, PRP, stem cells … it all depends on the horse. Some horses do very well with HA." Hodson added that regenerative therapies have become very easy to use … "they're a real game changer" in some horses!

In terms of frequency of intra-articular treatments, Espy said it is a balance.

"There is a cost factor and a danger factor," Espy noted. "First, if you inject a horse four times a year and the owner is spending $400-$500 minimum to inject a horse each time, that's a $2,000 'maintenance bill' on injections alone per year. An owner's budget may not be able to bear that. Second, from a medical standpoint, puncturing a joint four times a year increases the odds of infection."

Overall, both Hodson and Espy felt that it is reasonable to perform intra-articular treatments once every three months if needed, which is a popular opinion based on the industry survey reported above.

That said, Espy advised other practitioners to not be pressured by owners to over-inject.

"I have never injected a joint that didn't need it," he stated. "We don't need to inject prophylactically to maintain normal joint health. Everything I inject is in response to a problem."

NONSTEROIDAL ANTI-INFLAMMATORY DRUGS (NSAIDS)

These medications, particularly phenylbutazone and flunixin

meglumine, are a mainstay of maintaining a comfortable horse. With many over-the-counter products, your patients could be receiving these medications without your knowledge or medical input.

"Even though we aren't going into a joint, we still need to balance risk versus benefit," Espy advised.

As with any prescription medication, prior to use a veterinarian should perform a physical examination and review the horse's medical history. A veterinarian should advise horse owners to observe for signs of potential drug toxicity. As a class, non-steroidal anti-inflammatory drugs might be associated with gastrointestinal, hepatic and renal toxicity. Use with other NSAIDs, corticosteroids or nephrotoxic medication should be avoided.

Blood work might be indicated for patients on longer-term NSAIDs, even when using low daily doses. Longer duration of administration is often off-label use of these medications. For example, the label dosage of firocoxib is for 14 days.

"I strongly urge owners to check liver and kidney values [at least] once a year," Hodson said.

However, to do that, it is imperative that veterinarians know which patients are being given NSAIDs. Some owners, for example, don't think to mention that they are giving bute, aspirin or firocoxib because they are generally in every horse owner's medicine kit. Therefore, owners think they are safe to use whenever they want.

"I currently price match NSAIDs because I want an exclusive relationship with my client, and I want them to purchase it from me," said Espy.

Even with price matching, bulk NSAID sales will benefit your joint health profit center.

The first step in treating lameness is acquiring a proper diagnosis.

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ORAL JOINT HEALTH PRODUCTS

According to Seabaugh, et al. (2022), certain populations of horse owners spend >$60 per month on supplements, and oral joint health supplements are among the most popular. Murray, et al. (2018) also reported that joint supplements were commonly offered. Of the 134 individuals that responded to Murray's survey, 53% sought advice regarding joint supplement selection from merchants, and 46% from their veterinarians.

Given that many joint supplements do not contain the type or amount of product listed on the label (Oke, et al. 2006), it behooves practitioners to stock and sell quality products produced using appropriate manufacturing practices and quality assurance/control.

Even with quality products, Espy said that joint supplements are only about 30% absorbed.

"I've actually converted most of my clients to injectable [products] such as HA and polysulfated glycosaminoglycans instead," he said.

MISSED OPPORTUNITIES, MISSED INCOME

In addition to not charging for lameness exams and working up cases with blocking and imaging, Espy feels some veterinarians are missing opportunities to inject joints.

"I see a population of young vets that are hesitant to inject," he noted. "The have sensory overload with the options available. They can't decide between the products, the modalities, and the combinations available. It's confusing, and they often end up referring the horse instead of managing the case themselves."

Further, spending money on a regenerative therapy system might seem daunting, but the expenditure could very well be worthwhile.

"Despite having an active joint practice, even I was hesitant to invest in a system," said Espy. "I agonized over what to buy and whether or not it would be lucrative. I ended up paying for that machine in 90 days. It was an incredible experience as a small business owner."

GOOD MEDICINE IS GOOD BUSINESS

Embracing all of the available therapies advocated for robust equine health and being able to directly provide your owners with those products and services will allow your joint health profit center to thrive. Espy and Hodson recommend continuing education for practitioners to improve their joint injection skills.

"If you aren't utilizing your skills with injections, it's definitely something to look into CE-wise as it does benefit many horses," Hodson recommended.

Settlage added, "Developing a comprehensive joint health program can provide early-career equine veterinarians with improved income, deepen their relationship with their clientele, and provide a sense of pride when their patients are able to excel in the work their owners want them to do. All of these elements can be part of helping retain these important members of our profession."

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The Reality of Equine Practice in 2023

Take a look at the challenges and opportunities that equine practice is facing as we move into 2023.

By Amy L. Grice, VMD, MBA

When thinking about the current state of equine practice, it is important to consider a broad survey of data from the world in general as well as the equine and equine veterinary industries. Current global and national economic conditions strongly influence current conditions in equine practice.

The economic impacts of inflation, supply chain issues *(see article on page 78)*, Russia's war on Ukraine and the potential global recession will all affect equine veterinary practices. Declining horse numbers, changing owner demographics and corporate acquisitions of equine practices will impact the strengths and weaknesses in the equine world.

High educational debt, changing student demographics, compensation issues and family needs of equine veterinarians are also altering the landscape.

There are significant challenges, but also many opportunities as we look forward in equine practice.

Economic Indicators

Some economic indicators are currently worrisome for the equine world, but others are positive. Equine practice is highly dependent on horse owners feeling wealthy. When stock prices drop, typically people feel poorer, even if they only have long-term investments that they do not utilize for ordinary expenses. Unemployment rates typically rise in recessions, but they are currently low. In addition, unemployment rates among college graduates are usually significantly lower than for those with less educa-

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The majority (56.5%) of equine veterinarians today are female, according to AVMA statistics.

tion. Since most horse owners are in the educated segment, this bodes well for continued spending in the equine veterinary sector.

In addition, when looking at real average household income over the last 50 years, those in the top 20% have seen significant gains. Meanwhile, those in the other quintiles have remained flat. As most horse owners are in the top 20% of income, this means they have more disposable income to spend on luxuries such as horses.

The COVID-19 pandemic was kind to equine practices. Most reported increased revenue in 2020 compared to 2019, with continued growth in 2021. Pre-purchase exams increased, as did horse sale prices. Many practitioners worked more hours and saw more emergencies. Unfortunately, this increased workload also increased exhaustion and burnout among veterinarians.

Equine practices depend on horses remaining popular and numerous. It is estimated that the number of horses in the United States has decreased by 23% in the last 10 years. Recent estimates of the U.S. equine population are 6 million (Brakke study 2014), 8.9 million (AVMA AAEP Equine Economic Impact Survey 2016) and 7.2 million (American Horse Council [AHC] Study 2017). However, the 2017 AVMA Pet Ownership & Demographics Survey suggested that pet horse numbers have fallen by 61% in the last five years.

The AHC study indicated that horses are located all around the country, with the top three states, in order of horse population, being Texas, California and Florida. Although costs of keeping a horse have risen, more than 90% of horse owners expected to own the same number or more horses in 2022 compared to 2021, according to a survey done by the American Horse Publications. Fewer than 10% of respondents in that survey expected to own or manage

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A 2017 AVMA survey showed that 42% of horse owners considered their equids to be pets and 47% consider them to be family members.

fewer horses in 2022 than in 2021.

According to the AHC's 2017 Study, 1.3% of the U.S. population owns horses, 29.2% of American household members participate in equine-related activities but do not own a horse, and 13.2% spectate at horse events but do not own or participate. This means that almost a third of U.S. households own horses or participate in some way in the equine world, which is very good news for the industry.

The median age for horse owners is 38 years. For participants, the median is 22 years, and for spectators, 36 years. Among non-owner horse activity participants, 38% are children less than 18 years of age, so there is a new group of potential owners in the wings for the future. Among horse owners, the study found that 22% have incomes of $100,000-$149,000 and 28% have incomes >$150,000.

How We See Horses

Horses are increasingly valued by their owners and society. The 2017 AVMA Pet Ownership & Demographics Survey showed that 42% of horse owners considered them to be pets, 47% as family members, and just 11% as property.

The increasingly common societal view of animals as sentient beings worthy of humane care is impacting equine sports. Social license to operate is defined as "an intangible, unwritten, and non-legally binding social contract whereby the community gives the industry the right to conduct its business." In the U.S., the public is currently concerned about and attentive to horse racing, specifically catastrophic breakdowns, racing of 2-year-olds, aftercare of retired racehorses, race-day medication, doping and whip use. This broad public concern is likely to extend to many aspects of equine sport as social media shines a light on negative practices.

Because veterinarians benefit monetarily from some of these issues, this can result in lost credibility with the public.

Equine Practice

Equine practices are widely varied in size and scope. According to AVMA 2021 statistics, equine veterinarians are a small fraction (4.9%) of the total number of private practice veterinarians, representing 3,645 of 73,900. Females have become the majority, comprising 56.5% of equine veterinarians.

Veterinary students are now 85% female on average.

In the AAEP, 49% of members are over the age of 50 years.

In 2016, 52.8% of equine practices had one to two FTE (full-time equivalent) veterinarians, while 20.6% had six or more.

With these demographic changes come challenges. One of the most stressful and alienating aspect of equine practice is the need to provide emergency care 24/7/365. This need contributes to high attrition in the field—in part, perhaps, because new female entrants often have more family responsibilities.

The 2012 AAEP Owner Trainer Survey showed that one of clients' top priorities in choosing a veterinarian is the availability of on-the-farm emergency care.

In the last 20 years, about 50% of new graduates that were AAEP members have let their memberships lapse within five years of graduation. The number of new graduates entering equine practice has also been decreasing. From a high of 5.7% in 2003, this number fell to 1.0% in 2019 before rebounding to 1.4% in 2020 and 2021. In addition, 97 new graduates entered equine internships in 2021.

Veterinarian Shortage

There is a shortage of veterinarians to fill available jobs in all sectors. In 2021, the AVMA reported that there were 18.5 jobs for veterinarians per veterinarian jobseeker. Salaries, work hours and emergency service requirements are more attractive in the companion animal sector than the equine sector to many young graduates.

Veterinary unemployment climbed

MARLENKA/ISTOCK VIA GETTY IMAGES

Social license to operate is becoming increasingly important to the equine industry. The public is currently concerned about and focused on the racing industry, but other segments of equine sport are at risk.

to 1.8% in 2021, up from 0.7% in 2020, according to the AVMA census. This means that 1.8% of veterinarians are looking for employment or enrollment in an internship or residency, or they are working outside of veterinary medicine. In addition, the AVMA 2021 Census revealed that 44% of veterinarians have considered leaving the veterinary profession, up from 38% in 2020. Moreover, 39% of vets said they have considered leaving the profession within the last five years, and 23% said they have considered leaving within the last year.

Approximately 26% of veterinarians in 2021 indicated they want to work fewer hours. They cited such reasons as better work-life balance and mental health issues including stress, anxiety, burnout, feelings of being overworked and issues related to childcare and childbearing.

The Bureau of Labor Statistics has projected veterinary employment to grow 19% from 2021 to 2031, much faster than the average for other occupations. That group projects 16,800 veterinarians need to be added to the workforce in that time.

Geographic maldistribution is likely to remain a problem in the profession, which could leave some areas underserved.

As the U.S. population increases, the pet ownership percentage is forecast to remain stable, so demand will continue to increase.

Regarding job listings throughout the veterinary industry, on the AVMA Veterinary Career Center and other job sites, the AVMA reported that 70% come from corporate or consolidated practices and 30% percent from independently owned practices. Relatedly, about 35% of veterinary associates are employed by corporate practices. The remainder work for independently owned single or group practices.

Veterinary school graduates struggle with educational debt. Financial professionals state that a debt-to-income ratio (DIR) of <1.4 is reasonable for those in the medical field. In 2021, the DIR for recent graduates entering full-time equine practice was 3.7.

According to the AVMA 2021 State of the Profession Report, the average debt of those who graduated vet school with debt was $188,853 in 2020, with 12.5% having debt levels >$300,000 and 1.4% having debt levels >$400,000. Those that attended offshore veterinary schools were more likely to have high amounts of student loans.

About 30% of equine-focused graduates had no debt compared to about 20% of graduates entering companion animal practice. Graduates with no debt numbered 17%.

Take-Home Message

The combination of growing attrition, high educational debt, emergency service requirements, lower compensation than companion animal positions and intense work hours in equine practice is a significant challenge to the industry.

Fortunately, the strength of the equine industry, despite the current economic downturn, allows continuing opportunity.

Our profession will likely continue to have robust demand and can stay strong into the coming decades by adopting new paradigms. Practices are increasingly embracing the changes needed to keep equine veterinarians in equine practice.

Through flexible work schedules, improved veterinary practice cultures, shortened work weeks, emergency service coalitions, stronger boundaries between work and personal life and higher compensation, the tide is turning on the loss of exceptional talent that the equine veterinary industry has been experiencing.

These new paradigms allow our changing workforce to have the flexibility and support that they need while keeping practices financially healthy. Embracing the changes will keep the equine veterinary industry strong for the future. EM

ACCEPTFOTO/ISTOCK VIA GETTY IMAGES

Transport and exercise can contribute to leaky gut syndrome.

Research Reports

An overview of some of the latest findings in equine veterinary medicine.

By Nancy S. Loving, DVM

Topical DMSO vs. Topical MSM for Equine Tendon Treatment

Injury to the superficial digital flexor tendon (SDFT) can result in long-term lameness and a slow recovery. An Iraqi study compared DMSO to MSM when applied topically to the skin over an injured tendon [Ahmad, F.; Akbar, H.; Hayar, MA.; et al. The role of DMSO and MSM in treatment of tendinopathies affection in equine: A comparative study. *Iraqi Journal of Veterinary Sciences* 2022, vol. 36, no. 4, pp. 861-868; doi:10.33899/IJVS.2022.132428.2088].

Ten polo horses aged 5-15 years with chronic superficial digital flexor tendinitis participated in the study. Treatment was applied once weekly for seven weeks. Five horses received treatment of their SDFT injury using 60 ml of topical 90% DMSO aqueous solution. The other five received treatment of 60 ml of topical 90% MSM aqueous solution. The treatments were applied to a shaved area of the SDFT injury and bandaged for 12 hours.

PEOPLEIMAGES/ISTOCK VIA GETTY IMAGES

Topical DMSO proved superior to topical MSM in one study.

Researchers assessed lameness and pain scores. They performed ultrasonic imaging of fiber alignment and echogenicity on Days 0, 21 and 42.

The authors concluded that topical DMSO has a more significant effect on pain severity and lameness compared to topical MSM. In addition, ultrasound parameters—fiber alignment and echogenicity—improved more by Day 42 with DMSO compared to MSM.

Transport and Exercise Effects on Intestinal Permeability

A routine part of many horses' lives involves both travel and exercise as owners engage in their equestrian pursuits. A study at the University of Guelph in Canada analyzed the effects of transport and exercise on intestinal permeability and systemic inflammation in horses [McBilloway, M.; Manley, S.; Aho, A.; et

al. The combination of trailer transport and exercise increases gastrointestinal permeability and markers of systemic inflammation in horses. *Equine Veterinary Journal* Sept 2022; DOI: 10.1111/evj.13888].

The cross-over study took place from January 18 to May 13, 2021, with at least seven days separating treatments. Eight mature mares used in the study were stomach tubed with a contrast agent, iohexol, as a gastrointestinal permeability tracer. Then, four horses were assigned to one hour of trailer transport. That was followed by 30 minutes of moderate exercise on a free lunge in an indoor arena at heart rates of 150 bpm. The other four sedentary horses with no travel served as controls. Plasma samples were taken prior to administration of the GI tracer. They were taken again following transport and following exercise. Finally, plasma samples were taken 1, 2, 4 and 8 hours after exercise.

The plasma samples were evaluated for inflammatory biomarkers (SAA, LPS, lipopolysaccharide-binding protein and intestinal fatty acid binding protein) and tight junction protein. Feces—prior to loading, during or immediately after transport, and the first feces following exercise—were also evaluated for tight junction protein (zonulin).

Leakage through weakened tight junctions of the intestinal epithelium causes "leaky gut syndrome." Pathogens and other inflammatory substances entered the circulation and triggered systemic inflammatory conditions. An affected horse might experience impaired skeletal muscle metabolism, metabolic dysfunction, allergies and/or arthritis.

Results from the horses undergoing transport and exercise demonstrated that there was a marked increase in intestinal permeability. This was especially true compared to the sedentary control horses. Additionally, inflammatory markers were elevated in the transported/exercised horses. Markers of intestinal permeability and systemic inflammation were persistently elevated for up to six hours following transport and exercise.

The authors summarized, "Whilst our combined stress test produced a clear increase in gastrointestinal permeability, analysis of zonulin both in plasma and feces indicates that a decline in function of this tight junction protein was not a major contributor. There are many other possible explanations for the increase in gastrointestinal permeability, including decline in function of other tight junction proteins (such as claudin and occludin), ischemic injury to mucus-producing cells, and/or acute stress-induced disturbance of the gastrointestinal microbiome." The bottom line is that transport and exercise can contribute to leaky gut syndrome and systemic inflammation.

Equine Euthanasia Technique

In efforts to ensure a painless, easy death for equine patients, a case study on one suffering horse used a combination cocktail to accomplish this end. The euthanasia was conducted at the Bangladesh University Veterinary Teaching Hospital using intravenous xylazine hydrochloride (0.1 mg/kg; 20mg/ml) and thiopental sodium (10 mg/kg; 25% solution) [Rahman, MA.; Rahman, MT.; Saha, M.; et al. A case report on euthanasia of a rescued horse using xylazine hydrochloride and thiopental sodium. *Res. Agric. Livest. Fish* Aug 2022, 9 (2): 213-219].

Sodium pentobarbital is a common equine euthanasia drug in the United States. It can cause some level of excitement in horses that do not also receive sedation. The addition of xylazine mitigates this response. Other euthanasia drugs include potassium chloride, saturated magnesium sulfate and chloral hydrate, all of which have potential adverse effects, especially if the horse is not pre-medicated with xylazine. Many countries have not approved some of these options due to the potential for violent reactions from the horse that put people at risk.

A different barbiturate, thiopental sodium, is commonly used intravenously to achieve anesthesia. It has been approved for euthanasia in the Netherlands and Belgium. In this study, the authors explained that they administered xylazine first, then immediately followed with thiopental via rapid intravenous administration. Using xylazine initially might enable the use of a lower dose of thiopental. They reported that palpebral reflex, lacrimation and nystagmus became absent within 2-5 seconds following thiopental administration. Respiration ceased completely within 15 seconds. Heartbeats ceased after 3 minutes and 40 seconds. Clinical death was declared within four minutes.

In summary, the authors stated that this combination of xylazine and thiopental results in rapid, smooth loss of consciousness and death with no reactions or excitement. They concluded that "this is a humane and safe technique for sedating and euthanizing horses." EM

PAVLOVSKIJENYA/ISTOCK VIA GETTY IMAGES

A New Era of Diagnostics

By Rachel Lemcke, MS
Amwell Data Services LLC

A Successful Start with *Salmonella* PCR

In late 2021, equine veterinarians gained a new tool to improve biosecurity and identify pathogens: in-house Fluxergy *Salmonella* PCR testing. This tool marks the first widespread use of on-site qPCR in equine veterinary referral hospitals, thanks to a simplified workflow that eliminates difficult protocols and an extensive equipment list associated with traditional qPCR techniques.

Since December 2021, equine veterinary teams representing over 25 practices across North America and Europe have tested more than 1,700 samples for *Salmonella* on the Fluxergy platform. Fecal samples* were the primary sample type tested (n=650), followed by environmental samples** (n=328) (see Figure 1). A quarter of the practices saw at least one positive *Salmonella* result when testing environmental samples, and that rate climbed to 78 percent when testing fecal samples. Fluxergy has since expanded its user base to 50 equine hospitals in early 2023.

Salmonella results are available in just over 17 hours including sample incubation and enrichment, with the PCR run time under one hour. On top of a short turnaround time, the flexibility of the Fluxergy testing protocol allows for tested samples to be saved for further testing in the case of a positive result (i.e. serovar testing, etc.).

SAMPLE TYPE	QUANTITY OF POSITIVE & NEGATIVE SAMPLES	POSITIVITY RATE
Environmental Sample**	43 285	13.11%
Fecal Sample*	100 550	15.38%
Other/Unclassified (Excl. Controls)*	145 327	30.72%
TOTAL	Positive Results: **288** Negative Results: **1,162**	**19.86%**

*Fig. 1. Sample types tested using the **Salmonella** assay on the Fluxergy platform and associated positivity rates.*

*** Per validated protocol in Fluxergy's Instructions for Use.*
** Per internal protocols validated by users.*

Biosecurity is Now Feasible: *Improved Cost and Turnaround Time*

Proving Profitability of a New Diagnostic Technology

The investment associated with incorporating *Salmonella* testing into routine, targeted screening and environmental testing procedures can limit practices' willingness to build robust biosecurity programs. However, most, if not all, of these costs can be defrayed by adding biosecurity fees to appropriate patient case types.

To better understand estimated profitability, consider Clinic A, a hypothetical ambulatory and referral 8-vet practice with 20 stalls. This practice sees an average of 5 colitis patients, 25 colic surgeries, and 100 total inpatients per month. If labor and supplies are estimated to cost approximately $70.80 per test, Figure 2 shows the suggested biosecurity fees and estimated profits per use case.

Clinic A prices their biosecurity fees aggressively to help make their biosecurity program more profitable, though practices can choose to set more reserved biosecurity fees to offset the expenses of their biosecurity program.

Even if monthly environmental sampling of the facility was not billed to clients, Clinic A should expect to see a monthly profit of $8,138.60 (see Figure 2).

"With Fluxergy's POC testing, I can take what was a 10+ day cleaning process for a positive *Salmonella* patient and turn that into a four-day process due to a 24 hour environmental PCR turnaround. This means I don't have to turn away new patients because I can turnover stalls faster. In 2021, we had 50 horses a day in the hospital. For every day one stall is unavailable, we lose a minimum of $140 revenue. Looking at the cost savings with the Fluxergy test, saving six days means we're able to make a minimum of $840 revenue per stall that would've been otherwise closed pending reference lab results."

– Dr. Benjamin R. Buchanan, DVM, Diplomate ACVIM, Diplomate ACVECC

Clinic A: Biosecurity Financial Model

Total Monthly Profit = $8138.60

TESTING SCENARIO	ESTIMATED MONTHLY PATIENT CASE VOLUME	ESTIMATED MONTHLY TESTING VOLUME	SUGGESTED BIOSECURITY FEE	PROFIT MARKUP	Estimated Profit / Estimated Monthly Revenue / Estimated Monthly Cost
Colitis Cases Screen at Admission & Confirm Clean Stall at Discharge	5 Cases	10 Tests	**$250** per Admission & Post-Discharge Stall Screening	76.55%	$542 / $1,205 / $708
Post-Colic Surgery 3-Day Daily Monitoring	25 Cases	75 Tests	**$300** per 3-day Post-Surgery Daily Monitoring	41.24%	$2,190 / $7,500 / $5,310
Weekly Screening of Hospitalized Patients	Average 100 inpatients /month	100 Tests	**$125** per Hospitalization Week	76.55%	$5,420 / $12,500 / $7,080
Monthly Environmental Sampling of Hospital Premises	12 areas sampled monthly	12 Tests	*N/A*	–100.00%	–$849.60 / $0 / $849.60
Ambulatory Vehicle & Equipment Screening	Average 4 farm calls /day/vehicle = 1 test/week	4 Tests	**$10** per Farm call	295.48%	$836.20 / $1,120 / $283.20

Fig. 2. Estimated revenue, cost, and profit for different applications of Fluxergy's ***Salmonella*** *assay.*

What's Next for Fluxergy?

As the first commercially available assay from Fluxergy, the *Salmonella* PCR test has afforded equine veterinarians an expedited ability to detect *Salmonella* using the gold standard of qPCR testing.

Throughout this past winter season, Fluxergy has been heavily involved with EHV-1 biosecurity, assisting in rapid screening of febrile horses at the Desert International Horse Park in a partnership between USEF, UC Davis, and the organizers of the facility. Fluxergy has also worked with other shows in Florida, Southern California, and several large referral practices to understand how environmental testing can help to rapidly detect shedders of the pathogen.

Fluxergy has submitted application to USDA and is expected to receive CVB licensing for its EHV-1 DNA Test Kit in 2023. In parallel, Fluxergy is also conducting an experimental study with its equine veterinary partners to further evaluate the performance and usability of this EHV-1 DNA Test Kit.

To round out this year, Fluxergy will be releasing its *Streptococcus equi ss equi* PCR test for experimental use as part of a USDA submission, an ambulatory-ready total nucleated cell count (TNCC) test, and a fully room-temperature stable respiratory PCR panel that will detect EHV-1, EHV-4, *S. equi*, and EIV. Fluxergy is transitioning from a promising technology to a practical diagnostic tool for equine veterinarians to facilitate faster diagnoses and targeted treatment on-site.

Fluxergy working with the show organizers and UC Davis veterinarians Dr. Carrie Finno, Dr. Nicola Pusterla, and Amy Young to collect environmental and population data of show horses at the Desert International Horse Park.

"The limiting factor for all equine practitioners today is time. By the time the result comes back from the lab, the result is often meaningless when it comes to contagious infectious diseases and other disease. We need to change the dogma to bring diagnostics to the stall, rather than bringing the sample to the diagnostic lab. It's been exciting working with them thus far, and they're eager to continue pushing the science behind their patient-side detection technologies."

— Dr. Nicola Pusterla, DVM, PhD, Diplomate ACVIM, Diplomate AVDC-Equine

DISCOVER MORE

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Help owners control their horses' intake of nonstructural carbohydrates.

VIRGONIRA/ISTOCK VIA GETTY IMAGES

Decreasing NSCs for an Obesity-Free '23

Emphasize the 'NO' in nonstructural carbohydrates for overweight horses.

By Stacey Oke, DVM, MSc

A United Kingdom research team led by Tamzin Furtado published a study in *Frontiers in Veterinary Science* (2022) looking at the role of human behaviors in equine obesity. According to that study, some of the ways that owners—and veterinarians by proxy—contribute to equine obesity include the following:

- Vets and owners label horses as "easy keepers" and therefore assume that the horse's weight cannot be managed.
- Veterinarians fail to discuss weight management because it is perceived as a "sensitive subject."
- Veterinarians and owners have a "not me" attitude. Even though we are aware that overweight horses are at risk of laminitis, veterinarians and their clients still feel it won't happen to them.
- Many owners board their horses and do not control turnout, types of forages fed or other management practices.
- Owners feel that unless a horse is grazing on pasture for a certain amount of time each day, the animal's psychological needs are not being met.

With all these reasons that veterinarians and their clients accept obesity, we're now faced with an obesity epidemic that has developed into a veritable welfare issue.

"The main problem with obesity is that it can be a risk factor for horses developing insulin dysregulation (ID) and equine metabolic syndrome (EMS), and an even greater risk for developing hyperinsulinemia-associated laminitis,"

SPIRITARIST/E+ VIA GETTY IMAGES

Veterinarians need to play a more active role in counseling horse owners on proper equine nutrition.

said Amanda Adams, PhD, from the University of Kentucky's Gluck Equine Research Center.

Given the growing rate of obesity in the world's equine population, veterinarians need to play a more active role in nutritional counseling and implementing weight management strategies.

Controlling nonstructural carbohydrate (NSC) intake is a great place to start with helping owners battle their horses' bulges.

The Skinny on NSCs

To get owners actively engaged in an equine weight loss program, they need help understanding exactly what NSCs are and do.

There are key points you can relay to horse owners to help them comprehend carbs.

Forages have two main types of carbohydrates: structural and nonstructural.

The structural carbohydrates make up the cell wall and are the "fibrous" components. These are fermented in the horse's large intestine and cecum to produce volatile fatty acids (VFAs), which are the main source of energy (calories).

Non-structural carbohydrates are simpler sugars and starch. These are smaller sugar molecules compared to the long chains of sugars that make up structural carbohydrates found inside plant cells.

"Different types of plants have different types of sugars and starches. Corn, for example, stores a lot of simple sugars as starch whereas a plant cell in alfalfa might only store a bit of sugar," explained Shannon Pratt Phillips, PhD, from North Carolina State University's Department of Animal Science.

When a horse consumes NSCs, these are digested in the small intestine, and the simple sugar molecules are absorbed into the bloodstream. To help maintain stable blood sugar levels, the horse's body produces insulin.

When horses chronically ingest excessive amounts of NSCs, they can

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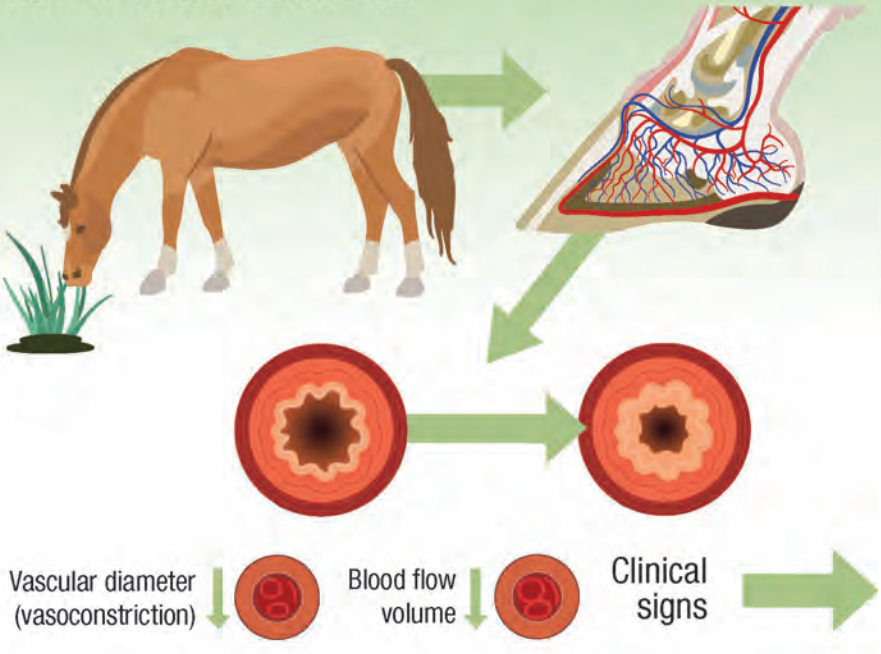

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04AD-EQU03-0120

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Use companion horses in dry lots to give horses company and make owners feel less stressed about taking horses off pasture.

become resistant to the effects of insulin. This means that the body has to produce increasingly more insulin to effectively control blood sugar levels.

Such horses are referred to as having insulin dysregulation (ID), a key component of EMS.

Adams said, "Recently published research from my lab shows that NSC drives higher insulin responses in ID horses post-feeding (Macon, et al., 2022). Our research is also shedding light into what level of NSC should be fed to ID horses to understand the cutoff for NSC. "

He added that, "In the meantime, we recommend feeding hay with <10% NSC for ID horses."

This <10% cut off is currently endorsed by the Equine Endocrinology Group in their recently updated 2022 Recommendations for the Diagnosis and Management of Equine Metabolic Syndrome.

Adams added, "It's important to remember that not only does the percent of NSC matter, but also the total amount being fed."

Go Big with Weight Management Recommendations

As mentioned above, some veterinarians are hesitant and/or cautious when addressing obesity and weight management with owners.

Rather than tiptoeing around the elephant in the barn, use some tips from Pratt Phillips during direct conversations designed to help owners whittle away at those NSCs.

Strip Down the Diet "An easy way to begin restricting calories, especially those stemming from NSCs, is eliminating most concentrates and 'treats' or at least using them in moderation," recommended Pratt Phillips.

"I would also consider removing a horse from pasture as it is a buffet of calories," she said. "Pasture calorie intake is difficult to quantify, so it makes it challenging to calculate how many calories are coming from pasture. Using a grazing muzzle can decrease pasture intake, but if you've got an 'at-risk' horse, you're better off not allowing them any pasture at all."

Should an owner strip the diet right down to bare bones and offer hay only?

"It depends on the horse," Pratt Phillips said. "Hay is easy to weigh and regulate access to compared to pasture, but hay might be lower in protein and will likely be low/deficient in vitamins A, D and E. Thus, horses consuming only hay need to be provided with these vitamins along with some other minerals or protein."

Encourage Forage Analysis

"Ideally, forages fed to overweight horses 'at risk' of insulin dysregulation and EMS have <10% NSC on a dry matter basis," Pratt Phillips reminded. "The only way to know the NSC content of a forage is to have it chemically analyzed."

In addition to revealing the NSC composition, forage analysis will also help owners find hay that has a low caloric density (usually because it has higher neutral and acid detergent fiber concentrations). This allows owners to offer a larger quantity of hay (which we know they like to do) plus it allows the horse to eat more.

Finally, forage analysis will also help owners choose an appropriate amino acid supplement or ration balancer based on the protein concentration.

If an owner suggests that it isn't worthwhile having the forage analyzed because the owner only has one or two horses, Pratt Phillips recommended discussing the merits and economics of testing with them.

"Forage analysis is worth it because hay can surprise you," she said. "Just looking at it or even knowing the species or maturity won't tell you everything. A basic analysis can be performed relatively inexpensively at state agronomy laboratories or at commercial facilities like Equi-Analytical."

Pratt Philips also said that if you're buying small amounts, the hay dealer might be able to offer hay analyses on what they are selling. It is worth asking whether the batch has been tested.

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Soaking and Steaming the NSCs Away

Studies confirm that both soaking and steaming decrease NSCs. However, an ideal methodology factoring in time, temperature, convenience and economics has not yet been identified.

Pratt Phillips said, "I prefer outright soaking for 30 minutes. In my opinion, it doesn't matter [about] the temperature of the water. I like either putting hay into a hay net and soaking that in a bin of water or having two bins inside each other with the one on top having holes in it. Put the hay in and fill with water, and after 30 minutes, lift the upper tub out; water flows through the holes and is left in the bottom."

Be sure owners are throwing the wastewater away and not using the same water repeatedly, she stressed. And make sure owners don't offer it to horses as drinking water!

Altering Owners' Mindsets

Furtado, et al. proposed the following strategies for facilitating the weight management process:

- Help owners set a series of small, reasonable weight loss goals with clear timelines. This will alleviate feelings of discouragement from lack of progress.
- Encourage owners to replace treats with attention or grooming.
- Use companion horses in dry lots. This fulfills the social needs of horses and helps keep owners from feeling guilty when not turning horses out on pasture.
- Provide environmental enrichment such as scratching posts and toys.
- Replace the lost pasture access with exercise.

Don't Get Fancy with Forage Alternatives

Furtado, et al. also suggested that owners might be more receptive to caloric restriction if they are able to offer different types of low-calorie forages to give their horse "variety."

Practically speaking, Pratt Phillips warns against this particular strategy. She said, "I would rather just find a low-NSC hay and feed as much of it as the horse would eat. If they don't like the hay, then some hay cubes (low NSC) or haylage can mix it up a bit. Forage alternatives like beet pulp and rice bran can be higher in NSC than some hay."

Using Social Media To Motivate Owners

While you might want to simply focus on the education piece of weight management, owners typically also need to be "cheered on."

According to Furtado, et al., "The key to encouraging behavior change is to first establish small changes in people's behavior, which will then lead to a change in their attitude and motivation."

Their research suggested that social media campaigns are a potentially effective tool. Using the example of smoking cessation in humans, they noted the "Stoptober Campaign," which encouraged people to publicly make a one-month commitment to stop smoking rather than focusing on education and the health detriments associated with smoking (of which most of us are already aware).

Using this theory, owners might wish to use their social media to track a horse's weight loss journey. They could set small, achievable goals for their horse so friends and followers could celebrate together.

Take-Home Message

Regardless of what combination of education and motivation you choose, becoming a weight management advocate for your clients and their horses will minimize your patients' risk of obesity-related illness and welfare concerns. EM

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Take steps now to help you face the predicted 2023 recession.

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Recession-Proof Your Practice and Your Life

We are likely to experience a recession in 2023, but taking steps now will help you weather it and emerge successful.

By Amy L. Grice, VMD, MBA

You might be wondering: What exactly is a recession? A simple definition is that a recession is a prolonged period of economic downturn that is both widespread and significant, often lasting six months or longer. A more granular definition is that a recession is when a country's gross domestic product declines for two consecutive quarters. According to this definition, the U.S. would currently be experiencing a recession. Painful recessions, such as the Great Recession of 2008, result in high unemployment, decreased consumer spending and widespread financial pain. We are not yet in such a place, but it might lie ahead.

More than two-thirds of the 49 U.S. macroeconomists surveyed by the *Financial Times* and the Initiative on Global Markets in June 2022 believe a recession will occur in 2023. With so many conflicting factors affecting the economy,

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More than two-thirds of the 49 U.S. microeconomists surveyed in June 2022 believe a recession will occur in 2023.

however, they found it difficult to predict how long a recession might last.

Other indicators, such as the yield on long-term, 10-year U.S. Treasury bonds falling below that of three-month T-bills, sounded the alarm in October 2022. Economic researchers regard the yield curve as among the best indicators that a U.S. recession is coming within six to 18 months. This indicator has successfully predicted all recessions in recent decades.

In June 2022, the U.S. annual inflation rate reached 9.1%, the highest it had climbed in 40 years. The Federal Reserve raised interest rates three-quarters of a percentage point four times in 2022, but high rates of

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1. SucroMate Freedom of Information Summary (November 2010) NADA 141-319

HUMONIA/ISTOCK VIA GETTY IMAGES

Rising costs to veterinarians and increased demand for services from horse owners have put increased stress on equine practitioners.

inflation have persisted.

The hope is that high interest rates will slow the economy, leading to decreased inflation and lower consumer prices. Price increases have been marked across many sectors, including groceries, cars, rent and housing prices. When there is a tight labor market and high consumer demand, inflation will often persist until the economy slows drastically or sinks into a recession.

Prices for Veterinary Services

Prices for veterinary services have risen sharply as well, increasing 10% in 2022. Government data shows that this is the biggest jump in two decades. According to the U.S. Bureau of Labor Statistics, over the last 25 years, prices for veterinary services rose 213%, with a $20 service in 1997 costing $62.54 in 2022.

During this same time, overall inflation was 2.42% per year, while veterinary services had an average inflation rate of 4.67% per year. This leap in the cost of veterinary services is an example of how high inflation has spread well beyond physical goods to services.

Fortunately, horse owners generally are among the higher income groups. The American Horse Council's 2018 study showed that 50% of horse owners earn more than $100,000. Of that group, 22% had incomes of $100,000-$149,000, and 28% had incomes greater than $150,000.

In addition, horses are increasingly valued by their owners and society. The 2017 AVMA Pet Ownership & Demographics Survey showed that 42% of horse owners considered them to be pets, 47% as family members and just 11% as property. This should ensure that horses continue to receive veterinary care even as household incomes possibly decline.

Increased Costs and Demands

Like many service industries, veterinary medicine is labor-intensive. Employee costs account for almost half of total revenue. Wages across the nation have been rising, and many workers have taken advantage of the tight labor market by quitting their jobs to earn higher pay with new opportunities.

As practice owners have been forced to increase wages to keep their staff, these costs have been passed on to clients through higher prices. At the same time, costs to practices for pharmaceuticals, medical supplies, laboratory testing and equipment have risen as well.

As if rising costs weren't enough of a burden, equine practitioners during the pandemic experienced increased

demand from horse owners. They worked longer hours and attended more emergencies, causing rising levels of burnout. With the difficulty in keeping staff and associates, equine practice owners had added stress.

During the pandemic years of 2020-2021, VetSuccess, a data analytics firm, tracked revenue and appointments across the country at companion animal practices. The data showed that visits at vet clinics rose 4.5% in 2020 and an additional 6.5% in 2021. Unfortunately, this was accompanied by a steep drop in efficiency, longer hours and increased burnout among veterinarians and staff, according to the AVMA's annual survey. Many people left the field for other jobs.

Be Prepared

With these stressors already in place, it is more important than ever to be prepared for an economic downturn. Here are five recommendations to start implementing now.

1. Understand and manage your cash flow. Whether economic times are booming or more difficult, having a consistent flow of money into your practice or personal wallet is always critical. The definition of cash flow is the total amount of money that comes in and out of a business or family. It is a key indicator of the financial health of your business or your life.

A consistent, positive cash flow is necessary to pay expenses, invest in new equipment, and save for the future. During a downturn in the economy, cash flow challenges can be particularly dangerous. If expenses are higher than usual and revenue is lower than usual, finances will be tight, and balancing your budget could start to feel scary.

To get familiar with your personal or business cash flow, begin to look at your weekly ins and outs. You can use your bookkeeping software's cash flow statement to do this every day, or at least every week. If your practice revenue or personal compensation is affected by seasonality, begin looking ahead with a forecast of the cash coming in and needing to go out, based on the previous year. Some expenses, such as insurance and licenses, come once a year. Others are monthly, such as utility or drug bills, or weekly, such as payroll or groceries.

By anticipating when cash might be tight, you can implement strategies ahead of time to be prepared. That might include utilizing a line of credit or minimizing drug orders or purchases during that time.

For practice owners, having a budget based on your practice profit & loss statement from the previous year can be a tool to help you project different scenarios and understand

The Reality of Recession

In the fall of 2008, on the cusp of the Great Recession and as the devastation of the economy became clear, my practice received a phone call from one of our Thoroughbred breeding farm clients who spent about $150,000 annually with us for services. They informed us that they were shutting down on January 1. They would be selling all their stock and no longer using our services.

After this call, my partners and I realized that this would likely not be the only farm that cut back sharply. Fortunately, as the managing partner, I had made a budget in Excel that allowed me to produce a projected budget for the coming year with these new realities. Because so many of our expenses were fixed, and our revenue would decrease, we were looking at hard times.

Within this projected budget, we then applied a series of strategic price increases and adjusted expenses to see how this closure would impact our bottom line. With this approach, we found our way forward through a tough time with increased confidence, decreased anxiety and a good financial outcome.

—Amy Grice, VMD, MBA

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Payment at time of service should be required of all clients in your equine veterinary practice.

their impact *(see sidebar above)*.

2. Reduce and eliminate debt. When revenue and cash flow are tight, minimizing obligations is smart. With rising interest rates, borrowing costs are significantly more expensive.

When going into a recession, assess the interest rates on your loans. Focus on paying down loans with the highest rates, especially if any are variable. If you have low interest rates on some loans, do not hurry to pay them off in advance. Instead, concentrate on not accumulating additional debt.

If you need to purchase new diagnostic equipment, explore all financing options. Also, seek your accountant's advice to determine whether leasing the equipment might be financially beneficial.

Consider keeping older vehicles a little longer while waiting for prices and interest rates to come down. If you have always purchased lightly used vehicles rather than new, calculate the savings on promotional interest rates to see if purchasing a new truck could make financial sense. If you are paying down educational debt, utilize the resources on VIN.com to determine your best path forward.

3. Decrease expenses. Evaluate your operations and trim any excess in order to strengthen your financial position. Review your insurance policies with your insurance agent to see if increasing your deductibles could give you significant savings.

Plan an in-house, scaled-down Christmas party rather than an expensive restaurant setting with an open bar.

Increase efficiency in scheduling ambulatory calls to decrease gasoline or diesel costs. Encourage haul-in appointments if you have a clinic space. Critically evaluate your cell phone plans, streaming subscriptions and shopping habits. Eliminate unneeded expenses.

4. Secure a line of credit. Many small businesses experience cash flow problems from time to time. These cash flow shortfalls can arise from a variety of reasons ranging from a large account falling behind in payments to a seasonal variation in revenue production. Day-to-day operations require an uninterrupted supply of cash.

While the optimal thing to do is save enough money to weather these times,

obtaining a line of credit provides a ready source of funding to keep your business running smoothly. Be sure to apply for a line of credit while you are in a comfortable financial position in order to qualify easily. Don't wait until you desperately need money!

A business line of credit is an arrangement between a financial institution, usually a bank, and a customer that establishes a maximum loan balance that the bank will permit the borrower to maintain. A line of credit will charge interest as soon as money is borrowed.

Like with most loans, borrowers must be approved by the bank through an examination of the borrower's financial position, credit rating and/or relationship with the bank. Some, but not all, banks charge a monthly maintenance fee if you do not use the line of credit. Terms of the line of credit

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are usually annual with an interest rate based on the prime rate plus 1-3%.

Payments are interest-only on the amount borrowed, but typically banks expect to see that the line has been paid off at some point during the year. Once the borrower establishes the line of credit, they can withdraw funds at any time as long as the cash does not exceed the maximum set in the agreement. In the event of a recession, having a line of credit can help you sleep at night!

For individuals, saving three months

of expenses in an emergency fund is often recommended but not often acted upon when times are good. Having a fallback supply of cash can be crucial. If you don't have this cushion, put it away without delay.

5. Require payment at the time of service. During a recession, almost everyone struggles financially to a certain degree. This means your clients might start paying more slowly, and you might have a more difficult time collecting accounts receivable. If you do not already have a policy of payment at the time of service, now is the time to make a change!

The money you must spend to provide pharmaceuticals and medical supplies for services will affect your cash flow if receipt of the revenue for providing those services is delayed. Make an effort to evaluate your clients and their accounts. If you have accounts receivable, stay on top of collections. Add convenient ways for your clients to pay, such as electronic payments (PayPal, Zelle) or credit cards on file that are charged automatically. Stop working with clients who don't pay you and stop extending credit. Consider offering clients a service like CareCredit so you are not in the position of being a banker lending money.

Being paid for your services promptly and fully is more necessary than ever during a downturn.

As an individual, paying cash or paying your credit card bill in full each month is living the philosophy of paying at the time of service. This can markedly improve your financial health. Try to live more simply and use what you already own.

Take-Home Message

In summary, although we are likely to experience a recession in 2023, taking a few steps now will help you weather it and emerge ready to enjoy renewed economic success. EM

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[1]Prascend® (pergolide tablets) [Freedom of Information Summary], St. Joseph, MO; Boehringer Ingelheim Inc.; 2011.

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COURTESY ANIMAL ARTS

It can be difficult to get construction work accomplished in our changing world, but there are exciting building opportunities nonetheless.

Construction in a Changing World

Construction and renovation are difficult, but 2023 might be a good year to undertake veterinary practice projects.

By Heather E. Lewis, AIA, AAA

If you have done any home repairs in the last year or two, you know the frustrations of getting work accomplished in our fractured and changing world. As if inflation, slow supply chains and availability of labor were not enough to worry about, the economists are now throwing around the "r" word—recession—as our collective economic reality for 2023.

If you're planning clinic construction or renovation, does that mean you should stop and reconsider? No, you should not. Our architectural firm has been around since 1979. Therefore, we have been through many cycles of the market. Moments in time have challenges, but there are also hidden opportunities.

In this article, I will outline the best ways to get work done, how to protect

your budget, and opportunities to find in today's construction economy.

Consider Renovation

Many of our equine doctor clients are considering renovation instead of new construction. Why? With the lack of available materials and labor, it can sometimes be more economical to renovate a structure than build a new one.

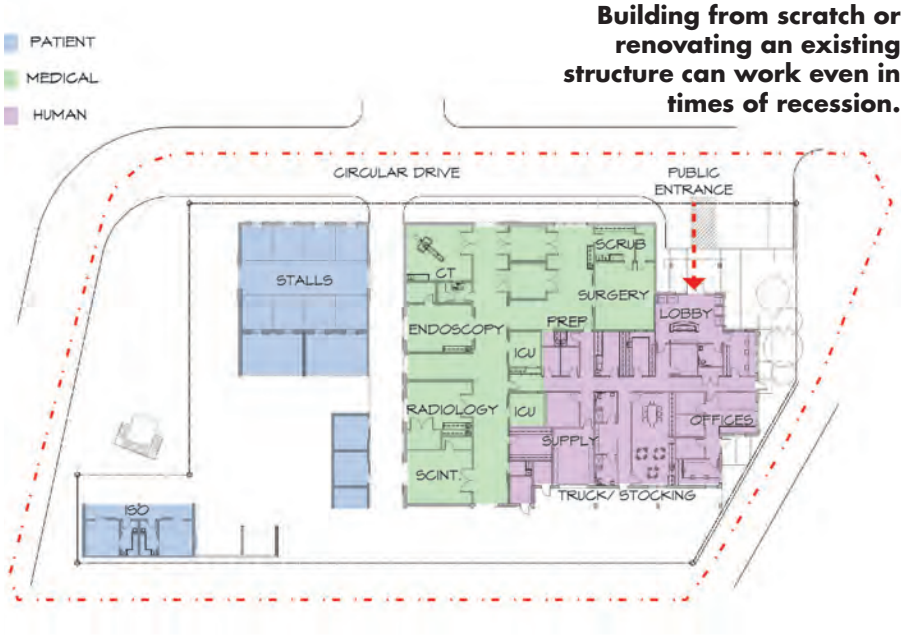
If your current facility is old and not worthy of a remodel, you can still consider remodeling another existing structure, such as an arena or former manufacturing or agricultural building. We have worked on many projects utilizing existing structures such as these. If you do decide to go the remodel route, be aware of this essential information: Metal structures are far more useful than wood structures. If you find an old wood barn, particularly a pole building, it is not going to be easy to use as an equine hospital (surgery and medical facility). However, it might be useful to you as outpatient housing or as a work-up area.

Equine hospitals are Business Occupancies in the building code. Therefore, in most locations, you must be able to meet code for a business. A pole barn is generally not sturdy enough from a structural perspective, nor will it meet the code for fire safety. Consider using larger wood structures only for outpatient housing rather than overnight housing, as they are more likely to become death traps in the event of a fire.

Tragedies have happened so often that a fire prevention code (NFPA 150) applies specifically to animal care facilities and limits the size of wood structures for housing animals such as horses. If you're in doubt about an existing wood structure and its usefulness, talk with an architect for a code interpretation before investing in renovations.

For existing metal structures, keep in mind that they also pose some challenges if they were used previously for manufacturing or agriculture and not for business. Here are some considerations:

Building from scratch or renovating an existing structure can work even in times of recession.



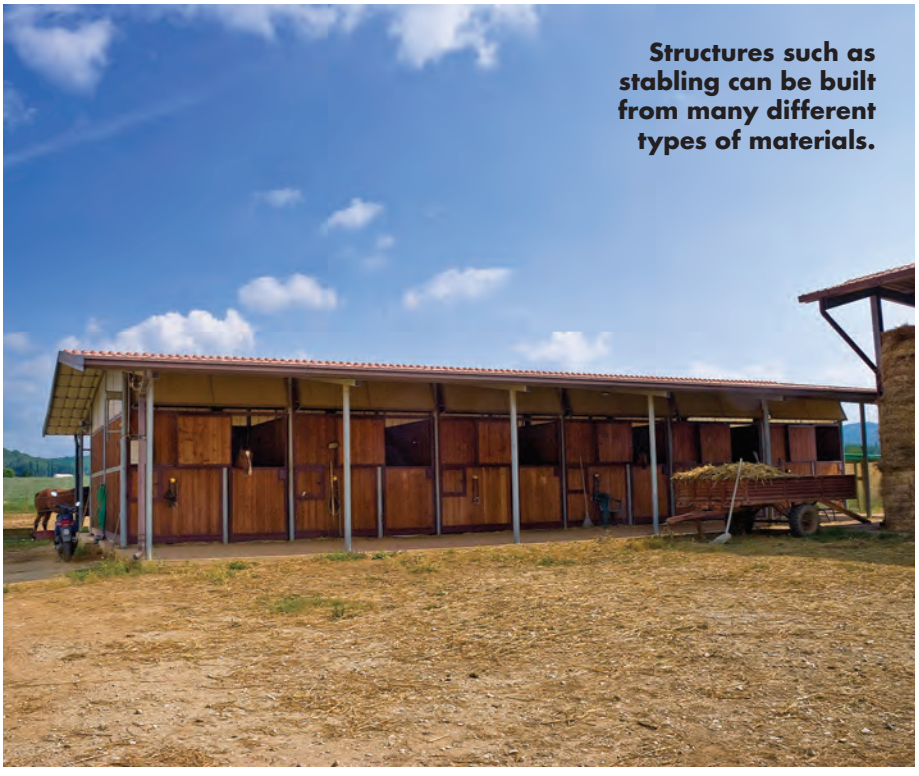
COURTESY ANIMAL ARTS

ARND BRONKHORST PHOTOGRAPHY

Even a surgical facility can fit into an existing structure. Just make sure the facility is suitable before you start work.

- Is it sturdy enough from a building code perspective to hold up to a major wind or snowstorm (or whatever weather event is likely in your area)? If not, does it have to be strengthened before it can be used? A local structural engineer can answer this question.
- Has it been used previously for anything that has caused it to become contaminated? For example, if it was used for repairing machinery, are there gasoline spills that would prevent its use as a commercial building? You might need to get a Phase 1 Environmental Assessment to answer this question.
- Is it high enough? Low-slung metal buildings are not sufficient for equine practice. You need height for patient safety. You also need height for supports for sling stalls and surgery hoists, and for adding ventilation, lighting and potentially fire sprinklers to the building. Look for buildings whose outside walls are 16 feet tall at the bare minimum.

If you can find a useable existing building (preferably metal, sturdy enough, high enough, and not contaminated), then you can save a lot of money compared to building a new one. The



Structures such as stabling can be built from many different types of materials.

ARND BRONKHORST PHOTOGRAPHY

inside can be outfitted for your needs. Even a surgical facility can fit in an existing building. The building structure will not be able to support a hoist beam, but you can construct concrete or concrete block walls within the shell of the building to support the beam.

Understand the Impact of Timeline

It can be very stressful for an equine veterinarian to be up against a time deadline in today's construction market. Some of the supply chain issues cannot be helped. For example, it takes an incredibly long time to get electrical infrastructure such as electrical switchgear, generators and transformers. The availability of these items sometimes sets the entire construction schedule.

If you understand that some timelines are out of your control, here are some of the ways you can avoid being surprised or negatively affected:

- Get a contractor on board early, even if your plans are not finished. The contractor can order and secure long lead-time items such as electrical switchgear.
- A contractor's early advice might help your architect and engineering team. For example, many projects have been unable to procure open web steel joists, which are the ubiquitous structural items used for roof construction. As a result, it has been necessary to use wide flange beams instead (or wood joists if allowed by code). Another example pertains to the types of mechanical rooftop units that are available. Some brands have longer lead times than others. It is essential for your design team to have this information so they do not design for items that cannot be procured.
- If you do not have a time deadline, continue to hold your construction team accountable for doing their work in a timely fashion and to a schedule. Expect that there probably

will be an uncontrolled slip here and there from having to explore alternative materials and systems. This might be frustrating at the time, but rushing a project almost always has worse impacts than taking a deep breath and figuring out the best path forward.

From my perspective as an architect, we hate to see our clients rushing. In those cases, even a small decision—such as the type of flooring to use—can have a long-term, negative effect on the practice if the available (but poorly researched) solution is not durable or non-slip enough for use in equine practice.

Find the Unique Opportunities

If constructing during these times sounds difficult, trust that there are unique opportunities as well. These are the opportunities we are excited for in 2023:

- The "r" word makes for a more competitive bidding climate. As soon as economists start talking about recession, we construction professionals start contemplating not taking home a paycheck. We work so much harder when times are lean. You are very likely to get more competitive bids from subcontractors next year than you would have in the past two years.
- Cost escalations are normalizing. We will see far fewer escalations in pricing in the next two years than we have in the past two, barring any more unforeseen global calamities.
- U.S.-made is the way to go. With the instability of China, U.S. manufacturing is getting a boost. You might be able to support more U.S. jobs with your construction project than you did in the past.
- Building in uncertain times gives your practice the leg up on your competitors. Having a physical facility is—and will always be—the differentiator for an equine practice. Having a better one allows you to attract and retain staff and associates, and we all know that this is the biggest challenge with running a veterinary business these days.

It still pays to find a way to improve your existing facility and grow your business. That growth will make your business more valuable to you when you choose to retire or sell. Be competitive. It's the best way to be in any business.

Themes for 2023

As you move forward to design or construct in 2023, some themes repeat themselves and some are new. Labor shortages will persist, but the experts predict—as investors pull back from development projects—that labor shortages will eventually ease. That means more companies will be eager to bid on your work.

Global instabilities, such as the war in Ukraine, have impacted the availability of materials. For example, the war in Ukraine affects copper and aluminum. Nevertheless, contractors are far savvier about supply chain difficulties, and they will help you mitigate them for your own project. This can happen by ordering supplies in advance and by helping you seek quality alternatives when they exist.

Extreme weather events, such as the devastation of Hurricane Ian, can temporarily affect local markets. However, the South, where more of the extreme weather events have occurred, is also strong and fast growing. That means there is enough economic vitality to overcome setbacks.

Take-Home Message

Your practice needs your investment. Construction is difficult, but it is not impossible. Armed with the right mindset and the right information, you can make your project, and your practice, a standout success. EM

USING AUTOLOGOUS BLOOD PRODUCTS TO MANAGE ARTHRITIS IN HORSES

A veterinary sports medicine and rehab specialist describes what we know about orthobiologic therapies for OA in horses and their high likelihood for variable responses.

By Stephanie L. Church

Equine regenerative medicine has come a long way since the mid-'90s, when researchers first began collecting blood from individual horses, adapting it to enhance the effects of different components, and injecting it back into the original horses to facilitate healing. Over that time, practitioners have developed a variety of treatment approaches and begun building a body of research on each treatment's components and how they might support different types of bone or soft tissue injuries in horses.

Gustavo M. Zanotto, DVM, PhD, Dipl. ACVSMR, clinical associate professor of equine sports medicine at Texas A&M University's School of Veterinary Medicine and Biomedical Sciences, in College Station, recently summarized autologous—those originating from the patient—products during a Sunrise Session sponsored by Dechra at the 2022 American Association of Equine Practitioners Convention, held Nov. 18-22, in San Antonio, Texas.

WHAT ARE REGENERATIVE THERAPIES IN HORSES?

A horse's healing response involves both repair and regeneration. Repair is associated with scar tissue formation, whereas regeneration is the deposition of new tissue that has similar biomechanical function to the original, uninjured tissue.

"When you talk about regenerative medicine or regenerative therapy, the whole goal of that therapy is trying to modify the microenvironment in the tissue to facilitate regrowth in a more originative status than the reparative phase," Zanotto said. "(We're also) focused on trying to limit the scar tissue formation so we can achieve a better biomechanical and better functional tissue in the end."

This involves stimulating tissue synthesis with bioactive signaling proteins called cytokines, while blocking cytokines that cause tissue degradation over time. At its simplest, the goal is to block inflammation to allow tissue to heal in a better way.

Zanotto described two proteins present in regenerative medicine treatments broadly:

Interleukin-1 receptor antagonist protein (IRAP) is one of the most important, he said, especially in the context of joints, because it modulates inflammation associated with cartilage breakdown and bone resorption. Essentially, it blocks the harmful cytokine interleukin-1's destructive effect.

Growth factors are signaling proteins in platelets that stimulate cell growth, cell differentiation, cell survival, inflammation resolution, and tissue repair.

AUTOLOGOUS BLOOD PRODUCTS FOR HORSES

Biologic therapies consist of three main categories: blood-derived (from serum or plasma), bone marrow concentrate and stem cells.

"When you talk about the blood-derived products ... the most common product that we are using in that category is the IRAP product or the autologous conditioned serum (ACS)," he explained. "On the other side, we have the plasma products ... the platelet-rich plasma (PRP), the autologous protein solution (APS) and alpha-2 macroglobulin (A2M) products."

Zanotto reviewed the different types of autologous therapies and research supporting them. (Learn more at EquiManagement.com/articles/managing-arthritis-in-horses-using-autologous-blood-products/.)

TAKE-HOME MESSAGE

Every time equine veterinarians use regenerative medicine, they aim to modulate the healing response, said Zanotto, and they must remember that not every patient, whether being treated for a joint injury or a soft tissue injury, acute or chronic, heals the same way or at a similar rate. Practitioners likely need to use different biological products in a multimodal way in their equine patients.

"I don't see that one single biological product will be able to be used for all clinical presentations," he said.

Zanotto wrapped up his presentation by emphasizing veterinarians are dealing with two variables they cannot control when using autologous blood therapies: individual variance in horses and products derived from those individuals. This is "going to affect the variance (in response) you're going to have," he said.

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Today's Vet Schools

With the shortage of equine veterinarians, those in the industry can direct interested young people toward veterinary schools.

By Katie Navarra

College application season is well underway. Applicants who aspire to become equine veterinarians can choose from a long list of DVM programs for earning their degrees. It's no secret that equine veterinary practitioners are in short supply in many areas of the United States and abroad. The equine veterinary industry is stepping up to make that career more attractive to vet school graduates.

The American Association of Equine Practitioners (AAEP) has formed the Commission on Equine Veterinary Sustainability to develop strategies to retain and recruit more veterinarians to equine practice. *(Editor's note: Don't miss our AAEP Commission column on page 22 and monthly online from Amy Grice, DVM, MBA, an AAEP Board and Commission member.)*

As an equine veterinarian, you can direct young people toward veterinary programs in North America. (There also are vet schools off-shore and overseas that aren't listed.)

Directory of AVMA-Accredited DVM Programs

Below is a list of DVM programs accredited by the American Veterinary Medical Association (AVMA). There are more than 30 accredited schools in the United States, five in Canada, one in Mexico and 16 others worldwide. Institutions must meet minimum AVMA standards and are granted accreditation for up to seven years. The listing below includes veterinary programs found in North America.

This article also will be posted on EquiManagement.com to make it easy for equine veterinary industry professionals to provide information to aspiring equine veterinarians.

A note about the listings: The "Equine Specialties" section of each listing highlights services noted on their respective websites.

AUBURN UNIVERSITY

College of Veterinary Medicine: (www.vetmed.auburn.edu)
Vaughn Large Animal Teaching Hospital: (www.vetmed.auburn.edu/animal-owners/jt-vaughan-large-animal-teaching-hospital/)
Equine Specialties: internal medicine, sports medicine and surgery, theriogenology, ambulatory, emergency and critical care, ophthalmology, infection control, large animal anesthesia and diagnostic imaging
1130 Wire Rd., Auburn, AL 36849
Phone: 334-844-4546

COLORADO STATE UNIVERSITY

College of Veterinary Medicine & Biomedical Sciences: (vetmedbiosci.colostate.edu)
Veterinary Teaching Hospital: (vetmedbiosci.colostate.edu)
Equine Specialties: surgery and lameness, emergency and critical care, ophthalmology, sports medicine, theriogenology, internal medicine and diagnostic imaging
300 W Drake Rd., Fort Collins, CO 80523-1601
Phone: 970-491-7051

CORNELL UNIVERSITY

College of Veterinary Medicine: (www.vet.cornell.edu)
Cornell Equine Hospital: (https://www.vet.cornell.edu/hospitals/equine-hospital)
Equine Specialties: anesthesia, cardiology, dentistry and oral surgery, dermatology, emergency critical care, farrier services, internal medicine, ophthalmology, regenerative therapies, sports medicine and rehabilitation, soft tissue surgery, theriogenology and imaging
602 Tower Rd., Ithaca, NY 14853
Phone: 607-2553-3000

IOWA STATE UNIVERSITY

College of Veterinary Medicine: (www.iastate.edu/academics/veterinary-medicine)

Lloyd Veterinary Medical Hospital: (vetmed.iastate.edu/vmc/equine)
Equine Specialties: preventive care, ophthalmology, dentistry, dermatology, surgery and internal medicine
1809 S Riverside Dr., Ames, IA 50011
Phone: 515-294-4900

KANSAS STATE UNIVERSITY

College of Veterinary Medicine: (www.vet.k-state.edu)
Equine Medical Center: (www.ksvhc.org/services/equine)
Equine Specialties: internal medicine, performance medicine, theriogenology and surgery
1710 Denison Ave., Manhattan, KS 66506
Phone: 785-532-5660

LINCOLN MEMORIAL UNIVERSITY

College of Veterinary Medicine: (www.lmunet.edu/college-of-veterinary-medicine/index)
Equine Veterinary Education Program: (www.lmunet.edu/college-of-veterinary-medicine/academics/equine-veterinary-education-program)
Equine Specialties: a fast-track equine veterinary program for students who have previous horse experience and are aspiring equine veterinarians
6965 Cumberland Gap Pkwy., Harrogate, TN 37752
Phone: 423-869-6600

LONG ISLAND UNIVERSITY

College of Veterinary Medicine: (https://liu.edu/vetmed)
720 Northern Blvd., Brookville, NY 11548
Phone: 516-299-3679

LOUISIANA STATE UNIVERSITY

School of Veterinary Medicine: (www.lsu.edu/vetmed)
LSU Equine: (www.lsu.edu/vetmed/ehsp)
Equine Specialties: diagnostic and therapeutic solutions for critically ill and injured horses, equine medication surveillance lab, gastrointestinal health, ophthalmology, orthopedics, regenerative medicine, surgery and theriogenology
Skip Bertman Dr., Baton Rouge, LA 70803
Phone: 225-578-9500

MICHIGAN STATE UNIVERSITY

College of Veterinary Medicine: (https://cvm.msu.edu/future-students)
Equine Services: (cvm.msu.edu/hospital/services/equine-services)
Equine Specialties: integrative medicine, emergency and critical care, internal medicine, sports medicine, surgery, dermatology, cardiology, ophthalmology, diagnostic imaging, neurology and rehabilitation
736 Wilson Rd., East Lansing, MI 48824
Phone: 517-432-7776

MIDWESTERN UNIVERSITY

College of Veterinary Medicine: (www.midwestern.edu/academics/our-colleges/college-of-veterinary-medicine)
Animal Health Institute Large Animal Clinic: (www.mwuanimalhealth.com/large-animal-clinic)
Equine Specialties: acupuncture, cardiology, dental surgery, digital radiography, endoscopy, elective and laser surgery, endocrinology, gastroscopy, internal medicine, lameness, lower respiratory diagnosis, theriogenology, tumor diagnosis and treatment, ultrasound, upper airway diagnosis and surgery, and video endoscopy
19555 N 59th Ave., Glendale, AZ 85308
Phone: 623-572-3215

MISSISSIPPI STATE UNIVERSITY

College of Veterinary Medicine: (www.vetmed.msstate.edu)
Equine Unit: (www.ads.msstate.edu/equine)
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By Nancy S. Loving, DVM

OSKA25/ISTOCK VIA GETTY IMAGES

Injuries are an acute manifestation of a chronic process.

AAEP 2022: Milne Lecture—Skeletal Injuries in Equine Athletes

Maintaining fitness is required to maintain bone mass, so training work must be relevant to the work the horse is expected to do.

The Frank J. Milne State of the Art lecture presented at the 2022 AAEP Convention featured Sue Stover, DVM, PhD, DACVS, of the University of California, Davis. She offered an in-depth look at the pathogenesis and training concepts for injury prevention in equine athletes based on a wealth of research.

Much of Stover's focus is on the racehorse due to high attrition rates at the track, including 1.62 deaths/1,000 starts. Every three months, 20% of racehorses are lost from racing, even due to mild injuries. This takes an economic toll on the industry with losses of $81 million each month. More than half of jockey injuries each year are related to racehorse falls due to equine injury or sudden death.

For eventing and show jumping horses, days are lost from training and competition from orthopedic injuries in 77% of competitors. She noted that 43% of those injuries are in the tendons or stay apparatus.

In a nutshell, Stover remarked that the public is asking the equine industry to do better.

Bone Injury

Much as with any occupational injury, she explained that even low loads of repetitive loading can produce cracks and reduce stiffness in bone, which decreases bone strength. A high load has a disproportionate effect on the number of cycles or strides preceding injury. A pre-existing stress fracture can become a complete fracture with enough strides at a high load.

In looking at the bones of horses that died of catastrophic injuries, it is apparent from the presence of calluses that cracks and stress fractures were in the process of trying to heal.

Bone is a heavy substance that the horse must carry around. Stover

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Dynamic remodeling rids mineral that isn't needed and deposits mineral where it is needed.

described a dynamic remodeling process that rids mineral that isn't needed and deposits mineral where it is needed. The musculoskeletal system must adapt continually in order to sustain increasing or changing loads as a horse advances in training. This is the key to injury prevention.

However, sometimes stresses cause strains greater than a structure can sustain.

Bone adapts with increases in cross-sectional area (CSA). Stover described the degree of strain for which a mature horse is adapted as 3000 με (units of microstrain). As a comparison, people at walk exercise experience strains of 2000 με. However, breezing speeds of 2-year-old Thoroughbred horses exceed 4000–5000 με, leading to dorsal metacarpal disease (bucked shins). Electron microscopy of these bones reveals linear cracks within the substance of the bone. With reduced stress and time, these cracks are capable of healing with new layers of bone.

Severe damage in bone causes necrosis that outpaces remodeling.

Osteocytes are important to keep bone from fully mineralizing and becoming brittle like a ceramic plate, said Stover. With the death of osteocytes, large resorption bays develop along with cracks. For these to heal by osteoblastic action takes time.

Initially, focal osteopenia persists for two to three weeks, which can result in cortical stress fractures that weaken bone. Full repair takes up to three months, with osteoblasts filling in the "holes" of porous bone to resist crack propagation. If a horse keeps training, increasing strain creates more damage. Stover compared the damage to perforations on a postage stamp that tear easily.

Stover reported that more than 85% of catastrophic fractures are due to training or competing on bone with a pre-existing injury. This means that at least 85% of racehorse (or other equine athletes) deaths are preventable with scrutiny and training modifications.

Recent interventions at U.S. racetracks have seen a 40-50% reduction in catastrophic musculoskeletal injuries. This is due to enhanced veterinarian/trainer collaboration, expansion of a culture of safety, increased scrutiny and training observations, horses being allowed time to rehabilitate, and enforcement of changes in medication allowances (including stand-down time for intra-articular corticosteroid injections).

Joint Injury

The articular joints also undergo adaptations when possible. When the fetlock extends, the suspensory apparatus stretches with great tension as it wraps around a corner of the proximal sesamoid bone. With hyperextension, the proximal sesamoid bone drops farther than normal to place pressure between the cannon bone and the proximal sesamoid. This leads to microdamage, devitalized bone and micro-sequestrum. Stover pointed out that with increasing loads, cracks form and joint cartilage collapses to result in end-stage arthrosis.

The only difference between the pathogenesis of stress fractures and subchondral bone stress remodeling is the overlying articular cartilage that prevents peripheral expansion of the end of the bone and periosteal callus. If caught early, bone can repair.

Stover stressed that it is possible to prolong the duration of healing, but it can't be shortened.

Prevention relies on influencing the rate that damage accumulates, which is related to the magnitude of the load and the rate of load cycles, i.e., stride. She advised that load magnitude is influenced by hoof conformation.

There are levers affecting joints. The hoof and pastern support one end of the lever, and the tendons and ligaments on the back of the limb support the other end of the lever. A longer length of the

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URBANCOW/E+ VIA GETTY IMAGES

hoof lever (long toe/low heel) magnifies the force that the tendons and ligaments must sustain, thereby increasing the load through the boney column. A long toe/low heel hoof conformation increases the risk of injury to the suspensory apparatus by 3.5 times.

Compared to shoes with no toe grabs, low toe grabs increase the risk of injury by 6.5 times and regular toe grabs by 15.6 times.

The load magnitude is also affected by exercise intensity. Greater intensity, such as speed or jump heights, increases the force between the hoof and the ground, referred to as ground-reaction forces (GRF). Similarly, the rate of load cycles (strides) increases with higher training intensity, which often incurs lay-ups due to injury. Injury risk can be reduced by managing hoof conformation and shoeing, and by modifying training and competition schedules.

Effect of Surfaces

Stover pointed out that the racetrack surface is often blamed for clusters of catastrophic injuries. A harder or stiffer surface increases forces on soft tissue structures supporting the fetlock, and those forces are transferred to the bony column of the limb.

Surface does play a big role. For example, she used this analogy of jogging on the beach: "The character of the surface changes as you get closer [to] or farther from the water. The least energy is tailored to the optimal support that is not too rigid or hard."

Instrumentation on horses on different racetracks has measured the GRF of dirt, synthetic surfaces and turf. GRF is found to be higher on dirt and turf than a synthetic surface. Higher GRF surfaces lead to greater fetlock hyperextension that injures proximal sesamoid bones and soft tissue structures, with potential for fatal injury as exercise intensity is increased.

The hoof moves differently on different surfaces—a synthetic surface has more stickiness, so the hoof slide is shorter and limb support is longer in duration. In contrast to racehorses, dressage horses in an extended trot experience a harder and stiffer surface with synthetic material compared to dirt. Suspensory apparatus injuries are common in dressage competitors.

Stover commented that a horse that steps on a previous hoof print will experience increased forces on the hoof due to the hoof-compressed surface. Fluffing up the arena or track with harrowing—and adding water—greatly improves limb protection.

She stressed a critical point: A competitive horse that travels from one track or one arena to another will experience different surface behaviors, and this affects fetlock angle.

She emphasized that injuries are multi-factorial, not just due to surfaces. Many times, the horse probably had suffered a previous injury, so it is set up for failure no matter the location or surface. There are many underlying factors.

As an example, a need for intra-articular corticosteroid injection demonstrates this concept, i.e., the risk of other underlying factors. Of 1,192 racehorses, 392 were treated with corticosteroids, and many did not race for six months or were retired. Those horses treated with corticosteroids (presumably due to a musculoskeletal injury) experienced three times the number of injuries as horses not treated with corticosteroids.

Injury Causes

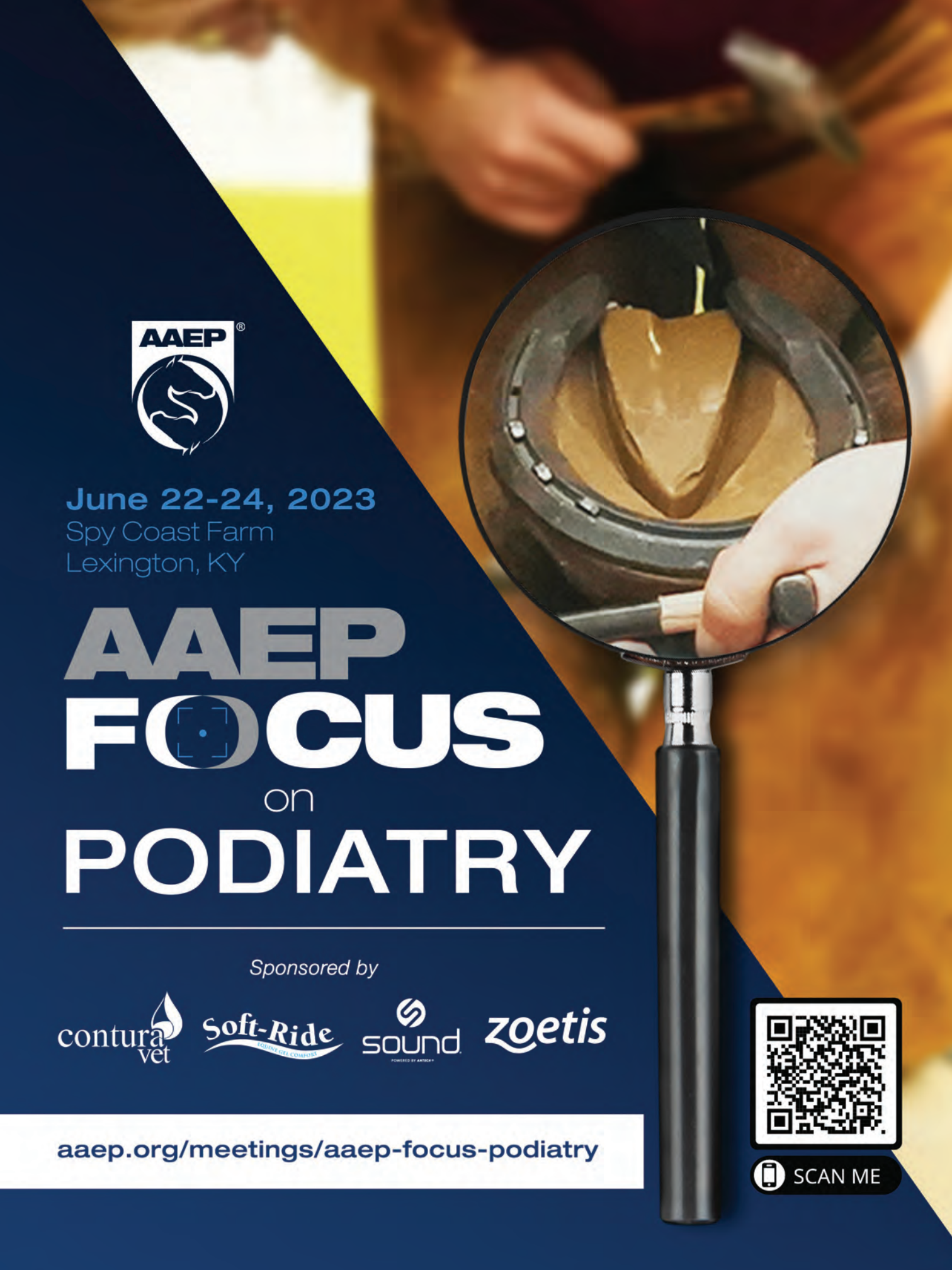
Three different scenarios can lead to injury, said Stover:

Insufficient conditioning tends to result in scapular, humeral or tibial fractures that typically occur early in training with high training loads.

Deconditioning during rehabilitation might result from loss of bone material during unloading of the skeleton with rest and rehab. If a high-intensity load is placed with return to full training without sufficient adaptation time, the inside of the bone is more porous. That results in the horse having a 61-times greater likelihood of fracture upon return to work, especially of the humerus.

Overtraining tends to result in fetlock or pelvic fractures later in the training program due to repetitive high-intensity exercise for long periods without an opportunity for the horse to recover. This occurs more often in older horses.

An important preventive feature that Stover stressed was that relatively little exercise at a new level is required to stimulate bone adaptation and gain bone mass. She stressed that bone responds to the level of work, not to the amount of work. So, all that is needed to promote adaptation is short periods of exposure of higher-intensity activity.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Adding in long periods of high-intensity work simply creates more musculoskeletal damage.

Another point she conveyed was that with bilateral bone disease, such as with tibial stress fractures, lameness might not be evident. She said, "Previous lameness is associated with development of more severe lameness later—lameness in the prior three months increases the odds ratio by 4.3 times."

Stover asked the question: "When does sufficient injury occur to skeletal structures that starts to cascade to events of concern?"

It begins with high-impact loads that induce microdamage and inflammation that might be painful enough to elicit lameness. Then, two to three months later, repair processes that resorb microdamage also create transient bone loss and porosity, which is likely less painful and without overt lameness. This increases the potential for fracture.

She suggested that riders and trainers should develop more finesse at injury detection—does the horse demonstrate changes in demeanor or exhibit poor performance? Is there transient lameness? Does the horse lie down more or less than usual?

Application of the pain ethogram is also helpful to discern whether a horse is experiencing discomfort.

A physical exam is important, and she advised not to forget evaluation of the proximal limb.

Bone scans and 3D PET scans are invaluable to identify inflammatory activity with high sensitivity and specificity.

Take-Home Message

Damage in a structure precedes focal osteopenia, which weakens bone and increases the potential for serious injury.

Training schedules need to take the horse into account and not just the business of racing, said Stover. Injuries are an acute manifestation of a chronic process. The objective is to increase strength and adaptation rather than the horse experiencing ongoing damage and repair cycles.

"Training that capitalizes on gains in strength achieves further gains in strength to produce a fit horse," said Stover. Maintaining fitness is required to maintain bone mass. She emphasized that training work must be relevant to the work the horse is expected to do for a living. EM

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