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AASV
830 26th Street, Perry, IA 50220-2328
Tel: 515-465-5255
Email: aasv@aasv.org

Editorial questions, comments, and inquiries should be addressed to Rhea Schirm, Publications Manager: Email: jshap@aasv.org.

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JSHAP SPOTLIGHT

Dr Beth Young

National Veterinary Institute, Sweden

Dr Beth Young earned a BSc ('97), DVM ('02), and DVSc ('05) from the University of Guelph. Dr Young is an epidemiologist at the Swedish National Veterinary Institute where, among other things, she coordinates national animal disease surveillance programs and advises other agencies, veterinarians, and farmers during investigations of reportable disease suspicions and outbreaks. Dr Young joined the JSHAP Editorial Board because she enjoys being part of the process of selecting quality papers that are relevant for swine practitioners. She believes it is also a great way to maintain and improve her critical review and scientific writing skills.

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1: Perri A et al. An investigation of iron deficiency and anemia in piglets and the effect of iron status at weaning on post-weaning performance. JSHAP. 2016;24:10–20.

2: Fredericks L et al. Evaluation of the impact of iron dosage on post- weaning weight gain, and mortality. AASV. 2018;315

3: Olsen, C. (2019) The economics of iron deficiency anemia on US swine production: An annual impact of 46-335 million US dollars. American Association of Swine Veterinarians. Orlando. Florida.

* Industry Standards for Blood Hb Levels (g/L)

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2022: The year in review

As we approach the end of 2022, I want to take time to reflect on the year and AASV.

After a virtual annual meeting in 2021, we were able to meet in person in Indianapolis. The sense of excitement and engagement amongst the members after minimal in-person meetings was palpable, and that enthusiasm carried through to the engagement of members in other AASV activities throughout the year. I would like to take another opportunity to thank all those involved in the meeting planning, and especially thank all the speakers who provided us with innovative, challenging, timely, thought-provoking presentations. It takes a tremendous amount of time and talent to make this meeting a success!

In March, the AASV officers and staff had the opportunity to travel to Washington DC for a joint meeting with the American Association of Bovine Practitioners (AABP) officers and staff for stakeholder meetings. During the meetings, we met with representatives from the American Veterinary Medical Association Government Relations team, US Customs and Border Protection, US Food and Drug Administration, National Pork Producers Council, National Milk Producers Federation, US Department of Agriculture (USDA) Food Safety and Inspection Service, Veterinary Medical Loan Repayment Program, USDA Animal and Plant Health Inspection Service, Food Animal Residue Avoidance Databank, National Cattlemen's Beef Association, and the US House and Senate Agriculture Committee's staff. These discussions provided updates on pending legislation, funding, and specific program updates on issues that impact food animal veterinarians. The continued opportunity to collaborate and communicate with AABP around all these topics is appreciated.

The AASV committees met at the AASV Annual Meeting, and most met again later in the year. Currently, there are 16 active committees with well over 350 AASV members volunteering their time. Many of the committees have been active bringing position statements and requests for financial support of projects to the board of directors. Several have also developed preconference seminars as part of the Annual Meeting. Thanks to everyone who has given their time to be part of a committee, or in some cases, multiple committees. If you are interested in joining a committee please reach out to the chairperson, or plan to attend the upcoming meeting at the Annual Meeting in Denver. To see current committee information, including past agendas and plan of work, please go to **aasv.org/aasv/committee.php**. All committees would benefit from the addition of new members and new perspectives!

In conjunction with the spring board of directors meeting, a strategic planning session was held. During this session, gradual declining membership was identified as an area of opportunity for the organization to evaluate more closely. Some of the observed decrease is in international membership, which may be related to global travel restrictions and the inability to attend the Annual Meeting in person. Other reasons for the decline are more challenging to determine due to the current lack of demographic information collected by the association beyond year of graduation and which college a member graduated from. The ability to better evaluate trends and determine contributing factors for declining numbers in specific segments of the membership would allow for specific plans to enhance membership retention and recruitment.

"I am looking forward to the continued activity and growth of AASV in 2023."

The threat of an introduction of a transboundary disease into North America remains. Throughout the year, activities such as presentations and discussions at the Annual Meeting, meetings with state and federal regulatory agencies, applied research, collaboration with allied industry groups, and the AASV member meeting at World Pork Expo have involved many AASV members. It is these collective efforts that continue to improve preparedness for such an introduction. It is AASV members who are best positioned to continue to identify gaps, advocate for better preparedness, and lead in the development of farm-specific plans.

None of the accomplishments of AASV would happen without the often-overlooked efforts of the AASV staff. Please remember to express your gratitude to them for their work at every opportunity.

As the year comes to a close, hopefully you will have time to slow down, reflect, and spend time with your families and friends. I am looking forward to the continued activity and growth of AASV in 2023.

Mike Senn, DVM, MS
AASV President

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To compound or not

All AASV members in the United States should have received a mailing recently reminding you about the regulations governing extra-label drug use and compounding. We sent this out to raise awareness of the regulations pertaining to compounding coccidiostats from bulk ingredients.

As you are probably aware, there are no US Food and Drug Administration (FDA) approved coccidiostats for use in swine. Therefore, it becomes necessary to use a product (such as Marquis), which is FDA approved in other species, in an extra-label manner. This is perfectly legal under the 1994 Animal Medicinal Drug Use Clarification Act (AMDUCA) which allows for the use of FDA approved animal and human drugs in food-producing animals under certain circumstances. The AMDUCA makes it legal to use approved products or to compound those approved products to make them more useful in swine.

The challenge we currently have is that the FDA-approved coccidiostats are in short supply and back ordered. From what I have been told, it will likely be at least the first quarter of 2023 before significant quantities of coccidiostats are available. Therefore, there is no approved product available to use in an extra-label manner and it is illegal to manufacture (compound) a product for use in food-producing animals from a bulk ingredient. Compounding, however, can be a very confusing process with some subtleties that veterinarians and pharmacists do not always think to consider.

According to the FDA website (**fda.gov/animal-veterinary/unapproved-animal-drugs/animal-drug-compounding**), compounding is generally considered to be the process of combining, mixing, or altering ingredients to create a medication specifically tailored to meet the needs of an individual patient or group of patients. Compounding includes the combining of 2 or more drugs. Compounded drugs are not FDA approved. This means that FDA does not verify the safety or effectiveness of compounded drugs. Further, when the compounded drug is for a food-producing animal, FDA has not reviewed evidence supporting conditions of use to protect against harmful drug residues in edible tissues (ie, meat, milk, eggs, etc.)

The Federal Food, Drug, and Cosmetic Act permits the compounding of drugs from 2 or more FDA approved final products but not from bulk ingredients. A bulk drug ingredient is a substance used to make a drug that becomes an active ingredient in the finished dosage form of the drug. In other words, although you may be able to purchase the raw ingredient ponazuril from a chemical supply house or a pharmacy, it is not an FDA-approved final product and may not be used to compound drugs for food-producing animals. I have been asked about using United States Pharmacopeia (USP)-approved ponazuril purchased from a reliable source. The USP designation denotes that a chemical is pharmaceutical-grade but has nothing to do with FDA or an FDA approval.

The FDA recently released Guidance for Industry #256 - Compounding Animal Drugs from Bulk Drug Substances (**fda.gov/regulatory-information/search-fda-guidance-documents/cvm-gfi-256-compounding-animal-drugs-bulk-drug-substances**) to describe their interpretation and enforcement strategy concerning animal drug compounding. Unfortunately, GFI #256 does not allow for compounding of drugs for food-producing animals except to produce antidotes or sedatives.

In addition to being illegal, there have been concerns expressed by harvest facilities regarding the use of unapproved products in food-producing animals. Foods derived from animals receiving unapproved products could be determined to be adulterated and, thus, unacceptable for human consumption.

This puts veterinarians in the untenable position of not having effective tools to treat coccidiosis while following FDA regulations. The AASV has been in discussion with FDA for weeks to try to obtain some sort of guidance or legal relief to allow veterinarians to effectively treat pigs and prevent the mortality, morbidity, production loss, and welfare challenges associated with coccidiosis. Unfortunately, while they are aware of our concerns, the FDA has not provided any such relief at the time of this writing. We will continue to push and interact with the FDA but felt it was important that we make you aware of the legalities and challenges associated with compounding in food-producing animals. You can see a reprint of the compounding article sent to US members in the Advocacy in Action column in this issue of the journal. The AASV staff will keep you apprised of any changes.

Harry Snelson, DVM
Executive Director

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Introducing JSHAP's newest team member

My name is Emily Hanna, and I am the new proofreader for the *Journal of Swine Health and Production*. I have worked in a similar role for the past 13 years at Des Moines Area Community College (DMACC) as an English instructor and tutor in the Academic Achievement Center. At DMACC, I work one-on-one with students and instructors to enhance their writing and fine tune their essays and reports. I have enjoyed learning and expanding into the pork industry since starting this summer and am looking forward to learning more about the world of swine and contributing to JSHAP.

When not focused on writing, I spend a lot of time growing my own business while helping others to overcome health struggles through nutrition. Having personally experienced a health crisis myself with a Lupus diagnosis, it has become a passion to provide hope to others by sharing my own journey through Hanna Valley Protein and providing products our consumers can trust. We specialize in organic, plant-based protein powders and protein granola made with whole food ingredients to support the health goals of others.

In my spare time, you will find me outdoors with my husband, son (9), and daughter (6). We love to bike, forage, hike, camp, and travel every chance we get.

I am excited to be able to contribute further to JSHAP and offer support to authors by providing an objective set of eyes that will allow their hard work and dedication to be communicated efficiently and effectively to their audience.

Emily Hanna
Proofreader

"I have enjoyed learning and expanding into the pork industry since starting this summer and am looking forward to learning more about the world of swine and contributing to JSHAP."

Peer reviewed **Original research**

HMH sked rescue system, revised deer sled, and ice fishing sled as humane on-farm handling tools to move nonambulatory grow-finish pigs on a commercial farm

Ella E. Akin, MS; Anna K. Johnson, PhD; Cassandra D. Jass, DVM; Locke A Karriker, MS, DVM, DACVPM; Jason W. Ross, PhD; Kenneth J. Stalder, PhD; Suzanne T. Millman, PhD

Summary

Objective: The objective of this study was to evaluate an HMH sked rescue system, revised deer sled, and ice fishing sled as humane handling tools for moving nonambulatory pigs on a commercial wean-to-finish farm.

Materials and methods: Eighteen commercial crossbred pigs received an epidural to induce a nonambulatory state. The HMH sked rescue system, revised deer sled, and ice fishing sled were tested as handling tools by 2 employees for time to place and move the pig, pig vocalization and struggle scores, and tool durability.

Results: Time to place the nonambulatory pig from the start pen floor onto the handling tool, time to secure the nonambulatory pig on the handling tool, and total time were not affected by the handling tool ($P \geq .12$). There was a trend for time to move the handling tool with the nonambulatory pig from the start to end pen, which included removing the pig from the handling tool and placing them onto the end pen floor ($P = .06$). The ice fishing sled was the most durable with no creases, rips, or holes. There were no handling tool differences for pig vocalization or struggle scores ($P > .10$). Changes in pig respiration rate and pig body temperature did not differ between handling tools ($P \geq .71$).

Implications: Under study conditions, the sked, revised deer sled, and ice fishing sled were all humane tools to move nonambulatory grow-finish pigs. Caretakers need to evaluate the best choice for their farm.

Keywords: swine, animal welfare, caretakers, handling tools, nonambulatory pigs

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Resumen – El sistema de rescate con patines HMH, el trineo de ciervos modificado, y el trineo para pesca en hielo como herramientas de manejo humanitario para mover cerdos no ambulatorios de crecimiento y finalización en una granja comercial

Objetivo: El objetivo de este estudio fue evaluar el sistema de rescate con patines HMH, el trineo para ciervos modificado, y el trineo para pesca en hielo como herramientas de manejo humanitario para mover cerdos no ambulatorios en una granja comercial de destete a finalización.

Materiales y métodos: Dieciocho cerdos comerciales recibieron una inyección epidural para inducir un estado no ambulatorio. El sistema de rescate con patines HMH, el trineo para ciervos modificado, y el trineo para pesca en hielo fueron probados como herramientas de manejo por 2 empleados para evaluar el tiempo para colocar y mover al cerdo, la vocalización del cerdo, el puntaje de forcejeo, y la durabilidad de la herramienta.

Resultados: El tiempo para colocar el cerdo no ambulatorio desde el piso del corral y sobre la herramienta de manipulación, el tiempo para asegurar el cerdo no ambulatorio en la herramienta de manipulación y el tiempo total no se vieron afectados por la herramienta de manipulación ($P \geq .12$). Hubo una tendencia en el tiempo para mover la herramienta de manipulación con el cerdo no ambulatorio desde el corral inicial hasta el final, lo que incluía retirar al cerdo de la herramienta de manipulación y colocarlo en el suelo del corral final ($P = .06$). El trineo

EEA, AKJ, JWR, KJS: Department of Animal Science, College of Agriculture and Life Sciences, Iowa State University, Ames, Iowa.

CDJ: Iowa Select Farms, Iowa Falls, Iowa.

LAK: Department of Veterinary Diagnostic and Production Animal Medicine, College of Veterinary Medicine, Iowa State University, Ames, Iowa.

STM: Department of Veterinary Diagnostic and Production Animal Medicine and Department of Biomedical Sciences, College of Veterinary Medicine, Iowa State University, Ames, Iowa.

Corresponding author: Dr Anna K. Johnson, 2356F Kildee Hall, Department of Animal Science, Iowa State University, Ames, IA 50011; Tel: 515-294-2098; Email: **johnsona@iastate.edu**.

This article was derived from Ella Akin's MS thesis, Iowa State University, Ames, Iowa.

Akin EE, Johnson AK, Jass CD, Karriker LA, Ross JW, Stalder KJ, Millman ST. HMH sked rescue system, revised deer sled, and ice fishing sled as humane on-farm handling tools to move nonambulatory grow-finish pigs on a commercial farm. *J Swine Health Prod*. 2022;30(6):346-354. **https://doi.org/10.54846/jshap/1301**

para pesca en hielo fue el más duradero sin presentar arrugas, rasgaduras, o agujeros. No hubo diferencias en las herramientas de manipulación en la vocalización de los cerdos o las puntuación de forcejeo ($P > .10$). La frecuencia respiratoria y la temperatura corporal de los cerdos no difirieron entre las diferentes herramientas de manipulación ($P \geq .71$).

Implicaciones: Bajo las condiciones del estudio, el sistema de rescate, el trineo de ciervos modificado, y el trineo para pesca en hielo fueron herramientas humanitarias para mover cerdos no ambulatorios de crecimiento y finalización. El personal del área debe evaluar la mejor opción para su granja.

Résumé - Système de sauvetage HMH sked, traîneau à cerf révisé, et traîneau de pêche sur glace en tant qu'outils de manutention sans cruauté à la ferme pour déplacer les porcs en période croissance-finition non-ambulatoires dans une ferme commerciale

Objectif: L'objectif de cette étude était d'évaluer un système de sauvetage HMH sked, un traîneau à cerf révisé, et un traîneau de pêche sur glace en tant qu'outils de manutention sans cruauté à la ferme pour déplacer des porcs non ambulatoires dans une ferme commerciale de type croissance-finition.

Matériels et méthodes: Dix-huit porcs croisés commerciaux ont reçu une épidurale afin d'induire un état non-ambulatoire. Le système de sauvetage HMH sked, le traîneau à cerf révisé, et le traîneau de pêche sur glace ont été testés en tant qu'outil de manutention par deux employés pour le temps à installer et déplacer le porc, les pointages pour la vocalisation et la lutte, et la durabilité de l'outil.

Résultats: Le temps pour placer les porcs non-ambulatoires du plancher de l'enclos de départ sur l'outil de manutention, le temps d'attacher les porcs non-ambulatoires sur l'outil de manutention et le temps total n'ont pas été influencés par l'outil de manutention ($P > .12$). Il y avait une tendance pour le temps, de déplacer l'outil de manutention avec les porcs non-ambulatoires de l'enclos de départ à l'enclos final, qui incluait le retrait du porc de l'outil de manutention et de placer les porcs sur le plancher de l'enclos final ($P = .06$).Le traîneau de pêche sur glace était le plus durable ne présentant aucun pli, déchirure ou trou. Il n'y avait aucune différence entre les outils de manutention pour les pointages de vocalisation ou de luttes ($P > .10$). Aucune différence n'a été notée entre les différents outils de manutention en ce qui regarde le rythme respiratoire et la température corporelle ($P \geq .71$).

Implications: Dans les conditions de la présente étude, le sked, le traîneau à cerf révisé, et le traîneau de pêche sur glace révisé se sont tous avérés des outils humanitaires pour déplacer des porcs non-ambulatoires en période de croissance-finition. Les personnes soignant les animaux doivent évaluer le meilleur choix pour leur ferme.

On-farm humane pig handling is important for pig welfare, caretaker safety, and improved product.[1] When a pig becomes nonambulatory, the trained caretaker must make an ethical decision if it is in the pig's best interest to be moved for recovery or to be humanely euthanized. A nonambulatory, noninjured pig that has become fatigued has a high likelihood of recovery and humanely moving them would be ethically correct. However, a pig that has an injury such as a displaced hip or broken leg must be euthanized in place.[1] The National Pork Board provides guidance about humane swine handling through the Pork Quality Assurance (PQA) Plus and Transport Quality Assurance (TQA) programs.[1,2] Building on these educational programs, the Common Swine Industry Audit (CSIA) is an audit tool designed to meet company and customer needs,[3] and includes requirements for humane swine handling. Willful acts of abuse and neglect are strictly prohibited critical elements of CSIA that can result in automatic audit failure and are described as, "[d]ragging of conscious animals by any part of their body except in the rare case where a non-ambulatory animal must be moved for a life-threatening situation. Non-ambulatory pigs may be moved by using a drag mat."[3] Nonambulatory pigs may be moved into hospital pens to facilitate recovery. There is limited evidence in the literature to suggest the impact of different handling tools, including drag mats, on a pig's response. To provide scientific evidence, initial research used cadavers to identify potentially viable handling tools and to eliminate tools that were impractical or clearly harmful to pigs. In a previous study[4] a wean-to-finish mat was eliminated when none of the employees were able to move 3 pig cadavers (68 kg, 118 kg, and 135 kg) from the home pen to the hospital pen. In a second study[5] we evaluated a sked, a deer sled, and a modified deer sled with straps using 15 pig cadavers (59-134 kg). The sked and modified deer sled were found to be suitable for moving cadavers; these handling tools were selected for further evaluation with live nonambulatory pigs. In the absence of straps on the deer sled, the cadavers were poorly restrained such that head and legs would catch on penning; this handling tool was not studied further. Consistent with the 3 Rs for ethical animal use in research (reduce, refine, and replace) cadavers were used instead of live pigs (replace) in our initial work evaluating the handling tools, from which modifications were made before use with live pigs. An ice fishing sled has restraints and moves over a variety of terrains and so was considered as a possible option for further testing. Therefore, the objective of this study was to evaluate an HMH sked rescue system, revised deer sled, and ice fishing sled as humane handling tools for moving nonambulatory pigs on a commercial wean-to-finish farm.

Animal care and use

All research was approved by Iowa State University Institutional Animal Care and Use Committee (Approval No. 18-319).

Materials and methods

Handling tools

The 3 handling tools evaluated in this study were selected based on 4 criteria: 1) durability, 2) ability to traverse a variety of surfaces, 3) ability to withstand heavy weights, and 4) presence of restraints.

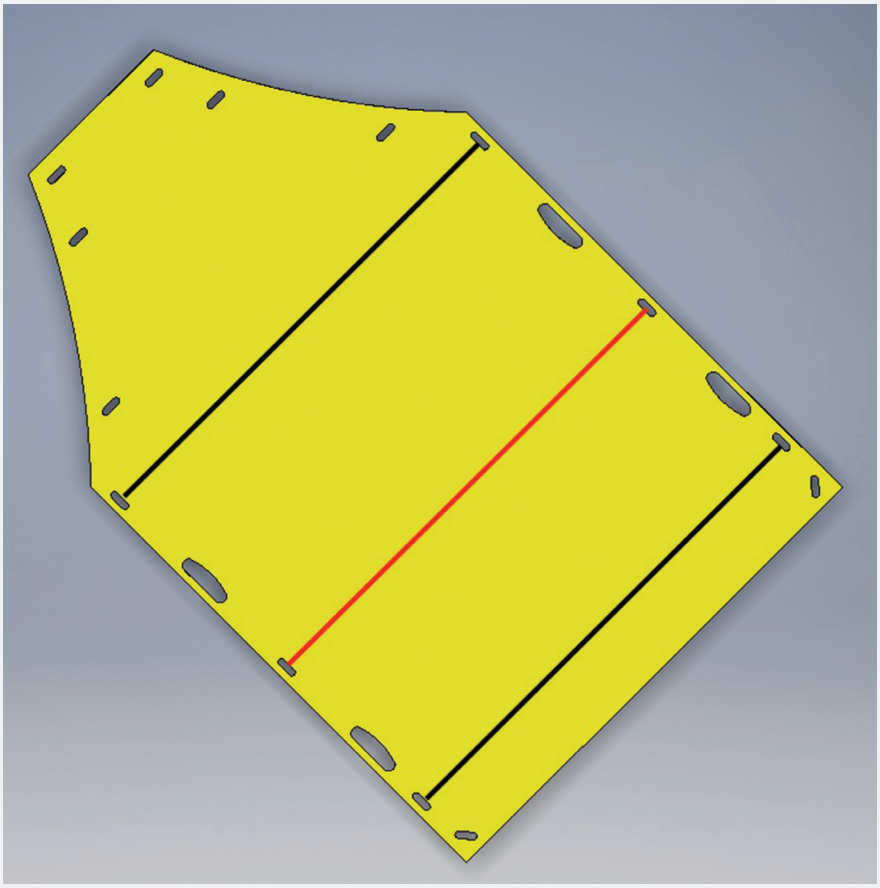
Handling tool 1. An HMH sked rescue system (sk-250; Skedco, Inc) was purchased. The HMH sked rescue system weighed 5 kg, measured 240 cm long × 91 cm wide × 0.3 cm deep and was made of medium-density polyethylene plastic. The HMH sked rescue system was modified to reduce length so transitioning between pens and alleyways was possible. All straps from the HMH sked rescue system were removed except

for 3 side-release plastic buckle straps (5.08-cm-wide polypropylene straps). Across the width of the HMH sked rescue system's foot-end, a 31.1 cm line was drawn and a hacksaw was used to cut across the line. The final sked dimensions were 190 cm long × 91.4 cm wide (Figure 1). The HMH sked rescue system cost $327 with $0 for modifications.

Handling tool 2. A Magnum Deer Sleigh'r Game Sled (Item No. 138755; Sportsman Guide) was purchased. The deer sled weighed 2 kg, measured 180 cm long × 92 cm wide × 0.2 cm deep and was made of slick polymer. Modifications were made to affix new restraints and a polypropylene rope was added to serve as a handle. Two grommets (4 cm) were installed on both sides of the deer sled. One grommet was inserted 50 cm from the top and 2.5 cm from the side. A second grommet was inserted 55 cm below the first grommet and 2.5 cm from the side. The process was repeated on the opposite side of the deer sled. Two side-release plastic buckle restraint straps (6-cm-wide polypropylene straps) were affixed to the grommets. A 3.7-m polypropylene rope was inserted through 3 pieces, 20 cm each, of braided vinyl tubing. The top handle was created with 2 additional handles added underneath (31 cm apart) to provide employees with handle length options when moving pigs. The handle was inserted and knotted on the upper surface of the deer sled. Final revised deer sled dimensions were 180 cm long × 91.8 cm wide (Figure 2). The revised deer sled cost was $30 and an additional $114 for modifications.

Handling tool 3. An Otter Pro Sled Mini (ice fishing sled; SKU: 200817) was purchased. The ice fishing sled weighed 4 kg, measured 109 cm long × 58 cm wide × 27 cm deep and was made of polyethylene material. Modifications were performed to affix new restraints and a polypropylene rope was added to serve as a handle. Two holes were drilled on both sides of the outer edge. A hole was drilled at 41 and 81 cm from the top of the ice fishing sled. Two side-release plastic buckle restraint straps (5-cm-wide polypropylene straps) were affixed to the holes. Two additional holes were drilled into the front of the ice fishing sled using a 1-cm spade bit to increase the size of the pre-existing holes. A 2.7-m polypropylene rope was inserted through a section of 25-cm braided vinyl tubing. The handle was knotted at the front, upper surface (Figure 3). The ice fishing sled cost $50 with an additional $19 for modifications.

Figure 1: The HMH sked rescue system was modified to move nonambulatory grow-finish pigs from the start to end pen. All straps were removed except 3 side-release plastic buckle restraint straps (5.08-cm-wide polypropylene straps). Across the width of the footend, a 31.1-cm line was drawn and a hacksaw was used to cut across the line. The final sked dimensions were 190 cm long × 91.4 cm wide.



Animals, employees, and facilities

The study was conducted on a commercial grow-finish site in central Iowa. Two production well-being employees were enrolled in the study. The male employee was 60 years of age, 180.3 cm tall, weighed 90.7 kg, and had 20 years of experience. The female employee was 30 years of age, 160.2 cm tall, weighed 63.5 kg, and had 10 years of experience. Eighteen commercial crossbred pigs were selected from the general population by the company veterinarian. Body weights were collected using a weigh scale (Raytec WayPig 300; AGRI-sales Inc) and rounded to the nearest whole number. The mean (SD) body weight was 98.4 (25.3) kg (range: 31.8-124.7 kg). Once pigs were weighed, they were individually marked with a unique letter using an animal safe spray paint before being released into the start (home) pen. Facility details are described in Table 1.

Epidural procedure

The Swine Medicine Education Center staff and veterinarians at Iowa State University's College of Veterinary Medicine completed the epidural procedure. Each pig was restrained with a pig snare while standing. Three additional personnel completed the epidural procedure: one supported the pig with a sort board during injection, a second administered the epidural, and a third handed supplies as needed. The injection site was located by palpating the cranial edge of the tuber coxae and finding the point perpendicular to that location on the pig's midline. The injection site was prepared by shaving the pig's back and then infiltrated with a local anesthetic agent (Lidocaine 2%; VetOne) prior to insertion of the spinal needle. An 18-gauge, 8.9-cm spinal needle (Becton, Dickinson and Co) was inserted at the prepared location

between the last lumbar and first sacral vertebrae. The needle was advanced through the skin, backfat, muscle, and then the fibrous interarticular spinous ligament. The stylet was removed and a 12-mL syringe filled with 2% lidocaine was attached to the needle for administering the anesthetic agent. As the lidocaine was injected, if resistance was noted, the needle was repositioned before administering the full dose; 1 mL/9 kg body weight was administered with a maximum of 12 mL. After administration, the needle was withdrawn and the pig snare removed. The epidural procedure took 6 minutes and the onset of anesthesia occurred within 20 minutes and lasted approximately 2 hours. To monitor the plane of anesthesia and to determine if a pig needed to be removed from the study for humane reasons, pig behavior responses were observed continuously from outside their flight zone and respiration and heart rate were monitored every 15 minutes. Once a pig completed the study, monitoring continued by a swine veterinarian until it was able to stand on all 4 legs and walk.

Handling tool assessment

Using the randomization function in Excel, pigs were randomly assigned to 1 of 3 handling tools. Each handling tool was assigned to 6 individual pigs for a total of 18 pig movement tasks. Employees loaded the nonambulatory pig onto the assigned handling tool and attempted to move the pig from the start pen to the end pen (total distance = 21 m). This distance represented the maximum distance between a home pen and a recovery pen on this farm.

For the sked and revised dear sled, one employee held the handling tool still while the second employee placed the nonambulatory pig onto the handling tool. Both employees secured the pig using the buckle restraint straps. For the ice fishing sled, the handling tool had to be flipped onto its side to allow both employees to place the nonambulatory pig, and then the bottom of the ice fishing sled was set back onto the pen floor. One employee held the pig inside the ice fishing sled, while the second employee secured the pig using 2 buckle restraint straps.

One researcher collected the measurements during the study using a stopwatch: 1) Time (seconds) to place the nonambulatory pig from the start pen

Figure 2: The revised deer sled was modified to move nonambulatory grow-finish pigs from the start to end pen. Two grommets were installed on both sides of the sled. Two side-release buckle straps were affixed to the grommets. A 3.7-m polypropylene rope was knotted on the upper surface to form a handle. The final sled dimensions were 180 cm long × 91.8 cm wide.

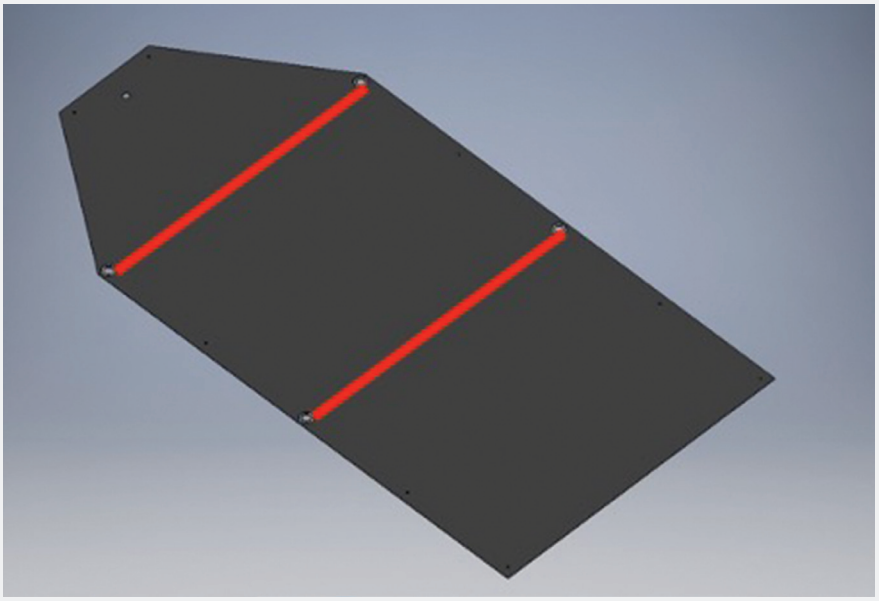


Figure 3: The ice fishing sled was modified to move a nonambulatory grow-finish pig from the start to end pen. Two holes were drilled on the lip of both sides. Two side-release buckle restraint straps were affixed to the holes on the lip. Two additional holes were drilled on the front to increase size of the pre-existing holes. A 2.7-m polypropylene rope was knotted on the upper surface to form a handle. The ice fishing sled dimensions were 109 cm long × 58 cm wide × 27 cm deep.

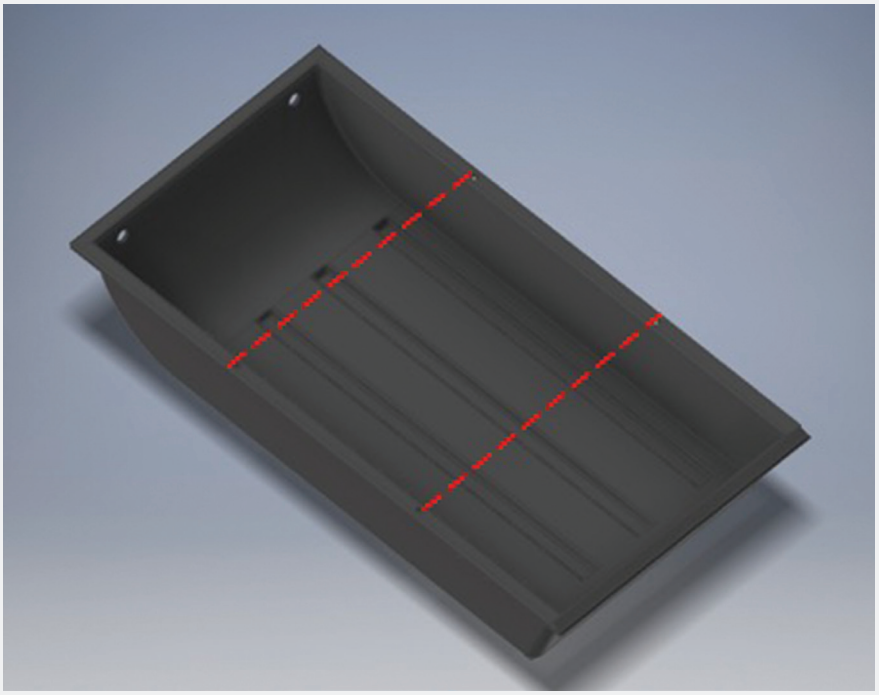


Table 1: Building and production specifications of a central Iowa commercial grow-finish site where handling tools* were evaluated to move nonambulatory pigs

Specifications	Details
Site capacity, No. of pigs	4800
Barn capacity, No. of pigs	1200
Projected market weight, kg†	127
No. of barns	4
Rooms/barn	1
Barn width, m	14.9
Barn length, m	57.9
Pen width, m	2.8
Pen depth, m	7.2
Pens/barn	40
Space allowance, m^2	0.7
No. pigs/pen	20-30
Pen flooring	Fully slatted
Slat width, cm	12.7
Slot width, cm	2.5
Alley flooring	Fully slatted
Alley width, cm	71
Distance from start pen to end pen, m‡	20.6

* Handling tools used were a sked, revised deer sled, and ice fishing sled.

† Pigs had a mean (SD) body weight of 100 (25.3) kg; range: 125-136 kg.

‡ Two empty pens were designated as the start and end pen.

floor onto the handling tool. 2) Time (seconds) to secure the nonambulatory pig on the handling tool. 3) Time (seconds) to move the handling tool with the nonambulatory pig from the start to end pen and remove the pig from the handling tool onto the pen floor. 4) Total time (summation of 1, 2, and 3). Handling tool durability was evaluated for presence of holes, rips, and creases at the conclusion of each handling tool movement. If observed, these were counted and measured (centimeters). During each rest period, comments were solicited from the 2 employees to collect qualitative information.

Animal-based assessment

Pig vocalizations and struggling were scored throughout the nonambulatory pig movement tasks. Pig vocalizations were scored as 0 = none, 1 = intermittent grunts/calls, or 2 = continuous grunts/calls.

Pig struggling was scored as 0 = none, 1 = intermittent movement of the legs and head, or 2 = continuous movement of the legs and head.

Pig temperature, respiration rate, and pig assessment were completed before the pig was placed onto the handling tool and once the pig had been removed from the handling tool and was lying on the floor. Pig temperature (°C) was collected via an infrared thermometer (Extech Dual Laser InfraRed Thermometer) and aimed at the pig's ventral plane. Pig respiration, defined as one inhalation and one exhalation, was counted over 15 seconds by viewing the flank then converted to breaths per minute (bpm). All these measures were collected by one researcher who stayed outside of the pig's flight zone.

Pig assessment included the number of scratches, defined as disruption of the epidermis and derma that did not penetrate to the subcutaneous and included inflammation; number of bruises defined as injury that included discoloration and inflammation of the skin without exposure of underlying tissues; panting indicated by increased respiration rate and open mouth breathing; muscle tremors indicated by shaking; and skin discoloration defined as blotchy or consolidated cyanosis.

Statistical analysis

All statistical analyses were completed using SAS v 9.2 (SAS Institute, Inc). Time (seconds) to place, secure, move from the start to end pen and remove pig from handling tool, and the total time were dependent variables evaluated using PROC UNIVARIATE. All time variables met the assumption of normality and data was analyzed using mixed model methods (PROC MIXED). The statistical design was a complete randomized design with the fixed effect of handling tool (n = 3), and pig weight (kg) as a linear covariate. Pig vocalization and struggle score data were analyzed using PROC FREQUENCY and CHI SQUARE to evaluate vocalization and struggle score distributions by handling tool. Two new variables, change in pig temperature and respiration rate, were created and were calculated using the following equations:

> Change in pig temperature (°C) = end pen nonambulatory pig temperature – baseline pig temperature

> Change in pig respiration rate (bpm) = end pen nonambulatory pig respiration rate – baseline pig respiration rate

Changes in pig temperature and respiration rate were evaluated using PROC UNIVARIATE. Pig temperature and respiration rate changes were normally distributed and data were analyzed using mixed model methods (PROC MIXED). The statistical design for pig temperature and respiration rate change was a complete randomized design with the fixed effect handling tool (n = 3), and pig weight (kg) as a linear covariate. All variables were considered significant at $P \leq .05$. Pig assessment (number of scratches, bruises, any open mouth breathing, muscle tremors, and skin discoloration) and handling tool durability (presence of creases, holes, or rips) are presented descriptively.

Results

All pigs remained in all phases of the study; no pigs were removed for ethical reasons. No pig assessment concerns were identified premovement. No pigs had any of the aforementioned animal-based measures (scratches, bruises, open mouth breathing, or skin discoloration). Immediately post movement, 4 nonambulatory pigs were observed to have muscle tremors in their front limbs consistent with muscle fatigue and typical of pigs undergoing an epidural. Upon completion of this study, all pigs stood and walked normally on 4 legs, after which time they were returned to their home pens.

Time to place the nonambulatory pig from the start pen floor onto the handling tool, to secure the nonambulatory pig on the handling tool, and total time was not affected by the handling tool ($P \geq .12$). There was a trend for time to move the handling tool with the nonambulatory pig from the start to end pen, which included removing the pig from the handling tool and placing them onto the end pen floor ($P = .06$; Table 2).

The ice fishing sled was the most durable with no creases, rips, or holes. The HMH sked rescue system developed 2 creases. The first crease occurred during the first pull and was 1.3 cm in length. The second crease occurred during the sixth (final) pull and was 7.6 cm in length. The revised deer sled developed 2 creases. The first crease occurred during the third pull and was 2.5 cm in length. The second crease occurred during the fourth pull and was 20.3 cm in length.

There were no handling tool differences for pig vocalization or struggle scores when placing a nonambulatory pig from the start pen floor onto the handling tool, securing the nonambulatory pig onto the handling tool, moving the nonambulatory pig on the assigned handling tool from the start to end pen, and removing the nonambulatory pig from the handling tool onto the end pen floor ($P > .10$; Table 3). Change in pig respiration rate and body temperature did not differ between handling tools ($P \geq .71$; Table 2).

Discussion

The objective of this study was to evaluate an HMH sked rescue system, revised deer sled, and ice fishing sled as humane handling tools for moving nonambulatory pigs on a commercial wean-to-finish farm. Anderson et al[7] defined a nonambulatory pig as a pig that is "unable to move or keep up with its contemporaries at the processing plant." Ellis and Ritter[8,9] delineated the nonambulatory pig into 2 categories: 1) fatigued is a pig that is without obvious injury, trauma, or disease and refuses to walk or keep up with their contemporaries at any stage of the marketing process and 2) injured is a pig that displays a compromised ability to ambulate because of structural unsoundness or an injury sustained before or during the marketing process. During the marketing process, approximately 80% of pigs that become nonambulatory are in a state of metabolic acidosis and are classified as fatigued, yet the majority of these pigs will recover fully if given time to rest.[10] The proportion of nonambulatory pigs on farm that recover is unknown.

Although national statistics are not available for the incidence of nonambulatory pigs, a review by Ritter et al[10] reported an incidence rate of 0.63% for nonambulatory pigs during marketing. Before the current study was initiated, a total of 6370 finishing pigs were observed during the marketing process on 5 wean-to-finish farms. However, only one naturally occurring nonambulatory

Table 2: Time and physiological measures assessed when moving a nonambulatory pig by handling tool from the start to end pen on a commercial grow-finish site

	Handling tool			
	HMH sked rescue system	Revised deer sled	Ice fishing sled	*P* value*
Time to complete handling task, mean (SD), s†				
Place	9 (10.2)	28 (10.0)	38 (10.0)	.16
Secure	24 (3.9)	26 (3.9)	15 (3.9)	.12
Start to end	106 (18.3)	121 (18.0)	58 (17.9)	.06
Total	139 (20.6)	175 (20.2)	115 (20.2)	.14
Respiration rate change, mean (SD), bpm‡	11.0 (3.9)	7.0 (3.8)	10.0 (3.8)	.81
Body temperature change, mean (SD), °C‡	0.8 (1.4)	1.9 (1.4)	2.5 (1.4)	.71

* All statistical analyses were completed using SAS v 9 using mixed model methods (PROC MIXED). All variables were considered significant at $P \leq .05$.

† Time to place the nonambulatory pig from the start pen floor onto the handling tool. Time to secure the nonambulatory pig on the handling tool. Time to move the handling tool with the nonambulatory pig from the start to end pen and remove the pig from the handling tool onto the pen floor. Total time was the summation of time to place, secure, and start to end.

‡ Two new variables, change in pig temperature and respiration rate, were created and were calculated using the following equations:

Change in pig temperature (°C) = end pen nonambulatory pig temperature – baseline pig temperature.

Change in pig respiration rate (bpm) = end pen nonambulatory pig respiration rate – baseline pig respiration rate.

Bpm = breaths per minute.

Table 3: Pig vocalization and struggle scores* by handling tool from the start to end pen on a commercial grow-finish site†

	Handling tool, No. of pigs (%)		
	HMH sked rescue system	**Revised deer sled**	**Ice fishing sled**
Vocalization score when placed onto the handling tool			
0	5 (27.8)	2 (11.1)	1 (5.6)
1	1 (5.6)	3 (16.7)	2 (11.1)
2	0 (0)	1 (5.6)	3 (16.7)
Struggle score when placed onto the handling tool			
0	2 (11.1)	3 (16.7)	3 (16.7)
1	4 (22.2)	2 (11.1)	1 (5.6)
2	0 (0)	1 (5.6)	2 (11.1)
Vocalization score when securing pig onto the handling tool			
0	5 (27.8)	2 (11.1)	2 (11.1)
1	1 (5.6)	4 (22.2)	4 (22.2)
2	0 (0)	0 (0)	0 (0)
Struggle score when securing pig onto the handling tool			
0	5 (27.8)	2 (11.1)	3 (16.7)
1	1 (5.6)	3 (16.7)	3 (16.7)
2	0 (0)	1 (5.6)	0 (0)
Vocalization score when moving the pig from the start to end pen and removal from the handling tool			
0	6 (33.3)	4 (22.2)	3 (16.7)
1	0 (0)	2 (11.1)	3 (16.7)
2	0 (0)	0 (0)	0 (0)
Struggle score when moving the pig from the start to end pen and removal from the handling tool			
0	5 (27.8)	4 (22.2)	5 (27.8)
1	1 (5.6)	2 (11.1)	1 (5.6)
2	0 (0)	0 (0)	0 (0)

* Pig vocalizations and struggling were scored throughout the movement tasks. Pig vocalization scores were 0 = none, 1 = intermittent grunts/calls, or 2 = continuous grunts/calls. Pig struggling scores were 0 = none, 1 = intermittent movement of the legs and head, or 2 = continuous movement of the legs and head. Handling tools did not differ ($P > .10$).

† One commercial grow-finish site was used and building and production specifications are provided in Table 1. The sked, revised deer sled, and ice fishing sled each moved 6 different nonambulatory pigs on farm.

pig was observed (0.002%). Therefore, waiting for naturally occurring nonambulatory incidences on farm was ineffective.

A novel nonambulatory pig biomedical model was created; this was an unplanned but significant outcome of the study. Because of the multiple and varied pathways that might lead to a naturally occurring nonambulatory animal, any consistent, controlled, and repeatable model was likely to imperfectly represent one or more natural causes. However, consistent with the principles of the 3 R's, this nonambulatory pig biomedical model strategy allowed for relative comparison of candidate devices with less animal impact by lowering the number of test repetitions necessary to draw conclusions. The epidural procedure affected the motor functions of the hind limbs and resulted in recumbency, therefore, mimicking a nonambulatory pig. It also eliminated the potential to exacerbate pain associated with a naturally occurring cause of nonambulatory status. After viewing vocalization and struggle score results, we question if the epidural procedure inadvertently lowered these scores. Epidural anesthesia refers to the sensory, motor, and autonomic blockade produced by epidural administration of local anesthetics. Lidocaine was used as the local anesthetic and administered into the lumbosacral epidural space, which produced a rapid desensitization of the caudal portions of the abdominal cavity, inguinal area, hind limbs, tail, and perineum.[11] Studies on horses,[12] dogs,[13] cattle, buffalo, and camels[14] have shown the effectiveness of spinal sensory blocks for pain control on the chronically ill and during surgical procedures. Naturally occurring nonambulatory pigs may become overwhelmed by the accumulation of stressors, including pain, and collapse, but may still have sensory function in their hind legs. Pigs used in the study may have had less of a vocalization and struggle reaction when employees were attempting to load and move the pigs onto the handling tools because of too little or lack of sensation in their hind limbs. The immobility and loss of sensation using this model infers that devices which were difficult to use in this study would certainly be expected to fail if the animal was able to move and resist with the hind legs.

Respiration rates increased in all groups and, given the lack of behavioral indicators of stress, may reflect the rising ambient temperature of the facility during the progression of the day. Pig temperatures differed by up to 2.5°C, but were not interpreted as indicators of stress because absolute values did not extend outside the normal range for the age, weight, and environment of the pigs. Most pigs were roused for the study from a resting period on cool concrete allowing for increases that did not exceed the upper limit of the normal range.

Field expertise associated with moving nonambulatory pigs has resulted in several guidance documents. The American Meat Institute recommends using slide boards, sleds, and "cripple carts" to move nonambulatory pigs within meat processing plants.[15] Similarly, the TQA program recommends stretchers, sleds, hand carts, and specialized skid loaders for moving nonambulatory pigs.[2] When nonambulatory pigs occur on farms, the PQA Plus program recommends using plastic sleds or drag mats.[1] Our previous 2 studies compared handling tools to move grow-finish pig cadavers. The first study did not support the use of a modified wean-to-finish mat as a suitable handling tool for manually moving grow-finish pigs. Although the second study did not support the use of a modified deer sled, it did support the use of a sked and deer sled.[4-6]

When comparing placing a pig onto the handling device, the HMH sked rescue system was the fastest (9 seconds) with the ice fishing sled taking an additional 29 seconds. Securing a pig was quickest on the ice fishing sled (15 seconds) with the revised deer sled taking the longest (an additional 11 seconds). There was a trend for the ice fishing sled to move from the start to end pen more quickly (58 seconds) compared to the other 2 handling tools, with the revised deer sled taking an additional 63 seconds. While there was no difference between the 3 handling tools for the total time needed to move between the start and end pens, these results should be interpreted with caution. The time to move from point A to point B are likely dependent on the farm. Grow-finish barn designs can vary by barn layout, differing alleyway width and length, pen and alley flooring, and percentage of dry vs wet manure covering the floor.

All handling tools were durable, with only 2 creases that developed for both the HMH sked rescue system and the revised deer sled. These creases did not cause injury to the pigs, nor did they impair the handling tool functionality.

After study completion, the 2 employees provided a summary describing the strengths and weakness of each handling tool. When moving the nonambulatory pig from the start pen floor onto the handling tool, both employees commented on how the sked's thicker material made loading easier compared to the other 2 handling tools. The flimsiness of the revised deer sled made this process more difficult. As the nonambulatory pigs were moved from the floor into the revised deer sled, some pigs struggled causing the employees to stop and readjust both the handling tool and pig. The ice fishing sled was the most difficult handling tool to move the nonambulatory pig from the start pen floor onto the handling tool because 2 employees were required to successfully complete this task. One employee commented that even when the ice fishing sled was tipped on its side this task was difficult to complete, especially if the pigs struggled. These comments are supported when considering the mean time needed to move the nonambulatory pig from the start pen floor onto the handling tools: sked (9 seconds) vs revised deer sled (28 seconds) vs ice fishing sled (38 seconds).

During the moving process, employees commented that the sked's stiff material would sometimes catch on gates causing sked readjustments, which prevented a smooth forward transition. Depending on the angle from the start pen to alley entrance, or conversely the alley to end pen entry, it was at times difficult to turn the sked. Both employees supported the sked handle placement and remarked that the sked pulled more evenly than the revised deer sled. For the revised deer sled, the material was easier to manipulate and the restraints worked well and could be adjusted so that the pig was safely cocooned inside. The ice fishing sled had the smoothest transition when moving from the start to the end pen. A negative to the ice fishing sled was related to its smaller size where it was noted that a heavier pig may not fit well onto this handling tool. These comments are supported by comparing the mean duration to move from the start pen to the end pen (ice fishing sled [58 seconds] vs revised deer sled [121 seconds]). Another susceptible animal group are those that cannot ambulate when injured. If the caretaker ethically determines that the prognosis of recovery is high, they may need to move this injured pig. It is hypothesized that these handling tools show promise and it would be prudent to test them with injured pigs on farm.

The purpose of this study was to determine if the sked, revised deer sled, and ice fishing sled could be suitable handling tools to move live nonambulatory pigs on farm. This novel study demonstrates that these 3 handling tools are suitable for

on-farm movement of a nonambulatory pig. Pigs were easy to secure, they did not struggle and vocalize, and the caretaker could move them quickly. These tools could be considered for inclusion in both the PQA Plus and TQA programs as humane handling tool options for nonambulatory pigs on farm.[16,17]

Implications

Under the conditions of this study:

- Pigs were easy to secure, did not struggle, and had minor physiological changes.
- All 3 handling tools were humane options to move nonambulatory grow-finish pigs.
- All 3 handling tools should be considered for the US industry's programs.

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Conflict of interest

None reported.

Disclaimer

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Maximizing value and minimizing waste in clinical trial research in swine: Selecting interventions to build an evidence base

Jan M. Sargeant, DVM, PhD, FCAHS; Annette M. O'Connor, BVSc, DVSc, FANZCVS; Terri L. O'Sullivan, DVM, PhD; Alejandro Ramirez, DVM, MPH, PhD, DACVPM

Summary

Researchers conduct a trial to compare an intervention of interest to a comparison group. Initially, researchers should determine whether a trial is evaluating superiority, equivalence, or noninferiority. This decision will guide the choice of a placebo versus active comparison group. Interventions, as well as baseline management, should be comprehensively reported to allow replication or clinical application. It is necessary to build a body of evidence across multiple trials to apply evidence-based decision-making. To achieve this, at least one intervention in every trial should be an intervention that has been used in at least one previously published trial.

Keywords: swine, clinical trial, evidence, interventions, linking networks

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Resumen - Maximizar el valor y minimizar el desperdicio en la investigación de ensayos clínicos en cerdos: Selección de intervenciones para construir una base de evidencia

Los investigadores realizan un estudio para comparar una intervención de interés con un grupo comparativo. Inicialmente, los investigadores deben determinar si un ensayo está evaluando la superioridad, la equivalencia, o la no inferioridad. Esta decisión guiará la elección de un placebo versus grupo la comparación activa de grupo. Las intervenciones, así como el manejo basal, deben informarse íntegramente para permitir la replicación o la aplicación clínica. Es necesario construir un cuerpo de evidencia a través de múltiples estudios para aplicar la toma de decisiones basada en evidencia. Para lograr esto, al menos una intervención en cada estudio debe ser una intervención que se haya utilizado en al menos un estudio publicado anteriormente.

Résumé - Maximiser la valeur et minimiser le gaspillage en recherche lors d'essais cliniques chez le porc: Sélectionner des interventions pour constituer une base de données probantes

Les chercheurs effectuent des essais afin de comparer une intervention d'intérêt à un groupe de comparaison. Au départ, les chercheurs devraient déterminer si l'essai vise à évaluer la supériorité, l'équivalence, ou la non-infériorité. Cette décision guidera le choix du placebo versus le groupe actif de comparaison. Les interventions, ainsi que la gestion de base, devraient être rapportées de manière exhaustive afin de permettre la reproduction ou l'application clinique. Il est nécessaire de constituer un ensemble de preuves à partir de multiples essais afin de mettre en place la prise de décisions fondée sur des preuves. Pour y parvenir, au moins une intervention dans chaque essai devrait être une intervention qui a été utilisée dans au moins une autre étude publiée précédemment.

In swine health and production, as in veterinary medicine in general, there is increasing emphasis on the use of evidence to inform decisions related to health and management. This evidence comes from research.[1] However, in the biomedical research field, it has been estimated that 85% of the research that is conducted is wasted (ie, not useful) because the questions asked are not relevant, the design and methods are inadequate, full reports are not accessible, or the results are biased or unusable.[2] The extent of research wastage is unknown and may be an issue in swine research, or whether there are ways the research community can better maximize the value of our research. However, a consideration of this issue and reflection on how we as a research community can maximize the value of our research is warranted.

In this commentary, we focus on clinical trials intended to assess the efficacy of an intervention to prevent or treat a clinical problem or to improve productivity, although the concepts have applicability to all study designs and research questions. Of the primary research designs, well-conducted clinical trials provide the highest level of evidence for evaluating the efficacy of an intervention when it is ethical and feasible to allocate study subjects to intervention groups.[3,4] A hallmark of a clinical trial is the use of a comparison group. A comparison group, which may be a placebo or another intervention, allows the investigator

JMS, TLO: Department of Population Medicine, Ontario Veterinary College, University of Guelph, Guelph, Ontario, Canada.

AMO: Department of Large Animal Clinical Sciences, College of Veterinary Medicine, Michigan State University, East Lansing, Michigan.

AR: University of Arizona College of Veterinary Medicine, Oro Valley, Arizona.

Corresponding author: Dr Jan M. Sargeant, 2536 Stewart Building, Ontario Veterinary College, University of Guelph, 50 Stone Road East, Guelph, Ontario, Canada N1G 2W1; Tel: 519-824-4120 Ext. 54045; Email: **sargeanj@uoguelph.ca**.

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to distinguish between the impact of the intervention on outcomes (preselected factors that are hypothesized to be a result or consequence of the intervention) versus other factors, such as the natural progression of disease, veterinarian or producer expectations, or other interventions.[5]

In designing a clinical trial, the selection of intervention and comparator groups is of paramount importance. An individual researcher may select an intervention because they are interested in evaluating the efficacy of that specific intervention. However, researchers also should consider the potential for the results of the trial to contribute to building a body of evidence for the prevention or treatment of a clinical problem or productivity issue. This does not restrict the selection of the intervention of interest. Rather, the selection of the comparison group(s) can impact the larger usability of the trial in contributing to a body of evidence. Selecting interventions to build a body of evidence will be the focus of this article. The intention is to focus on principles of trial design, and not drug regulatory requirements.

Defining the trial purpose and intervention type

Prior to selecting the comparison group(s), the trial purpose should be determined. A trial may be intended to evaluate whether the intervention of interest is superior to another intervention (superiority), has the same efficacy as another intervention (equivalence), or is not worse than another intervention (noninferiority).[6,7] With a superiority trial, the null hypothesis is that there is no difference between the intervention groups; therefore, the alternative hypothesis is that the intervention groups differ. With an equivalence design, the null hypothesis is that the interventions differ by at least a prespecified amount, with the alternative hypothesis being that there is no difference between the interventions. A new intervention that has equivalent efficacy to an existing intervention still may be preferable based on cost, few side effects, easier dosing,[8] or shorter withdrawal time for livestock. Finally, for a noninferiority trial, the null hypothesis is that the intervention of interest is worse than the comparator by more than a margin of noninferiority (a predetermined acceptable difference) and the alternative hypothesis is that the intervention of interest is not worse than the comparator by the margin of noninferiority.[6,9] The decision on the study purpose is important, as it will impact the required sample size and the analysis and interpretation of the trial results. Typically, superiority trials have the smallest sample size, followed by noninferiority trials, with equivalence trials having the largest required sample size.[6] The use of intention to treat (ITT) versus per-protocol (PP) analysis also will differ. With ITT analysis, individuals remain in the group to which they were originally allocated, regardless of whether they completed the intervention as intended. With PP analysis, individuals are only included in an intervention group if they completed the intervention protocol as intended. Therefore, PP analysis reflects the biological efficacy of an intervention whereas ITT analysis relates to the real-world effectiveness, where not all individuals comply with or complete the exact intervention protocol. While ITT is the recommended approach to analysis of superiority trials, both ITT and PP analysis should be conducted for noninferiority and equivalence trials.[6-8]

Based on common statistical approaches and narrative interpretations of trial results provided by authors, it might reasonably be assumed that most trials in the swine literature are intended to evaluate superiority. However, explicit reporting of the trial purpose is uncommon. A word search of 179 clinical trials from 146 articles included in a recent systematic review and network meta-analysis of vaccinations for bacterial respiratory diseases in swine[10] revealed that none of the studies were explicitly described by the authors as superiority trials. Two of the trials were described by the authors as intending to evaluate equivalence of interventions[11,12] and the authors of one trial stated in the discussion section that the primary aim was to evaluate noninferiority.[13] Additional examples in the swine literature include a noninferiority trial comparing antibiotic treatments for *Actinobacillus pleuropneumoniae* in growing-fattening pigs in Europe[14] and an equivalence trial evaluating concurrent vaccinations for respiratory illness.[15]

The trial purpose also has implications for the type of comparison group, specifically to whether a placebo or an active intervention is the appropriate comparator. Using a placebo, sham, or nontreated control as the comparison group allows the investigator to evaluate whether an intervention is better than nothing. Thus, placebo comparators only make sense for trials intended to evaluate superiority. In the initial stages of identifying efficacious interventions for a clinical problem, there may not be any interventions that have consistently been shown to be superior to a nonactive control. In this instance, the use of placebo comparison groups may be appropriate. However, using placebo controls often does not address a question of interest to producers and veterinarians who generally want to know what product to use rather than whether to treat or prevent at all. Additionally, if an efficacious alternative is available, it may be inconsistent with animal welfare concerns and uneconomical to expose animals to a placebo control.[5,16] Unless there is previous empirical evidence that another intervention is consistently superior to a placebo, the results of head-to-head comparisons of active ingredients are not interpretable; if two interventions are found to be equivalent (or a new intervention is found to be noninferior), it is possible that both are highly efficacious or that both are not efficacious at all.[9,17,18] In addition, if multiple intervention options exist, researchers planning trials designed to evaluate noninferiority or equivalence might use the least efficacious alternative intervention as the comparator. This could potentially lead to progressively less efficacious interventions being identified as equivalent or noninferior, a phenomenon referred to as "biocreep."[8,18] Although more costly to perform, a viable option to consider is to add a placebo arm to a trial. For example, if the intention was a pairwise comparison of the intervention of interest to an intervention known to be efficacious, adding a placebo arm will ensure confirmation of the superiority of the comparator in the study population.[17] The sample size required for the superiority comparison will be less than the equivalence comparison, so the additional cost may be manageable.

Defining the intervention

When writing the report of a clinical trial, it is essential that the intervention groups are described in sufficient detail to allow replication. The REFLECT-statement reporting guidelines for clinical trials in livestock, highlighted in the instructions to authors by the *Journal of Swine Health and Production*, recommend that a trial report include "precise

details of the interventions intended for each group, the level at which the intervention was allocated, and how and when interventions were actually administered."[19] The REFLECT-statement explanation and elaboration document provides an example of comprehensive intervention reporting, as well as further information on the detail needed to allow for replication.[20] Moura et al[21] compared the completeness of reporting of REFLECT-statement items in clinical trials in swine prior to and after publication of the REFLECT-statement. The clinical trials included in this evaluation were published in 1 of the 5 journals that had published the REFLECT-statement (*Journal of Swine Health and Production*, *Preventive Veterinary Medicine*, *Journal of Food Protection*, *Journal of Veterinary Internal Medicine*, and *Zoonoses and Public Health*). After publication of the REFLECT-statement, 79% the intervention groups were fully described in the evaluated swine trials compared to 67% prior to publication. The improvement is encouraging; however, this still means that reporting of interventions is not comprehensive in approximately 1 in 5 trials. In addition to the REFLECT-statement, expanded guidelines on reporting of active interventions (TIDieR guidelines)[22] and reporting of placebo groups (TIDieR-Placebo)[23] in the human healthcare literature are available and may provide additional guidance for complete reporting of interventions.

A further consideration when describing interventions is the baseline management used in the herd(s) enrolled in a trial. Swine management of important health outcomes often is multifaceted; for instance, there may be a vaccination protocol in place for respiratory illness in a herd that is participating in a clinical trial on metaphylactic antibiotic use to control respiratory disease. Interventions compared to no intervention in the absence of other management practices (such as vaccination) may appear more efficacious than if the comparison was made in a population with other standard industry practices in place. Similarly, it may be important to know about management practices more broadly used to control multiple diseases, such as all-in all-out management. If all trials on an intervention have been conducted in all-in all-out herds, the results may not be as applicable to herds with continuous flow systems. This is more critical when comparing across swine production regions or systems where common production practices can be quite variable. Therefore, to allow the reader to interpret the trial results, it is important that baseline management practices that all trial animals have been exposed to are completely described.

Building a body of research by linking interventions

A final consideration moves beyond the design of a single trial to the building of a body of evidence that can be used for evidence-informed decision-making. Replication is a hallmark of science; trials evaluating the efficacy of the same intervention may reach different conclusions and it is not uncommon for highly cited clinical research showing efficacy of interventions to subsequently be contradicted.[24] Results from a single trial are based on a sample of study subjects. Therefore, it would be expected that different samples of animals from the same target population would lead to somewhat different study findings due to chance (sampling error).[25] In addition to the statistical argument for replication, there is a scientific argument wherein the efficacy of interventions is more likely to be correctly identified if the results have been seen in multiple trials with the same interventions and outcomes evaluated under similar conditions and in similar populations.[25,26]

When making clinical decisions, the relative (comparative) efficacy of all available intervention options is of interest; veterinarians and producers usually want to know which intervention is best, rather than whether to use any one specific intervention. Network meta-analysis is an extension of meta-analysis wherein relative efficacy can be estimated for all interventions for a specific condition and outcome.[27,28] However, to estimate relative efficacy in a network meta-analysis, at least one intervention arm in the trial needs to have been evaluated in at least one other trial with the same outcome. As a case study to explore this issue in swine health, Figures 1 and 2 were created using data from a systematic review of preventive antibiotics for respiratory disease in swine[29] to illustrate the relationships between the interventions in the included trials. Each node represents an intervention used in at least one trial, with the lines between nodes illustrating the comparisons between interventions that were evaluated in the trials. Figure 1 shows the network of each unique intervention as described by the trial authors; for instance, if a trial compared high dose to low dose for the same antibiotic or if different modes of administration for a single antibiotic were compared, these were considered as unique interventions. The majority of comparisons were to a nonactive control (the green central node in the larger cluster of interventions), with very few head-to-head comparisons outside of a single trial. In addition, there were 8 head-to-head comparisons with no replication (the 2-node clusters not connected to the larger cluster) and therefore no possibility of estimating the efficacy of these interventions compared to other interventions that had been evaluated in the literature. In Figure 2, interventions were amalgamated, such that each node represents an antibiotic, with all doses and routes of administration for each antibiotic combined into a single intervention. When interventions were combined in this manner, there was only one trial that did not have a common intervention arm with any other trial. There also was more replication and more connections between the interventions. However, considerable detail on the efficacy of each unique intervention was lost by combining different doses and routes of administration together. End-users may also have concerns about the assumptions made to amalgamate interventions into a single intervention ie, different doses and baselines representing the same intervention. To maximize the value of individual trials, consideration should be given to designing trials to ensure that at least one intervention in their trial has been included in a previous trial (preferably with the same parameters, eg, the same dose and route of administration), so that a comparative body of evidence can be developed over time.

Where to go from here

Researchers select an intervention to evaluate in a clinical trial because they are interested in exploring whether the intervention is efficacious in preventing or treating a condition of interest. However, by carefully considering the comparison groups that are selected, the results of the trial can contribute to the larger body of evidence on the prevention or treatment of the condition of interest. For instance, in Figure 2, the inclusion of a nonactive intervention group in the trial that did not connect to the network would have allowed that

Figure 1: Network of interventions used in trials evaluating the efficacy of preventive antibiotics for respiratory disease in swine[29] where each node represents a unique intervention.

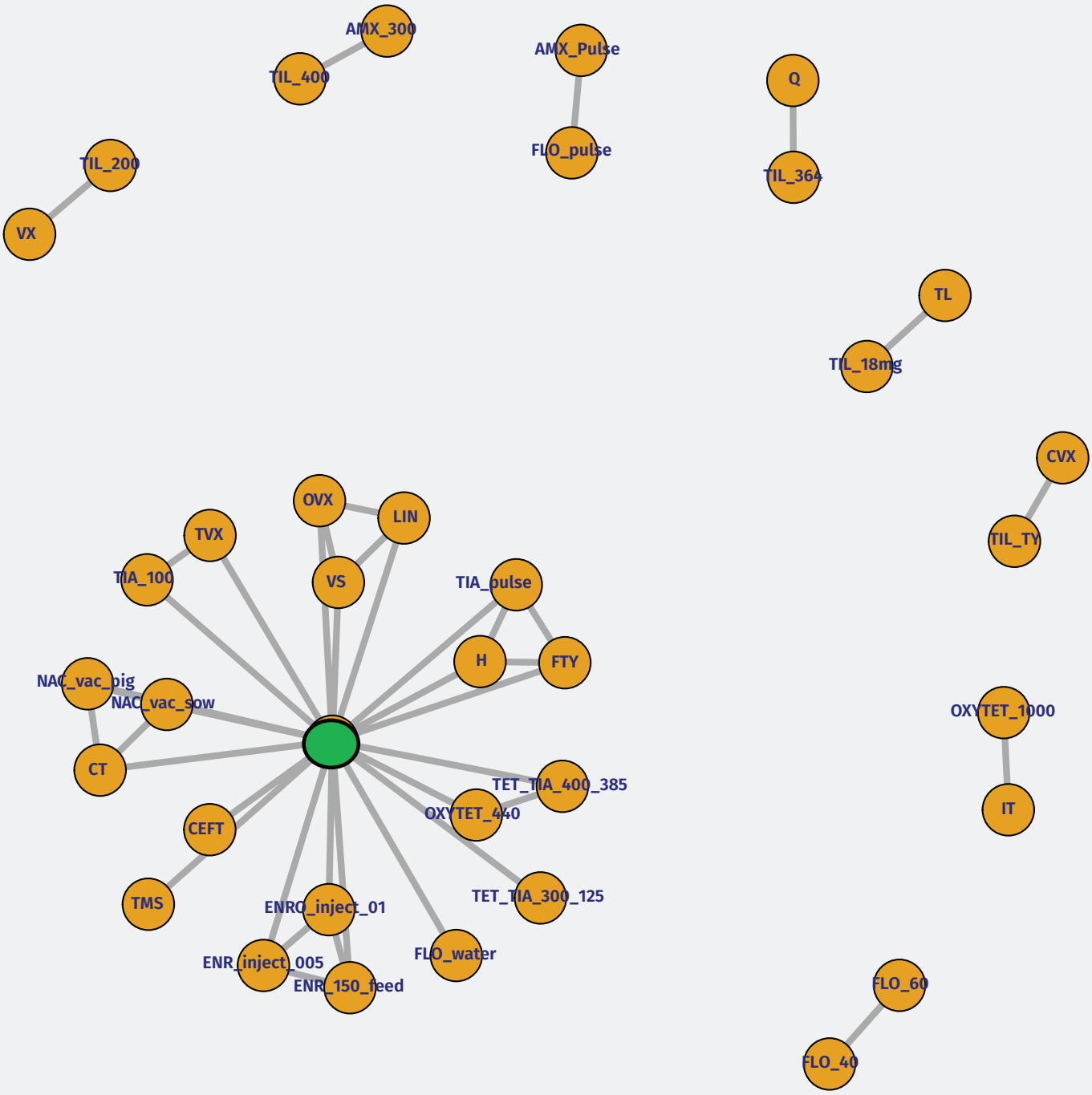
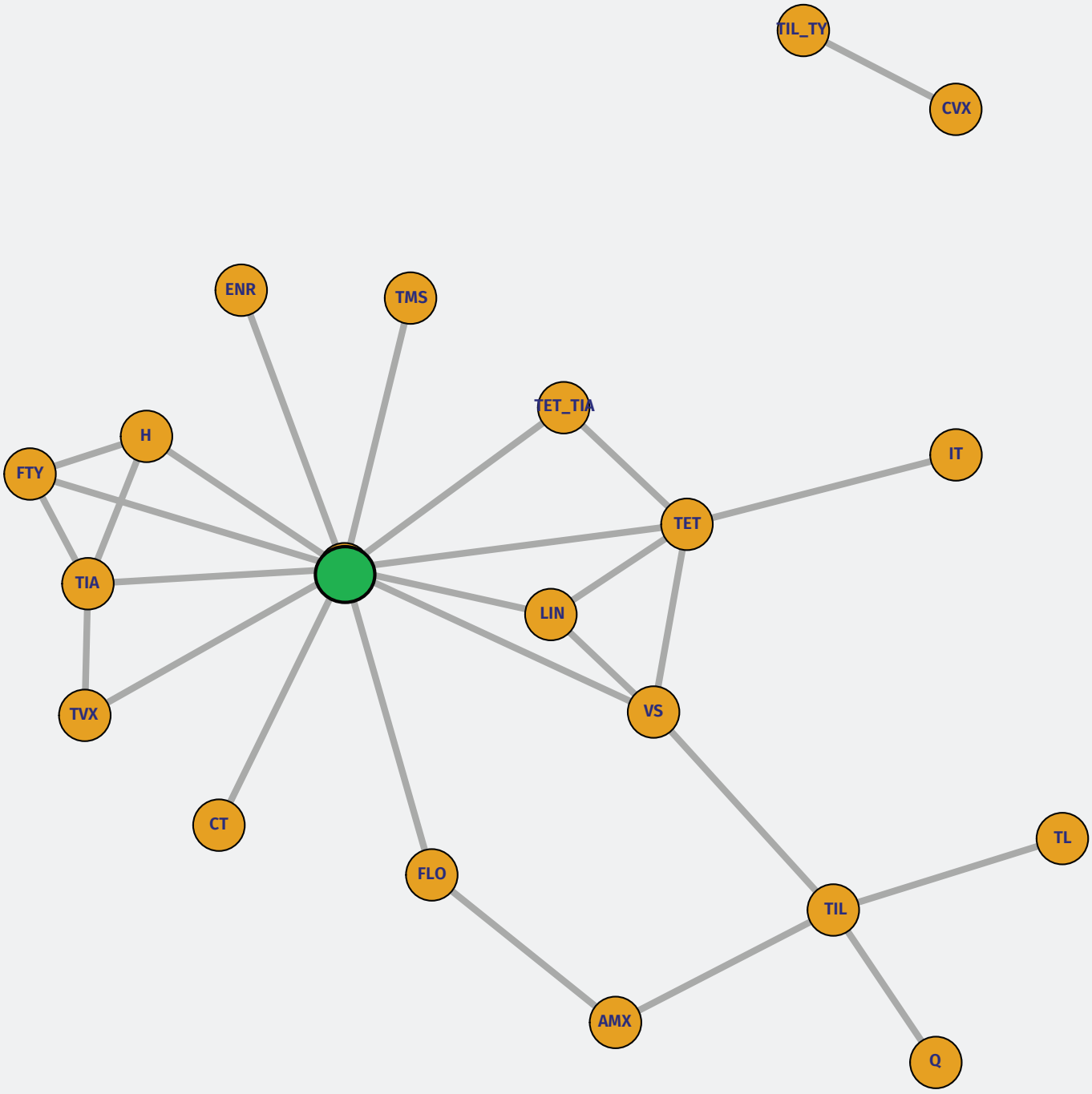


Figure 2: Network of interventions used in trials evaluating the efficacy of preventive antibiotics for respiratory disease in swine[29] where each node represents an antibiotic, with different doses or modes of administration combined into a single intervention.



trial to be linked into the larger body of literature. The appropriate comparison group will vary over time, as more research on efficacious interventions for a given outcome becomes available. Initially, superiority trials comparing a new intervention to a placebo are appropriate. As efficacious interventions are identified, head-to-head comparisons using superiority, equivalence, or noninferiority approaches may be employed. Determining whether an efficacious intervention exists may require a search of the literature and evaluation of multiple trials if no systematic review is available on the topic of interest. However, systematic reviews are increasingly being published in the veterinary literature; a scoping review of systematic reviews and meta-analyses related to animal health, performance, or on-farm food safety identified 240 systematic reviews involving swine.[30]

Regardless, at least one intervention arm in a clinical trial should have been evaluated in a previously published report, to allow linking of trials across all intervention options. Systematic reviews, meta-analyses, and network meta-analyses provide useful information of whether there are interventions shown to be superior to a placebo and on the interventions that have been evaluated for researchers designing a clinical trial. Network meta-analysis provide information on all possible interventions evaluated in the literature for a given outcome. However, these review types are still relatively uncommon in swine health; there are two network meta-analyses published on swine respiratory illness that provide intervention maps detailing all of the intervention groups that have been evaluated in the literature for that topic,[10,31] a mixed treatment meta-analysis for porcine circovirus type 2 vaccines,[32] and a network meta-analysis on antibiotic alternatives.[33] Thus, until more network meta-analyses are conducted, it may be necessary for researchers to conduct a scan of the literature to determine what intervention comparisons have been conducted and to select an intervention group in common with at least one other trial. Ultimately, selecting intervention groups with a view to building a body of evidence will benefit the entire industry, will enhance clinical decision-making by practitioners, and will also improve the health and welfare of swine.

Implications

- Existing efficacious interventions will guide trial purpose and comparison group type.
- Complete description of interventions and baseline management is essential.
- Linking interventions with other published trials builds a body of evidence.

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Conflict of interest

None reported.

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Evaluation of biosecurity measures on a swine operation using Glo Germ powder as a visible learning aid

Olivia L. Harrison, BS; Payton L. Dahmer, MS; Jordan T. Gebhardt, DVM, PhD; Chad B. Paulk, PhD; Jason C. Woodworth, PhD; Cassandra K. Jones, PhD

Summary

Glo Germ powder was used to determine the efficacy of common biosecurity practices to prevent the powder from spreading to other areas within a farm. Pictures from 4 locations were taken before and after personnel movement to observe any differences in Glo Germ coverage. The percentage of Glo Germ coverage observed in the pictures was evaluated by 47 panelists and averaged. The area without biosecurity measures had more Glo Germ coverage than the 3 areas with biosecurity measures ($P < .001$). The use of Glo Germ can be used as a learning aid to demonstrate the efficacy of common biosecurity practices.

Keywords: swine, biosecurity, teaching aid

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Resumen - Evaluación de las medidas de bioseguridad en una operación porcina usando Glo Germ en polvo como un apoyo visible de entrenamiento

El polvo Glo Germ se utilizó para determinar la eficacia de las prácticas comunes de bioseguridad para evitar que el polvo se disemine a otras áreas dentro de una granja. Se tomaron fotografías de 4 ubicaciones antes y después del movimiento del personal para observar cualquier diferencia en la cobertura del Glo Germ. El porcentaje de la cobertura del Glo Germ observado en las imágenes fue evaluado por 47 panelistas y promediado. El área sin medidas de bioseguridad tuvo mayor cobertura del Glo Germ que las 3 áreas con medidas de bioseguridad ($P < .001$). El uso del Glo Germ se puede utilizar como un apoyo de entrenamiento para demostrar la eficacia de las prácticas comunes de bioseguridad.

Résumé – Évaluation des mesures de biosécurité sur une ferme porcine en utilisant la poudre Glo Germ comme support visible d'apprentissage

La poudre Glo Germ a été utilisée pour déterminer l'efficacité de pratiques de biosécurité usuelles à empêcher la poudre de disséminer à d'autres endroits à l'intérieur d'une bâtisse. Des images en provenance de quatre endroits ont été prises avant et après le mouvement du personnel afin d'observer des différences dans la couverture par le Glo Germ. Le pourcentage de couverture par le Glo Germ observé dans les images a été évalué par 47 panélistes et la moyenne calculée. L'endroit sans mesure de biosécurité avait plus de couverture par le Glo Germ que les trois endroits avec des mesures de biosécurité ($P < .001$). L'utilisation de Glo Germ peut être employée comme support à l'apprentissage pour démontrer l'efficacité de pratiques usuelles de biosécurité.

Farm biosecurity is an integral aspect of maintaining herd health. Movement and isolation of animals, human traffic, and pests can all pose a risk of a biosecurity infraction. Viruses, such as porcine reproductive and respiratory syndrome virus, can be transferred from boots to vehicles and to other farms.[1,2] Under simulated conditions, lax biosecurity measures have been shown to increase the spread of porcine epidemic diarrhea viruses compared to rigorous biosecurity measures, such as showers and changing clothes.[3]

Upholding the health of the farm is reliant on the ability of workers to continuously implement existing biosecurity protocols. Lapses in biosecurity compliance, especially in times of perceived low infection risk or during worker shortages, can cause biosecurity breaches. During simulated games, players were more likely to break biosecurity to earn a higher payout when they were more certain animals would not become infected.[4,5] Frequent biosecurity breaches were observed when 8 poultry farms were surveyed using hidden cameras. During the surveillance time, 44 types of biosecurity errors were made, with 2 to 7 errors occurring per day per farm.[6] Biosecurity breaches tend to happen when personnel rush through work and are often done unintentionally.

OLH, PLD, JCW, CKJ: Department of Animal Sciences and Industry, Kansas State University, Manhattan, Kansas.

JTG: Department of Diagnostic Medicine/Pathobiology, Kansas State University, Manhattan, Kansas.

CBP: Department of Grain Science and Industry, Kansas State University, Manhattan, Kansas.

Corresponding author: Dr Cassandra K. Jones, 133 Weber Hall, Manhattan, KS 66506; Tel: 785-532-5289; Email: **jonesc@ksu.edu**.

This article was derived from Olivia Harrison's MSc thesis, Kansas State University, Manhattan, Kansas.

Harrison OL, Dahmer PL, Gebhardt JT, Paulk CB, Woodworth JC, Jones CK. Evaluation of biosecurity measures on a swine operation using Glo Germ powder as a visible learning aid. *J Swine Health Prod*. 2022;30(6):362-366. **https://doi.org/10.54846/jshap/1289**.

It is difficult for employers to visually demonstrate a biosecurity breach when teaching new employees or visitors without endangering animal health.

Glo Germ Company manufactures fluorescent gels and powders which can simulate germs or other contaminants under ultraviolet (UV)-A light. Glo Germ has been used in research settings to compare handwashing techniques and as a demonstration for aseptic technique in hospitals.[7,8] Spreading Glo Germ throughout a deli revealed areas of cross-contamination between the original equipment and the doors, meat products, and prep equipment.[9] Similarly, Glo Germ has been used to evaluate biosecurity exit protocols when applied to lab coats and gowns and has been used on farms to demonstrate lines of separation.[10-12] The different applications have all demonstrated Glo Germ's ability to be used as a teaching aid to improve biosecurity aptitude of individuals and the opportunity for continued use in swine facilities to teach biosecurity principles. Therefore, the objective of this study was to use Glo Germ within a swine operation to demonstrate the efficacy of common biosecurity protocols and be used as a visible teaching aid for future students and farm personnel.

Materials and methods

The Kansas State University Institutional Review Board approved the protocol used in this experiment. The study was conducted concurrently with the spring 2021 swine undergraduate research class (UGR). Prior to the start of the trial, all undergraduate students were taught the biosecurity protocols of the farm. Students were not made aware how the biosecurity protocols were being evaluated or why there was powder in key areas throughout the farm.

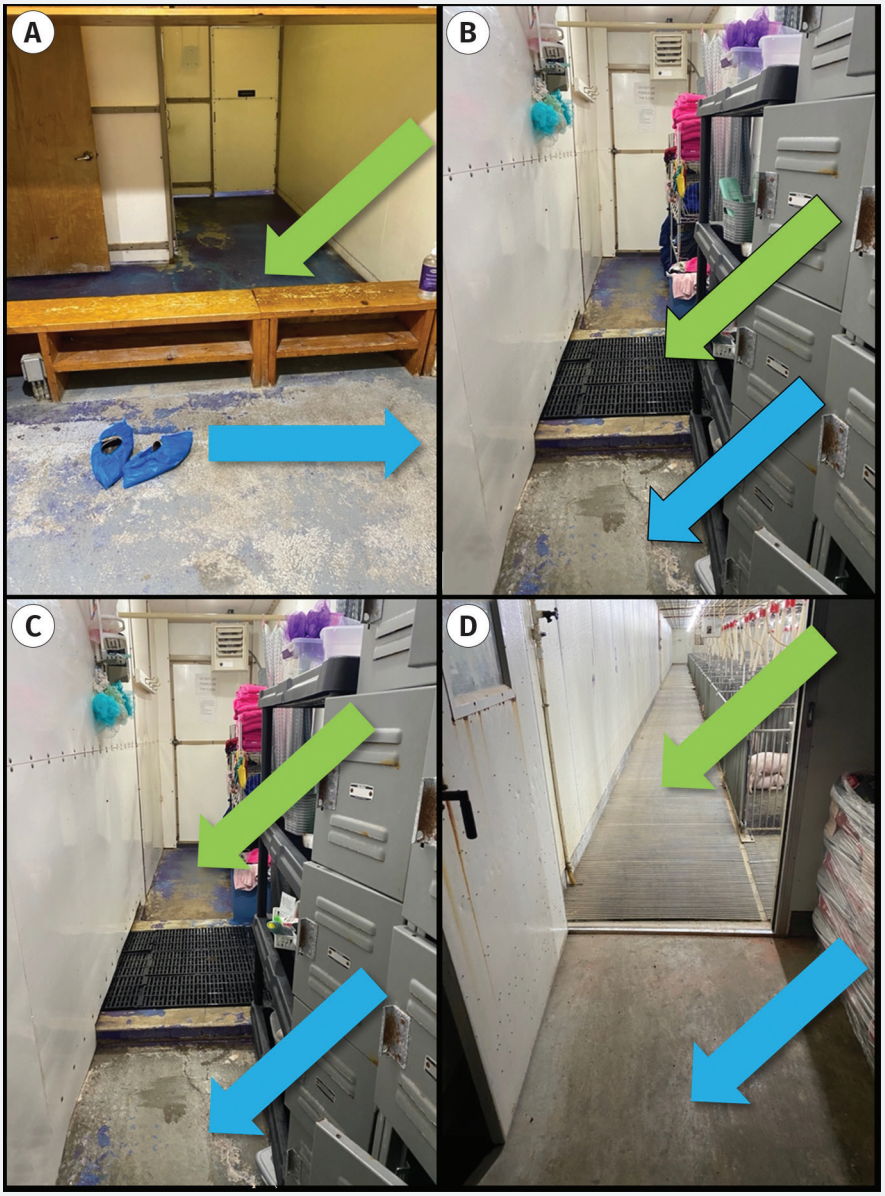
Glo Germ coverage

Four different locations at the Kansas State University Swine Teaching and Research Center were photographed weekly for 7 weeks to assess the efficacy of the biosecurity measures to prevent movement of the Glo Germ powder (Glo Germ Company). All pictures were taken on a standard iPhone mounted on a polyvinyl chloride (PVC) frame with attached blacklights (Figure 1) which could be transported to each location. The PVC frame measured 2 × 2 × 2 ft and was wrapped in a large black trash bag to block the surrounding light. Two UV light-emitting diode flashlights (Rayovac; Energizer Brands, LLC) were mounted equal distance apart on the center beam of the frame. Markers were placed on the flooring to align the PVC frame to ensure consistency when photographing the locations.

The biosecurity measures tested were 1) entry benches, 2) showering into a farm, and 3) no biosecurity measures (control). The locations used to test these measures were 1) the clean side of the entry bench into the farm, 2) the flooring within the shower, 3) the clean side of the locker room after completing the required shower, and 4) within the barn (Figure 2). Glo Germ was spread in areas preceding the clean areas such as outside the entry door, the dirty side of the locker room, and the feed room used in the barn. The clean areas were cleared of any remaining Glo Germ from the prior week on the evening before the UGR's weekly weigh day, and photographs were taken of these areas to serve as "before" pictures. Floors in the locker room and entry area were cleaned with a Swiffer WetJet (Procter & Gamble Company), while the floors in the barn were cleared with paper towels and a spray disinfectant. All cleaned areas were exposed to UV lights to ensure no Glo Germ remained in the testing area; if any remained, cleaning was repeated. Following student entry onto the farm, "after" photographs were taken of the same areas. These before and after pictures were blindly evaluated by 47 panelists to determine the quantity of Glo Germ coverage visible within each photograph on a scale from 0% to 100% coverage; each picture was assessed once per panelist. Panelists were provided photographs with examples of 0% and 70% Glo Germ coverage within each location to use as a reference. The assessed quantity of visible Glo Germ was then averaged across all panelists so that each photograph was represented by

Figure 1: Image of PVC frame with attached blacklights used to photograph Glo Germ coverage.

Figure 2: Glo Germ was spread (dirty areas; blue arrows) and coverage was measured (clean areas; green arrows) in 4 locations on the farm. A) Glo Germ was spread on the walkway into the building and coverage measured on the clean side of the entry bench into the farm. Glo Germ was spread on the dirty side of the locker room and coverage was measured on the B) the shower floor and C) clean side of the locker room. D) Glo Germ was spread in the feed room of the barn and coverage measured on the flooring immediately following.



a single value. Before and after Glo Germ means were then aligned and the difference between the means for each location within a day was calculated. These mean differences represent the increased quantity of Glo Germ visible between the before and after pictures.

Statistical analysis

Data were analyzed using a linear model fit using the GLIMMIX procedure of SAS v 9.4 (SAS Institute Inc). Location on a given day was the experimental unit, and data were analyzed as the mean change in before and after panelist-assigned Glo Germ coverage at each location on each day of evaluation. Location was considered a fixed effect in the statistical model. Least squares means were reported using a Tukey multiple comparison adjustment.

Results

The control location had increased Glo Germ coverage compared to the 3 other locations ($P < .001$), as would be expected considering no biosecurity measures were in place to prevent movement of Glo Germ onto the surface evaluated. The 3 locations with biosecurity measures in place did not have increased Glo Germ coverage above 1% following movement of students through the 3 locations. The mean difference in Glo Germ coverage of the control location, however, was 19.5% across the 7 weeks (Figure 3). There was no evidence of a difference in Glo Germ coverage between the entry bench, shower floor, or clean side of the shower ($P > .05$).

Due to the subjective nature of the panelists, there was some variation between the Glo Germ coverage scores. The SEM for the entry bench, shower floor, and clean side of the shower were less than half a percent different from the mean (0.46%, 0.43%, and 0.28%, respectively). Glo Germ coverage for the control location was greater than the other locations with an SEM of 2.97%.

Visual evidence of a biosecurity breach was apparent during week 2 of this experiment. Figure 4A is the floor of the clean side of the locker room prior to any student and personnel movement. Figure 4B is of the same area after a biosecurity breach with increased visible coverage of orange Glo Germ. In contrast, Figure 4C shows the same location from week 3 with little to no visible Glo Germ after all student and personnel successfully showered through and stopped the spread of Glo Germ.

Discussion

Fomites, such as boots and coveralls, have been identified as sources of viral transmission in previous studies.[3,13,14] These studies found that a lack of handwashing and not changing clothing and shoes between groups of animals led to infection and cross-contamination of pathogens. However, like most viral work, the research was conducted in a biosecure facility and is hard to replicate on a commercial farm or alongside farm personnel.

Implementing Glo Germ at the farm allowed students and personnel to see the difference biosecurity measures can make in reducing pathogen

Figure 3: The mean increase in Glo Germ coverage before and after personnel traffic on a swine farm. A higher percentage represents more Glo Germ visible after personnel movement. The control area had no biosecurity measures. Means with differing superscripts differ significantly ($P < .05$).

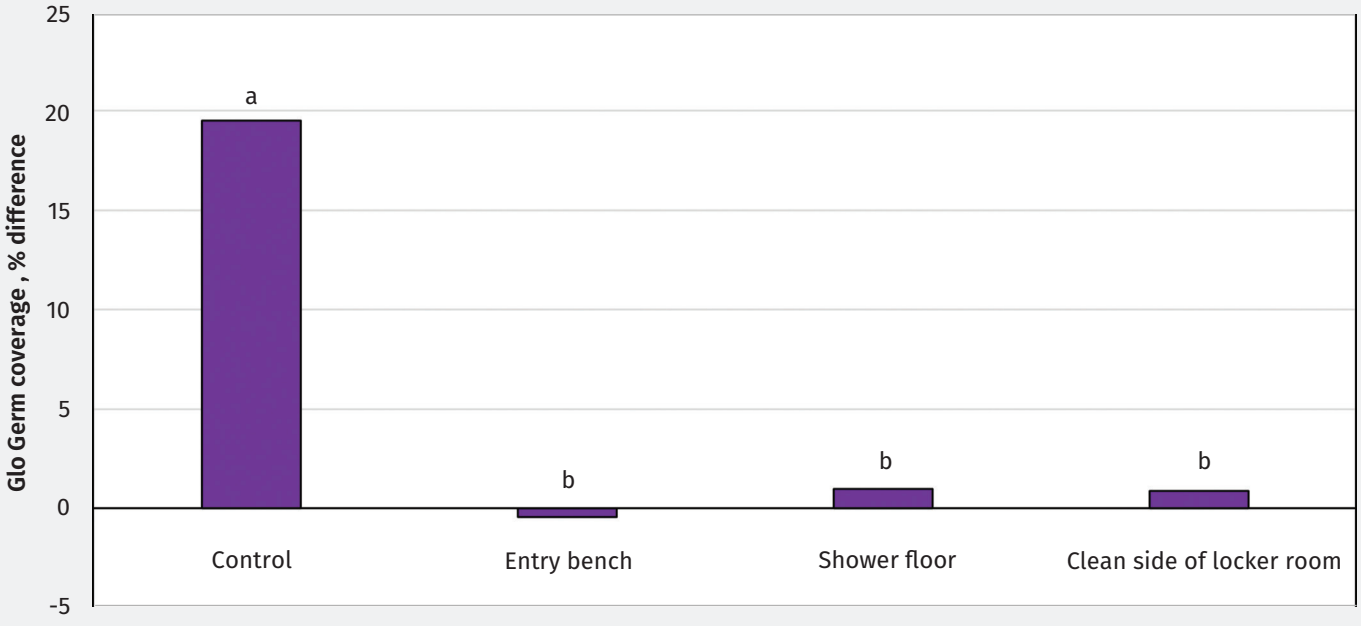
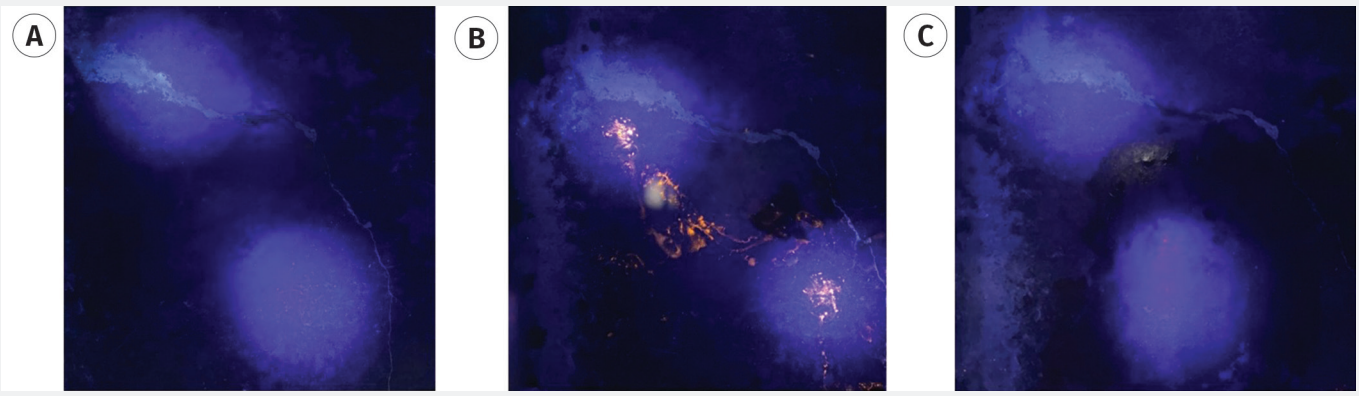


Figure 4: A biosecurity breach was observed on the swine operation. Glo Germ powder was orange in this location. A) The clean side of the locker room before student and personnel movement in week 2. B) Clean side of the locker room after student and personnel movement in week 2. C) Clean side of the locker room after student and personnel movement in week 3.



introduction. In the control location, increased quantities of Glo Germ could be seen without UV light and could be tracked throughout the barn. However, areas where biosecurity measures were followed greatly reduced the quantity of visible Glo Germ and predominantly stopped the spread of Glo Germ altogether. Similarly, Anderson et al[11] included an entry bench prior to the showers at a commercial swine farm and saw reduced coverage of Glo Germ beyond the bench and no visible Glo Germ after the bench and shower. Julien and Thomson[15] also used Glo Germ as a teaching aid for poultry producers. Producers were impressed that Glo Germ provided a quick visual and efficiently demonstrated the gaps in biosecurity.

One biosecurity breach was observed during our trial. Glo Germ was observed on the clean side of the locker room following the shower. It was most likely due to personnel undressing on the dirty side of the locker room, stepping through the Glo Germ powder, walking across the shower without washing off, and stepping onto the clean side. The reason for this breach is largely unknown but could have been caused by someone rushing into the farm late or assuming they were not at risk for bringing pathogens onto the farm and decided to skip the shower. Time constraints have previously been cited as the reason for a lapse in biosecurity even if the worker was aware of the necessary protocols.[16]

Biosecurity continues to be a difficult subject for employers to teach and for farm personnel and visitors to continuously uphold. Breaches of varying extremes are common in farms; however, the risk of pathogen introduction

remains a constant threat. Demonstrating the potential spread of and contamination by a pathogen will help reiterate the need for biosecurity protocols on farms. Visual aids, such as Glo Germ, are easy and effective ways to exhibit biosecurity compliance and highlight any breaches within a farm.

Acknowledgments

Conflict of interest

None reported

Disclaimer

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Conversion tables

Weights and measures conversions

Common (US)	Metric	To convert	Multiply by
1 oz	28.35 g	oz to g	28.35
1 lb (16 oz)	0.45 kg	lb to kg	0.45
2.2 lb	1 kg	kg to lb	2.2
1 in	2.54 cm	in to cm	2.54
0.39 in	1 cm	cm to in	0.39
1 ft (12 in)	0.3 m	ft to m	0.3
3.28 ft	1 m	m to ft	3.28
1 mi	1.6 km	mi to km	1.6
0.62 mi	1 km	km to mi	0.62
1 in^2	6.45 cm^2	in^2 to cm^2	6.45
0.16 in^2	1 cm^2	cm^2 to in^2	0.16
1 ft^2	0.09 m^2	ft^2 to m^2	0.09
10.76 ft^2	1 m^2	m^2 to ft^2	10.8
1 ft^3	0.03 m^3	ft^3 to m^3	0.03
35.3 ft^3	1 m^3	m^3 to ft^3	35.3
1 gal (128 fl oz)	3.8 L	gal to L	3.8
0.26 gal	1 L	L to gal	0.26
1 qt (32 fl oz)	0.95 L	qt to L	0.95
1.06 qt	1 L	L to qt	1.06

Temperature equivalents (approx)

°F	°C
32	0
50	10.0
60	15.5
61	16.1
65	18.3
70	21.1
75	23.8
80	26.6
82	27.7
85	29.4
90	32.2
102	38.8
103	39.4
104	40.0
105	40.5
106	41.1
212	100.0

°F = (°C × 9/5) + 32
°C = (°F - 32) × 5/9

Conversion chart, kg to lb (approx)

Pig size	Lb	Kg
Birth	3.3-4.4	1.5-2.0
Weaning	7.7	3.5
	11	5
	22	10
Nursery	33	15
	44	20
	55	25
	66	30
Grower	99	45
	110	50
	132	60
Finisher	198	90
	220	100
	231	105
	242	110
	253	115
Sow	300	136
	661	300
Boar	794	360
	800	363

Conversion calculator available at: amamanualofstyle.com/page/si-conversion-calculator

1 tonne = 1000 kg
1 ppm = 0.0001% = 1 mg/kg = 1 g/tonne
1 ppm = 1 mg/L

FAD simulation exercises help states prepare for a potential outbreak

Four state pork associations participated in foreign animal disease (FAD) simulation exercises this year to help local producers and responders prepare in case an outbreak happens. The exercises were conducted by National Pork Board (NPB) and funded by Pork Checkoff. These state-based field exercises provided first-line responders with hands-on opportunities to find gaps in their plans, equipment, and supplies. Kansas, Montana, Nebraska, and Tennessee have completed the exercises that began last spring and ended this fall.

Keeping African swine fever out of the United States and preparing for any FAD outbreak is a top priority for NPB as identified by producer leaders. Preparing for an FAD takes planning at all levels. National Pork Board has a checklist for producers of steps to prepare farm-level plans.

For more information, please contact Dr Lisa Becton at **lbecton@pork.org**.

Safe pig care and handling resources available

National Pork Board offers Safe Pig Handling video training modules in English and Spanish to help make sure farm employees know how best to create a safe environment for both pigs and people. The Swine Care Handbook uses the latest animal husbandry research to guide caretakers in providing the best care for pigs and represents a commitment to continuous improvement in animal ethics. Topics include animal observation and care, production practices and animal husbandry, feeding and water practices, environmental management, and more.

For more information, please contact Stephanie Wisdom at **swisdom@pork.org** and visit **checkoff.org/certification**.

Food animal producers, vets visit CDC to discuss multiple issues

The National Institute for Animal Agriculture hosted a visit to the Centers for Disease Control and Prevention (CDC) in Atlanta for farmers who raise cattle, pigs, and poultry, along with food-animal veterinarians. Three swine veterinarians represented the pork industry, including Dr Heather Fowler, National Pork Board's director of producer and public health. It was an opportunity to learn from, collaborate, and foster dialogue with CDC colleagues about their work in public health as it relates to antibiotic use, antibiotic resistance, food safety, and One Health.

For more information about public health and One Health related to the pork industry, please contact Dr Heather Fowler at **hfowler@pork.org**.


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AASV awards nominations due December 15

Do you know an AASV member whose dedication to the association and the swine industry is worthy of recognition? A practitioner who goes above and beyond in providing service to clients? A young swine vet who is already leading the way? An academic whose teaching and research is making a difference? Now is the time to speak up! The AASV Awards Committee requests nominations for six awards to be presented at the 54th AASV Annual Meeting.

Are you wondering who has been recognized in the past? See **aasv.org/aasv/awards** for a list of previous recipients of the following awards.

Howard Dunne Memorial Award – Given annually to an AASV member who has made a significant contribution and rendered outstanding service to the AASV and the swine industry.

Meritorious Service Award – Given annually to an individual who has consistently given time and effort to the association in the area of service to AASV members, officers, and staff.

Swine Practitioner of the Year – Given annually to the swine practitioner (AASV member) who has demonstrated an unusual degree of proficiency in the delivery of veterinary service to his or her clients.

Technical Services/Allied Industry Veterinarian of the Year – Given annually to the technical services or allied industry veterinarian who has demonstrated an unusual degree of proficiency and effectiveness in the delivery of veterinary service to his or her company and its clients as well as given tirelessly in service to the AASV and the swine industry.

Outstanding Swine Academic of the Year – Given annually to an AASV member employed in academia who has demonstrated excellence in teaching, research, and service to the swine veterinary profession. Faculty members, graduate students, and researchers are eligible to receive this award.

Young Swine Veterinarian of the Year – Given annually to a swine veterinarian who is an AASV member, 5 years or less post graduation, who has demonstrated the ideals of exemplary service and proficiency early in their career.

Nominations are due December 15. The nomination letter should specify the award and cite the qualifications of the candidate for the award. Submit to AASV by mail, 830 26th Street, Perry, Iowa 50220, or by email, **aasv@aasv.org**.

USDA-NIFA grant supports AASV's participant-led, early-career swine veterinarian development program

The US Department of Agriculture National Institute of Food and Agriculture (USDA-NIFA) has announced the awarding of an Education, Extension, and Training grant in the amount of $202,548 to the American Association of Swine Veterinarians. The grant will fund a participant-led, early-career swine veterinarian development program. It is one of 20 Veterinary Service Grants Program (VSGP) awards intended to help mitigate food-animal veterinary service shortages in the United States.

Although swine veterinarians are critical to maintaining a healthy, secure, and safe pork supply, many veterinary colleges in the United States have a limited swine caseload and curriculum. It is therefore difficult for veterinary students to obtain a comprehensive swine medicine education that addresses complex and regional food safety and animal welfare concerns and regulations. Without easily accessible and affordable post-graduate training opportunities, early-career swine veterinarians may be predisposed to career burnout and leave food-animal practice or the veterinary profession early. The AASV Early Career Committee identified the need for additional nondegree educational coursework and training for swine veterinarians early in their careers and applied for the grant to address this need.

The AASV Early Career Committee's goal is to create a practitioner-led, early-career swine veterinarian development program to provide participants with resources needed to encourage and ensure successful, lifelong careers as swine veterinarians and to cultivate new leaders in swine veterinary medicine. The AASV will provide information and resources that support early-career swine veterinarians, as identified by the program participants. Coursework and training will be delivered through educational modules administered to up to 25 AASV-member, early-career swine veterinarians who are 1 to 5 years post graduation, with preference given to current or previous Veterinary Medical Loan Repayment Program recipients or those serving in a USDA-NIFA-designated veterinary shortage situation.

This program is expected to directly address veterinary shortage situations by providing nondegree educational coursework and training to veterinarians who provide services to swine in at least 50% of their practice time.

AASV news continued on page 373

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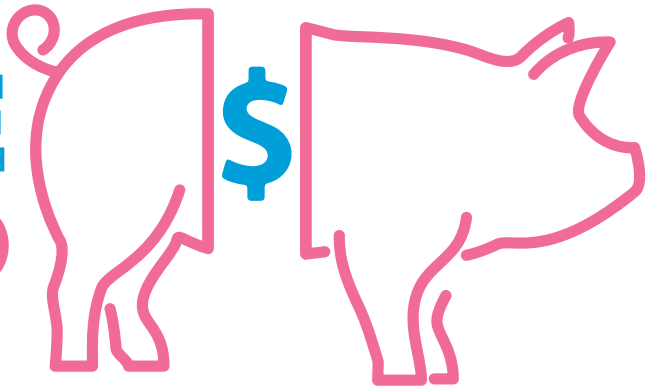

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[1]Nautrup, BP, et al., Res Vet Sci, 2020

zoetis

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The goals of the USDA-NIFA VSGP are to support food animal veterinary medicine through Education, Extension, and Training funds for accredited schools and organizations and through Rural Practice Enhancement funds for veterinary clinics that provide services in areas with a veterinary shortage situation. This program is designed to support education and extension activities that will enable veterinarians, veterinary students, and veterinary technicians to gain specialized food-animal skills and practices. The 2014 Farm Bill authorized the establishment of the VSGP as a companion to the Veterinary Medical Loan Repayment Program to incentivize service in veterinary shortage situations. Ultimately, the VSGP will bolster the capacity of private veterinary practitioners to provide food-animal medicine in rural veterinarian shortage locations.

For more information, visit **aasv.org**.

54th AASV ANNUAL MEETING

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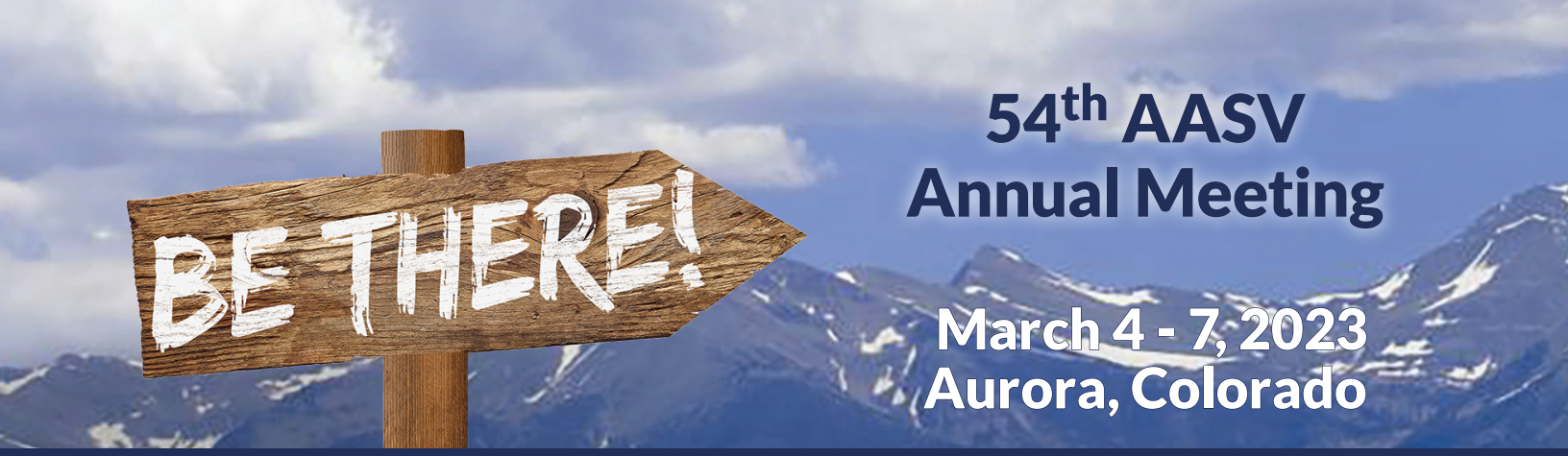

2023 Annual Meeting Program

SATURDAY, MARCH 4
Preconference seminars

1:00 PM – 5:00 PM

Seminar #1 Practice Tips: Be Transparent
Melissa Billing, chair

Seminar #2 PRRSV Monitoring and Diagnostics
Daniel Linhares, chair

Seminar #3 Pen Gestation: We're There!
Michelle Sprague, chair

Seminar #4 Be a Good Steward: Antibiotics and Sustainability
Rebecca Robbins, chair

Seminar #5 Improving Pig Survivability through Research and Industry Collaboration
Jordan Gebhardt, chair

Seminar #6 Our Swine Family Health
Emily Byers Taylor, chair

SUNDAY, MARCH 5
Preconference seminars

8:00 AM – 12:00 PM

Seminar #7 Boar Stud Health, Biosecurity, and African Swine Fever Preparedness
Deanne Hemker, chair

Seminar #8 Data Integration to Support Real-Time Decision Making
Gustavo Silva, chair

Seminar #9 New Technologies
Angela Baysinger, chair

Seminar #10 Swine Medicine for Students
Jeremy Pittman and Angela Supple, co-chairs

Seminar #11 Understanding Swine Business
Tyler Bauman, chair

Research Topics

8:00 AM – 12:00 PM

Session chair: Chris Rademacher

8:00 AM Spatiotemporal relative risk distribution of PRRSV in the southeastern United States
Felipe Sanchez

8:15 AM In-silico characterization of the relationship between PRRSV prevalence at the individual piglet level and prevalence at the litter level in a farrowing room
Onyekachukwu Henry Osemeke

8:30 AM Refining PRRRS-2 genetic classification based on global ORF5 sequences and investigation of geographic distributions and temporal changes
Jianqiang Zhang

8:45 AM Investigating whether PRRSV can reach groundwater after manure-spreading events
Joaquin Alvarez-Norambuena

9:00 AM Hand sanitation protocols to decrease the risk of influenza transmission in pigs and from pigs to people
Joaquin Alvarez-Norambuena

9:15 AM	Divergent pathogenicity between highly pathogenic avian influenza A (H5N1) strains in swine *Bailey Arruda*
9:30 AM	Modeling the introduction and control of African swine fever within commercial swine populations in the United States *Abagael Sykes*
9:45 AM	REFRESHMENT BREAK
10:15 AM	*Actinobacillus pleuropneumoniae* serotype 15 outbreak investigation: Comparative whole genome sequencing of pan-North American isolates *Alyona Michael*
10:30 AM	Dynamics of infection of disease-associated *Streptococcus suis* (DASS) in the lactation phase *Robert Mugabi*
10:45 AM	Antibody response to rotavirus A and C in gilts and their piglets after prenatal natural planned exposure *Deepak Kumar*
11:00 AM	Effect of rotavirus vaccination of gilts prior to farrowing following natural planned exposure at breeding on piglet growth, prevalence of diarrhea, and preweaning mortality *Lindsey Britton*
11:15 AM	Assessing the efficacy of different combinations of time and temperature to inactivate PRRSV and PEDV *Mafalda Mil-Homens*
11:30 AM	Attenuation phenotypes and protective efficacy of cell culture adapted PEDV non-S INDEL strain *Loni Schumacher*
11:45 AM	Impact of sow farm PED outbreaks on the downstream nursery performance in the absence of PRRS acute herds *Edison Magalhaes*
12:00 PM	Session concludes

Poster session: Veterinary Students, Research Topics, and Industrial Partners

12:00 PM – 5:00 PM

Poster authors present from 12:00 PM to 1:00 PM
Poster display continues on Monday, 8:00 AM to 5:00 PM

Concurrent sessions

1:00 PM – 5:15 PM

Session #1	**Student Seminar** *Andrew Bowman and Justin Brown, co-chairs*
Session #2	**Industrial Partners** *Cesar Corzo and Mary Battrell, co-chairs*
Session #3	**Industrial Partners** *Clayton Johnson, chair*
Session #4	**Industrial Partners** *Cameron Schmitt, chair*

MONDAY, MARCH 6
General Session
Be There!

8:00 am – 12:30 pm

Program and Session chair: Bill Hollis

8:00 AM	**Howard Dunne Memorial Lecture** Be there. Be the leader for the pig, the client, the customer *Egan Brockhoff*
9:00 AM	**Alex Hogg Memorial Lecture** Seizing opportunity within swine veterinary medicine *Attila Farkas*
10:00 AM	REFRESHMENT BREAK
10:30 AM	Ten industry needs you can meet right now, so be smart and be prepared … get involved *Gordon Spronk*
11:30 AM	Lessons learned from the poultry industry for housing and health *Craig Rowles*
12:30 PM	LUNCHEON

Concurrent Session #1: Build Back Biosecurity and Make Health Great Again!

2:00 PM – 5:30 PM

Session chair: Amber Stricker

2:00 PM	Stranger than fiction: PRRS in a remote farm *Corrine Frugé*
2:20 PM	Outbreak of *Actinobacillus pleuropneumoniae* serotype 15 in central Iowa in the winter of 2021-22 *Isadora Machado*
2:40 PM	Biosecurity: Why do we do it and who do we do it for? *Brandi Burton*
3:00 PM	Farm Health Guardian: What we have learned so far *Brad Chappell*
3:20 PM	Biosecurity Q&A panel *Frugé, Machado, Burton, and Chappell*
3:30 PM	REFRESHMENT BREAK
4:00 PM	Impactful investments: Measuring return on investment for biosecurity *Pete Thomas*
4:20 PM	Water biology: The next frontier for biosecurity *Gabi Doughan*
4:40 PM	Management and facility factors that impact biosecurity and biocontainment *Jordan Graham*
5:00 PM	Biosecurity: What is the US missing? An international perspective *Eveline Willems*
5:20 PM	Biosecurity Q&A panel *Thomas, Doughan, Graham, and Willems*
5:30 PM	Session concludes

Concurrent Session #2: Disease (PRRS and …)

2:00 pm – 5:30 pm

Session chair: Chase Stahl

2:00 PM	PRRS: The fight continues *Clayton Johnson*
2:45 PM	Revenge of *E coli* – but wait, there's more … *Deborah Murray*
3:30 PM	REFRESHMENT BREAK
4:00 PM	Sapovirus: Diagnosis to solution … a cooperative success *Tom Petznick*
4:30 PM	Remind me about *Actinobacillus pleuropneumoniae* *Jon Van Blarcom*
5:00 PM	Disease Q&A panel *Johnson, Murray, Petznick, and Van Blarcom*
5:30 PM	Session concludes

Concurrent Session #3: Foreign Animal Diseases: Be Prepared – Be Aware

2:00 PM – 5:30 PM

Session co-chairs: Marie Culhane and Marisa Rotolo

2:00 PM	Introduction *Marie Culhane and Marisa Rotolo*
2:05 PM	What's going on? African swine fever global update *Karyn Havas*
2:30 PM	What's new? African swine fever vaccine update *Douglas Gladue*
2:55 PM	REFRESHMENT BREAK
3:25 PM	Who can test for foreign animal diseases? *Pam Zaabel*
3:50 PM	How can we get prepared together? US SHIP *Rodger Main*

4:15 PM	What is targeted, science-based African swine fever surveillance? *Marie Culhane*
4:40 PM	When does being prepared pay off? Japanese encephalitis: The Australian experience *Chris Richards*
5:25 PM	Wrap-up and take-home messages *Marie Culhane and Marisa Rotolo*
5:30 PM	Session concludes

TUESDAY, MARCH 7

General Session

Important Conversations: Be Engaged and Committed for a Common Goal

8:00 AM – 12:00 PM

Session co-chairs: Matthew Turner and Jordan Gebhardt

8:00 AM	The time is now to eliminate PEDV *Paul Yeske*
8:25 AM	PEDV controlled exposure: A critical tool *Luc Dufresne*
8:50 AM	PEDV exposure, a tool for elimination *Karine Talbot*
9:05 AM	Experiences in removing planned PEDV exposure for acclimatization in a large commercial production system *Lauren Glowzenski*
9:20 AM	PEDV elimination/exposure Q&A panel *Yeske, Dufresne, Talbot, and Glowzenski*
10:00 AM	REFRESHMENT BREAK
10:30 AM	Veterinary medicine and swine nutrition at AMVC *Jason Hocker and Trey Kellner*
11:15 AM	Veterinary medicine and swine nutrition at JBS *Darin Madson and Kyle Coble*
12:00 PM	Session and meeting conclude

The 2023 AASV Annual Meeting will be held on site at the Gaylord Rockies Resort in Aurora, Colorado. Due to cost, staffing, and hotel contract obligations, a virtual attendance option will not be available. As in the past, some presentations will be recorded for AASV members to view after the meeting.

Researchers invited to submit proposals for funding in 2023

The AASV Foundation plans to award up to $100,000 in 2023 to support research with direct application to the swine veterinary profession and is now receiving proposals to be considered for funding.

Proposals are due by 12:00 PM Central Time on **January 12, 2023** and may request a maximum of $30,000 per project. The announcement of projects selected for funding will take place during the AASV Annual Meeting on Sunday, March 5, 2023.

Proposed research should fit one of the five action areas stated in the AASV Foundation mission statement (see sidebar). The instructions for submitting proposals are available on the AASV Foundation website at **aasv.org/foundation/2023/research.php**. A panel of AASV members will evaluate and select proposals for funding, based on the following scoring system:

- Potential benefit to swine veterinarians/swine industry (40 points)
- Probability of success within timeline (35 points)
- Scientific/investigative quality (15 points)
- Budget justification (5 points)
- Originality (5 points)

A summary of the research previously funded by the foundation is available at **aasv.org/foundation/research.htm**.

For more information, or to submit a proposal:

AASV Foundation
830 26th Street, Perry, IA 50220-2328
515-465-5255; **foundation@aasv.org**

AASV Foundation Mission Statement

The mission of the AASV Foundation is to empower swine veterinarians to achieve a higher level of personal and professional effectiveness by:

- enhancing the image of the swine veterinary profession
- supporting the development and scholarship of students and veterinarians interested in the swine industry,
- addressing long-range issues of the profession,
- supporting faculty and promoting excellence in the teaching of swine health and production, and
- funding research with direct application to the profession.

Veterinary students: Apply for $5000 scholarship by December 31

To assist future swine veterinarians with their educational expenses, the AASV Foundation and Merck Animal Health are pleased to offer the AASVF-Merck Animal Health Veterinary Student Scholarships. Ten $5000 scholarships will be awarded to sophomore and junior veterinary students in 2023. Applications are due December 31, 2022 for scholarships that will be announced during the 2023 AASV Annual Meeting.

Second- and third-year veterinary students enrolled in AVMA-accredited or -recognized colleges of veterinary medicine in the United States, Canada, Mexico, South America, or the Caribbean Islands are eligible to apply. All applicants must be current (2022-2023) student members of AASV. Students who have previously been awarded one of the scholarships are not eligible to reapply. Previous scholarship recipients are recognized at **aasv.org/foundation/scholarshipwinners.htm**.

To apply, students submit a resume and the name of a faculty member or AASV member to serve as a reference, along with written answers to 4 essay questions. The application and instructions are available at **aasv.org/foundation/2023/AASVF-MerckScholarships.php**.

A committee of 4 conducts the selection process. Two AASV Foundation board members and two AASV members-at-large rank the applicants by scoring their past and current activities, level of interest in swine veterinary medicine, future career plans, and financial need. The scholarship recipients will be announced during the luncheon on Monday, March 6 at the 2023 AASV Annual Meeting in Aurora, Colorado (attendance not required). The scholarship funds will be disbursed after the conference.

The AASVF-Merck Animal Health Veterinary Student Scholarship Program is part of how Merck Animal Health and the AASV Foundation fulfill a shared mission of "supporting the development and scholarship of students and veterinarians." For more information on scholarships and other AASV Foundation programs, see **aasv.org/foundation**.

AASV Foundation news continued on page 381

Shaping the future of piglet care

Prepare, protect, and support resilience in your piglets. As your partner, we provide local swine expertise and complete, tailor-made solutions to help you achieve your goals. Together, we can create a new future for piglet care.

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AASV Foundation news continued on page 379

Early career swine vets: Apply for debt relief

Applications are now being accepted for three $5000 scholarships to be awarded to early-career swine practitioners through the Dr Conrad and Judy Schmidt Family Student Debt Relief Endowment. The scholarship recipients will be announced during the 2023 AASV Annual Meeting.

The scholarships are available to AASV members who are between 2 and 5 years post graduation from veterinary school (DVM/VMD graduation years 2018, 2019, or 2020), engaged in private practice, and who carry a significant student debt burden.

The scholarship program was initiated in 2019 with a $110,000 contribution to the foundation by the Conrad Schmidt and Family Endowment. Strong interest by applicants prompted the foundation board to increase the number of scholarships awarded to 3, beginning in 2021.

The scholarship application form is available at **aasv.org/foundation/debtrelief.php**. Applications are due **January 31, 2023**. The following criteria will be used to select the scholarship recipient:

1. Joined AASV as a student enrolled in an AVMA-recognized college of veterinary medicine.
2. Attended the AASV Annual Meeting as a student.
3. Maintained continuous membership in AASV since graduation from veterinary school.
4. Is at least 2 years and at most 5 years post graduation from veterinary school (2018, 2019, or 2020 DVM/VMD graduates).
5. Has been engaged in private veterinary practice, 50% or more devoted to swine, providing on-farm service directly to independent pork producers. Veterinarians who work for production companies, pharmaceutical companies, or universities are not eligible for the scholarship.
6. Has a significant student debt burden.

For more information, contact the AASV Foundation: **foundation@aasv.org**.

Hogg Scholarship available to practitioners seeking MS or PhD

The American Association of Swine Veterinarians Foundation is now accepting applications for the prestigious Hogg Scholarship, established to honor the memory of longtime AASV member and swine industry leader Dr Alex Hogg.

The intent of the $10,000 scholarship is to assist a swine veterinarian in his or her efforts to return to school for graduate education (resulting in a master's degree or higher) in an academic field of study related to swine health and production. Seventeen swine practitioners, recognized at **aasv.org/foundation/hoggscholars**, have been awarded the scholarship since it was established in 2008.

Applications for the scholarship will be accepted until **January 31, 2023**. The scholarship recipient will be announced Sunday, March 5 during the 2023 AASV Annual Meeting.

Dr Alex Hogg's career serves as the ideal model for successful applicants. After 20 years in mixed animal practice, Dr Hogg pursued a master's degree in veterinary pathology. He subsequently became Nebraska swine extension veterinarian and professor at the University of Nebraska. Upon "retirement," Dr Hogg capped off his career with his work for MVP Laboratories. Always an enthusiastic learner, at age 75 he graduated from the Executive Veterinary Program offered at the University of Illinois.

The scholarship application requirements are outlined below, and on the AASV website at **aasv.org/foundation/hoggscholarship.htm**.

Hogg Scholarship application requirements

An applicant for the Hogg Scholarship shall have:

1. Three or more years of experience as a swine veterinarian, either in a private practice or in an integrated production setting
2. Five or more years of continuous membership in the AASV

Applicants are required to submit the following for consideration as a Hogg Scholar:

1. Current curriculum vitae
2. Letter of intent detailing his or her plans for graduate education and future plans for participation and employment within the swine industry
3. Two letters of reference from AASV members attesting to the applicant's qualifications to be a Hogg Scholar

Applications and requests for information may be addressed to:

AASV Foundation
830 26th Street
Perry, IA 50220
foundation@aasv.org

Foursome of individuals sweeps the team competition

Eleven teams of golfers – many of them perennial participants – enjoyed clear weather as they pitted their skills against the challenging Veenker Memorial Golf Course in Ames, Iowa during the annual AASV Foundation Golf Outing on August 31. In the end, it was the team of four individual registrants brought together by chance that took first place overall in the best ball competition. The winners were announced by event coordinator Josh Ellingson during the concluding pork dinner sponsored by Boehringer Ingelheim.

Golfers Dakota Fiene, Daryl Hammer, Nick Knute, and Dan Rosener combined their efforts to lead the field, coming in at 11 strokes under par. The AMVC team of Josh Ellingson, Jason Hocker, Trey Kellner, and Nick Weihs took second place and Fairmont Vet Clinic golfers Justin Borchardt, Brian and Deb Roggow, and Danielle Sandberg claimed third to finish out the top flight.

Veenker Pro Shop gift cards were awarded to members of the first-, second-, and third-place teams in each of 3 flights of golfers. A variety of individual contests hosted by golf hole sponsors and the foundation supplemented the team competition and gave individual golfers the opportunity to win prizes for their driving, chipping, and putting.

The success of the fundraiser is due in no small part to the generous support of faithful sponsors. For several years, **Boehringer Ingelheim** has sponsored the awards dinner, **APC** has funded the box lunches, and **Zoetis** has hosted the beverages for the day. Ten golf-hole sponsors participated in this year's event by providing on-course giveaways, games, and contests for the golfers to enjoy. Please join the foundation in thanking **Furst McNess Company**, **Huvepharma**, **Insight Wealth Group**, **Kemin Animal Nutrition and Health**, **Merck Animal Health**, **National Pork Producers Council**, **Pharmgate Animal Health**, **Phibro Animal Health**, **Ralco**, and **United Animal Health** for their support!

The event raised nearly $13,000 to help support a variety of AASV Foundation activities, including scholarships, research grants, student debt relief, swine externship grants, travel stipends for students attending the AASV Annual Meeting, and more.

Four individual registrants came together the day of the event to form the winning team. Left to right: Daryl Hammer, Nick Knute, Dan Rosener, and Dakota Fiene. Photo courtesy of Andrew Kleis, Insight Wealth Group.

And the winners are:

First flight

First place: Dakota Fiene, Daryl Hammer, Nick Knute, and Dan Rosener

Second place, hosted by AMVC: Josh Ellingson, Jason Hocker, Trey Kellner, and Nick Weihs

Third place, hosted by Fairmont Vet Clinic: Justin Borchardt, Brian Roggow, Deb Roggow, and Danielle Sandberg

Second flight

First place, hosted by Phileo/ISU DVM Class of 2016: Chelsea Hamilton, Chris Olsen, and Scott Radke

Second place, hosted by NPPC: Pete Houska, Jeff Kindwall, Derrick Sleezer, and Greg Thornton

Third place, hosted by Phibro Animal Health Corp: John Charley, Dennis Dwyer, Ron Kaptur, and Mark Rooney

Third flight

First place, hosted by Norbrook: Leland Brown, Matt Garvin, Brad Gulker, and Brian Van Beek

Second place, hosted by Topigs Norsvin: Mitch Christensen, Trevor Schwartz, Ethan Spronk, and Amber Stricker

Third place, hosted by APC: Bryan Allen, Nathaniel Carney, Nathan Duncan, and Yanbin Shen

Individual contests

Hole #2, **Chipping contest**, sponsored by Kemin Animal Nutrition and Health: John Charley and Nate Duncan

Hole #5, **Closest to the target**: Mitch Christensen

Hole #6, **Closest to the pin**, sponsored by Merck Animal Health: Kent Schwartz

Hole #9, **Longest putt**, sponsored by United Animal Health: Steve Sprague and Ethan Spronk

Hole #11, **Closest to the pin**, sponsored by Huvepharma: Ethan Spronk

Hole #12, **Closest to the pin**, 2nd shot: Nick Weihs

Hole #14, **Longest drive**: Deb Roggow

Hole #18, **Drawing for cooler**, sponsored by Pharmgate Animal Health: Ethan Spronk

One more thing to BE

The 2023 AASV Annual Meeting theme calls upon swine veterinarians to "BE" and fill a variety of roles within their families, jobs, communities, and profession. It just so happens that the AASV Foundation was formed in 1989 to support and assist with that very effort! The foundation's mission is to "empower swine veterinarians to achieve a higher level of personal and professional effectiveness."

Over the years, the foundation has initiated and funded a variety of programs to help potential and current swine veterinarians BE the best they can be. Scholarships, travel stipends, and externship grants help budding swine vets navigate their way into the profession. Foundation-funded research projects add to the body of knowledge that practitioners rely upon to advise their clients. The Hogg and American College of Animal Welfare Scholarships provide opportunities for graduate veterinarians to obtain advanced degrees and certifications. These are just a few of the ways the AASV Foundation continues to motivate and support swine veterinarians in their efforts to BE more.

Of course, these programs all require money. Fortunately, AASV members and friends of the profession know how to BE generous. This is no better demonstrated than by the results of the 2022 AASV Foundation fundraising auction, which raised over $112,000 to support the very programs previously described. Thank you to ALL whose generosity made this success possible!

BE generous – Donate an item for the foundation auction!

The annual auction fundraiser is essential for providing immediate and ongoing support for the many scholarships and grants doled out each year. Please BE generous and consider donating an item – or making a cash contribution – for the 2023 auction.

The Auction Committee members are reaching out to potential donors to solicit auction items and cash donations for the auction, but don't wait – please contact a member of the committee if you are interested in supporting the auction this year. To ask questions or discuss possibilities, contact one of the committee members listed at **aasv.org/foundation/2023/auctioninfo.php**.

Auction donations due December 1

To donate, complete the donation form at **aasv.org/foundation/2023/auctioninfo.php** and submit a description and image of your item by **December 1.** Your contribution will be recognized in the auction catalog as well as on the auction website, and your name will appear in the full-page JSHAP spread recognizing our auction item donors.

As in recent years, the silent auction will be conducted virtually via ClickBid, and auction donors are asked to keep their donation for shipment to the winning bidder after the auction. The live auction will be held immediately following the Monday evening awards reception at the 2023 AASV Annual Meeting in Aurora, Colorado.

Just think, your contribution will enable yourself, your colleagues, and your profession to BE so much more! To get started, just BE generous.

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Elanco Pulmotil® AC tilmicosin phosphate™

TRUSTED FOR 25 YEARS

ONE consistent molecule.
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FOUR SRD* challenges tackled.

CONSISTENT QUALITY, WITH PULMOTIL®.

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*Swine Respiratory Disease

PULMOTIL AC

IMPORTANT SAFETY INFORMATION: Before using this product, it is important to read the entire product insert, including the boxed human warning.

WARNING: Exposure to tilmicosin in humans has been associated with chest pain, increased heart rate, dizziness, headache, and nausea. Death has been reported following ingestion or injection of tilmicosin. Avoid direct skin and eye contact. In case of human exposure, call 1-800-722-0987 and consult a physician immediately.

Wear overalls, impervious gloves and eye protection when mixing and handling the product. Wash hands after handling the product. Wash affected parts if skin contact occurs. If accidental eye contact occurs, immediately rinse thoroughly with water. **CAUTION:** Federal law restricts this drug to use by or on the order of a licensed veterinarian. For use only in swine. Not for injection. Injection of tilmicosin has been shown to be fatal in swine and non-human primates, and may be fatal in horses and goats. Swine intended for human consumption must not be slaughtered within 7 days of treatment. Always treat the fewest number of animals necessary to control a respiratory disease outbreak. Prescriptions shall not be refilled. Concurrent use of Pulmotil AC and another macrolide by any route, or use of another macrolide immediately following this use of Pulmotil AC is not advised. Ensure that pigs have continuous access to medicated water during the treatment period. Monitor pigs for signs of water refusal and dehydration while being treated.

The label contains complete use information, including cautions and warnings. Always read, understand and follow the label and use directions.

Elanco™

AH0470

Pulmotil™ AC

960 ml

tilmicosin phosphate (250 mg/ml tilmicosin)

Aqueous concentrate for oral use in drinking water.
For swine only.
Macrolide Antibiotic.
Do not inject this product. Injection of tilmicosin has been shown to be fatal in swine and non-human primates, and may be fatal in horses and goats.

WARNING

Exposure to tilmicosin in humans has been associated with chest pain, increased heart rate, dizziness, headache, and nausea. Death has been reported following ingestion or injection of tilmicosin.
Avoid ingestion. Avoid direct skin and eye contact. In case of human exposure, call 1-800-722-0987 and consult a physician immediately.
NOTE TO THE PHYSICIAN:
The cardiovascular system is the target of toxicity and should be monitored closely. The primary cardiac effects are tachycardia and decreased contractility. Cardiovascular toxicity may be due to calcium channel blockade.
See User Safety Warnings for additional information.

CAUTION: Federal law restricts this drug to use by or on the order of a licensed veterinarian.

Active Drug Ingredient: tilmicosin (as tilmicosin phosphate) 250 mg/ml

Description: Pulmotil is a formulation of the antibiotic tilmicosin. Tilmicosin is produced semi-synthetically and is in the macrolide class of antibiotics. Each milliliter (mL) of Pulmotil aqueous concentrate solution contains 250 mg of tilmicosin.

Indications: For the control of swine respiratory disease associated with *Pasteurella multocida* and *Haemophilus parasuis* in groups of swine in buildings where a respiratory disease outbreak is diagnosed.

For the control of swine respiratory disease associated with *Mycoplasma hyopneumoniae* in the presence of Porcine Reproductive and Respiratory Syndrome Virus (PRRSV) in groups of swine in buildings where a respiratory disease outbreak is diagnosed.

Dosage and Administration: Must be diluted before administration to animals. Include in the drinking water to provide a concentration of 200 mg tilmicosin per liter (200 ppm). One 960 ml bottle is sufficient to medicate 1200 liters (320 gallons) of drinking water for pigs. The medicated water should be administered for (5) five consecutive days.

Use within 24 hours of mixing with water. Do not use rusty containers for medicated water as they may affect product integrity.

When using a water medicating pump with a 1:128 inclusion rate, add 1 bottle (960 ml) of Pulmotil AC per 2.5 gallons of stock solution.

WARNINGS:
USER SAFETY WARNINGS: FOR USE IN ANIMALS ONLY.
NOT FOR HUMAN USE. KEEP OUT OF REACH OF CHILDREN.
SEE BOXED WARNING AND NOTE TO THE PHYSICIAN FOR ADDITIONAL INFORMATION.
Wear overalls, impervious gloves and eye protection when mixing and handling the product. Wash hands after handling the product. Wash affected parts if skin contact occurs. If accidental eye contact occurs, immediately rinse thoroughly with water.
To report suspected adverse events, for technical assistance, or to obtain a Material Safety Data Sheet (MSDS), call 1-800-428-4441.

▶ **RESIDUE WARNING:** Swine intended for human consumption must not be slaughtered within 7 days of the last treatment with this product. ◀

Note to the Physician:
The cardiovascular system is the target of toxicity and should be monitored closely. Cardiovascular toxicity may be due to calcium channel blockade. In dogs, administration of intravenous calcium offset tilmicosin-induced tachycardia and negative inotropy (decreased contractility). Dobutamine partially offset the negative inotropic effects induced by tilmicosin injection in dogs. ß-adrenergic antagonists, such as propranolol, exacerbated the negative inotropy of tilmicosin injection in dogs. Epinephrine potentiated lethality of tilmicosin injection in pigs. This antibiotic persists in tissues for several days.

Precautions:
Do not allow horses or other equines access to water containing tilmicosin. The safety of tilmicosin has not been established in male swine intended for breeding purposes.

Always treat the fewest number of animals necessary to control a respiratory disease outbreak. Prescriptions shall not be refilled. Concurrent use of Pulmotil AC and another macrolide by any route is not advised. Use of another macrolide immediately following this use of Pulmotil AC is not advised.

Adverse Reactions in Animals: Decreased water consumption was observed in healthy pigs administered tilmicosin in target animal safety studies. Ensure that pigs have continuous access to medicated water during the treatment period. Monitor pigs for signs of water refusal and dehydration while being treated. If decreased water consumption occurs, replace the medicated drinking water with fresh non-medicated water and contact your veterinarian.

Clinical Pharmacology: Tilmicosin is a macrolide antibiotic with *in vitro* antibacterial activity primarily against Gram-positive bacteria, although certain Gram-negative bacteria are also susceptible. Macrolides interfere with bacterial protein synthesis by reversibly binding to the 50S subunit of the ribosome. They are typically regarded as being bacteriostatic, but at high concentrations can be bactericidal. When administered orally to pigs via the drinking water, tilmicosin is rapidly absorbed and slowly eliminated from the body. Tilmicosin distributes rapidly to the target tissues. Detectable levels are found in lung tissue as early as 6 hours and peak at about 5 days after the commencement of treatment. The relationship of serum tilmicosin concentration to lung tilmicosin concentration or the concentrations in bronchial secretion has not been determined. In addition, the extent to which total lung concentrations represent free (active) drug has not been defined. Therefore, no conclusions can be made with regard to the clinical relevance of elevated tilmicosin concentrations in the lung. Tilmicosin has been shown to concentrate within alveolar macrophages. It is also found at fairly high concentrations in liver and kidney tissue, as it is excreted both via the bile into the feces and also via the urine.

Effectiveness: The effectiveness of Pulmotil AC for the control of SRD associated with *P. multocida* and *H. parasuis* was confirmed in a natural infection field study across six U.S. sites. A total of 960 commercial-type grower pigs were enrolled and assigned to the tilmicosin-treated group (200 mg tilmicosin/L in drinking water for 5 consecutive days), or a non-medicated control group. Pigs that 1) were found dead and were diagnosed with SRD, or 2) had a depression score and a respiratory score ≥ 2 (on a scale from 0 [normal] to 3 [severe]) and a rectal temperature of ≥ 104.5 °F were considered clinically affected. At each site, treatments were initiated when at least 15% of the pigs were classified as clinically affected. After the 5-day treatment period and a 4-day post-treatment period, pigs were evaluated for treatment success (respiration and depression scores of 1 or 0 and rectal temperature < 104.5 °F), and were euthanized and evaluated for lung lesions. A significantly higher ($p = 0.0118$) success rate (based on back-transformed least squares means) was detected for the tilmicosin-treated group (275/473, 58.64%) compared to the control group (230/475, 47.89%).

The effectiveness of Pulmotil AC for the control of SRD associated with *M. hyopneumoniae* in the presence of PRRSV was confirmed in an induced infection model study. A total of 340 commercial-type pigs were enrolled and challenged with *M. hyopneumoniae* (single infection) or *M. hyopneumoniae* and PRRSV (co-infection). When necropsied sentinel pigs had at least 5% lung lesion involvement, study pigs were treated with Pulmotil AC (200 mg tilmicosin/L in drinking water) or non-medicated water for 5 consecutive days. After the 5-day treatment period and a 4 day post-treatment period, pigs were euthanized and evaluated for lung lesions.

For both the single infection and co-infection groups, the lung lesion percentage was statistically significantly different ($p = 0.005$ and $p = 0.0004$, respectively) in favor of the tilmicosin phosphate-treated group (21.01% and 31.74%, respectively) compared with the control group (28.26% and 43.04%, respectively).

Animal Safety: A pharmacokinetic study was conducted to evaluate Pulmotil AC concentrate solution in pigs. The results were compared to pharmacokinetic data generated with Pulmotil 90 Type A medicated article (NADA 141-064). The data demonstrates that blood and tissue levels of tilmicosin when administered to pigs at 200 mg/L (ppm) in water were consistently lower than when tilmicosin was administered to pigs at 181 g/ton (200 ppm) in feed.

A target animal safety study was conducted to evaluate the tolerance of Pulmotil AC concentrate solution in pigs when administered in drinking water. Twenty pigs were administered medicated water at 0, 200, 400, or 600 mg/L (0, IX, 2X, or 3X the labeled dose) for 5 consecutive days or 200 mg/L for 10 consecutive days. No treatment-related lesions were observed in any animals at necropsy. Water consumption was decreased in all tilmicosin-treated groups compared to the non-medicated group. One pig in the 600 mg/L group was euthanized due to decreased water consumption, neurological signs attributed to severe dehydration, and subsequent refusal to drink non-medicated water. Two pigs in the 400 mg/L group had reduced water intake and displayed mild clinical signs attributed to dehydration. One pig recovered after being offered non-medicated water. The second pig completed the treatment regimen without intervention.

Hydration and water consumption were evaluated during the control of SRD effectiveness field study. Tilmicosin was administered to study pigs in drinking water at 200 mg/l for 5 consecutive days. There was no statistically significant difference in water consumption between tilmicosin-treated pigs and pigs receiving non-medicated water. A subset of study pigs (20 tilmicosin-treated pigs and 20 non-medicated pigs) were evaluated for hydration via a physical examination and analysis of blood samples for hematocrit, total protein, creatinine, and blood urea nitrogen. There were no abnormal physical examination findings or clinically relevant differences in clinical pathology variables between tilmicosin-treated pigs and pigs receiving non-medicated water.

How Supplied: Pulmotil AC is provided in a 960 ml amber-colored plastic bottle sealed with a plastic screw cap.

Storage Conditions:
Store at or below 86° F (30° C). Protect from direct sunlight.

Restricted Drug (California) - Use Only as Directed
NADA # 141-361, Approved by FDA

Manufactured For:
Elanco US Inc.
Greenfield, IN 46140, USA


USDA Animal and Plant Health Inspection Service
U.S. DEPARTMENT OF AGRICULTURE
AFRICAN SWINE FEVER?
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PROTECT OUR PIGS
FIGHT AFRICAN SWINE FEVER
A single case of African swine fever could wipe out America's swine population. Help farmers defend their herds by sharing vital information on biosecurity safeguards, signs of infection and reporting protocols. Get materials to spread the word – and stop the virus.
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AASV and AABP address the use of ponazuril, diclazuril, and toltrazuril in swine and cattle in the United States

Questions have been raised regarding the use of compounded ponazuril, diclazuril, and toltrazuril medications being offered by compounding pharmacies. In some cases, these products are being offered directly to the public.

Ponazuril, diclazuril, and toltrazuril are not approved for food animal use in the United States. Information on drug labels approved by the US Food and Drug Administration Center for Veterinary Medicine (FDA CVM) may be found at Animal Drugs @ FDA.[1] On that site, drugs may be searched by proprietary name, established drug name, or by FDA New Animal Drug Application (NADA) approval number or Abbreviated New Animal Drug Application (ANADA) approval number.

The law permits compounding of an animal drug when the source(s) of the active ingredient(s) for compounding is/are the finished FDA-approved drug(s) and not a bulk drug substance. The FDA CVM defines "Bulk Drug Substance" and "Active Pharmaceutical Ingredient" (API) in a footnote in Guidance for Industry (GFI) #256.[2]

> FDA regulations define "bulk drug substance" and "active pharmaceutical ingredient" as "any substance that is intended for incorporation into a finished drug product and is intended to furnish pharmacological activity or other direct effect in the diagnosis, cure, mitigation, treatment, or prevention of disease, or to affect the structure or any function of the body."

Bulk API may be legally used for production of the FDA-approved product by the approved manufacturer. In this case, the source of the bulk API has been approved and is inspected by the FDA.

The extralabel drug use (ELDU) provisions of the Federal Food, Drug, and Cosmetic Act (FD&C Act) permit the compounding of animal drugs made from FDA-approved animal or human drugs, provided the conditions for legal ELDU use described in the FD&C Act and FDA's ELDU regulations are met.[3,4] The use of a drug compounded from bulk API is not permitted in any food animal under the Animal Medicinal Drug Use Clarification Act (AMDUCA) regulations, except in the case of specific antidotes as noted in FDA CVM GFI #256 and listed on FDA's website.[2,5] Therefore, when compounded from bulk API, ponazuril, diclazuril, and toltrazuril products are specifically prohibited for use in food animals.

Compound-specific discussions

Ponazuril

There is an FDA-approved equine ponazuril paste labeled for the treatment of equine protozoal myeloencephalitis (NADA No. 141-188). This drug is not prohibited for food animal use in the United States and is therefore, able to be considered for ELDU within a valid Veterinary-Client-Patient relationship (VCPR) under the AMDUCA regulations.[6]

Compounding using the FDA-approved ponazuril product may be considered under the AMDUCA regulations by a veterinarian within a VCPR. The use of compounded ponazuril originating from bulk API in food animals is illegal under any circumstances.

Diclazuril

There is an equine diclazuril oral pellet approved for the treatment of equine protozoal myeloencephalitis (NADA No. 141-268) and a medicated feed for broiler chickens and growing turkeys approved for prevention of coccidiosis (NADA No. 140-951). The equine oral pellet is an alfalfa-based pellet designed for administration by adding to the feed of horses. Under 21 CFR §530.11, the ELDU of an approved new animal drug or human drug in or on an animal feed is an ELDU that is not permitted and results in the drug being deemed unsafe.[7] Similarly, any ELDU of the chicken and turkey medicated feed is strictly prohibited in food animals. The use of compounded diclazuril originating from a bulk API in food animals is illegal under any circumstances.

Toltrazuril

There is no FDA-approved toltrazuril product in the United States. Therefore, toltrazuril is illegal to use in food animals in the United States in any form.

These drugs may be approved for food animal use in other countries. However, drugs approved in other jurisdictions may not be legally imported and used in food animals in the United States, regardless of their labels in other countries.

Guidance on compounding from bulk drugs should be sought from FDA CVM GFI #256.[2] The FDA CVM may be contacted with questions at **AskCVM@fda.hhs.gov**.

The AASV continues to advocate for swine veterinarians and animal health and work with FDA to find solutions. **If you are experiencing drug supply issues**, please send any animal drug

shortage information to the FDA Animal Drug Shortages mailbox (**animaldrugshortages@fda.hhs.gov**) or call FDA at 240-762-8893. This will facilitate FDA drug shortage staff getting access to all information more expeditiously. You can also reach out to AASV, and we will submit on your behalf.

American Association of Swine Veterinarians Pharmaceutical Issues Committee

American Association of Bovine Practitioners Committee on Pharmaceutical and Biologic Issues

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for working together and creating a journal to be proud of!

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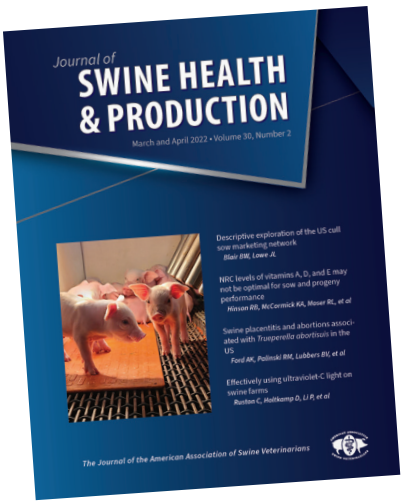

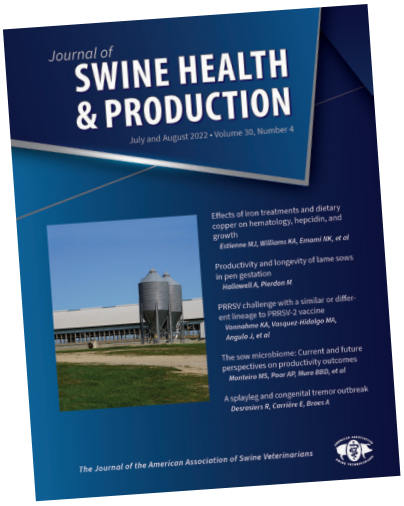

Share your pig photos for the JSHAP cover

Submissions by readers are welcome!

- Photos must represent healthy pigs and modern production facilities and not include people.
- Photos must be taken using the camera's largest file size and highest resolution.
- Please send the original image(s); do not resize, crop, rotate, or color-correct the image prior to submission.
- Submit photos with your name and affiliation to **tina@aasv.org**.

Cumulative index

The *Journal of Swine Health and Production* cumulative index is updated online throughout the year as issues go to press. Articles can be accessed via the "Search" function and from the Abstracts page, **aasv.org/shap/abstracts/.**

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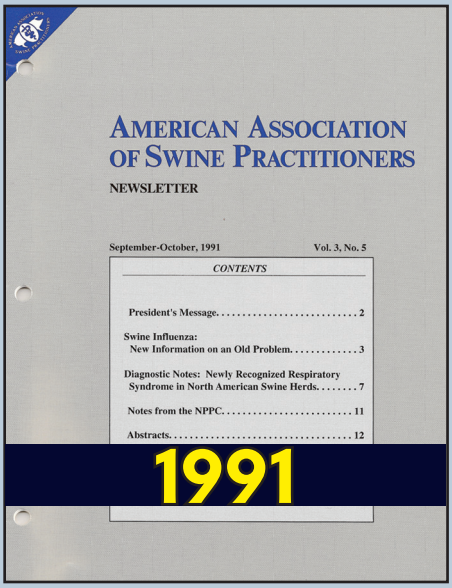

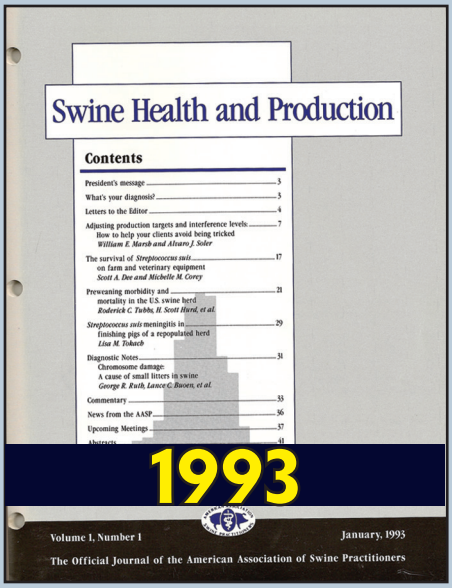

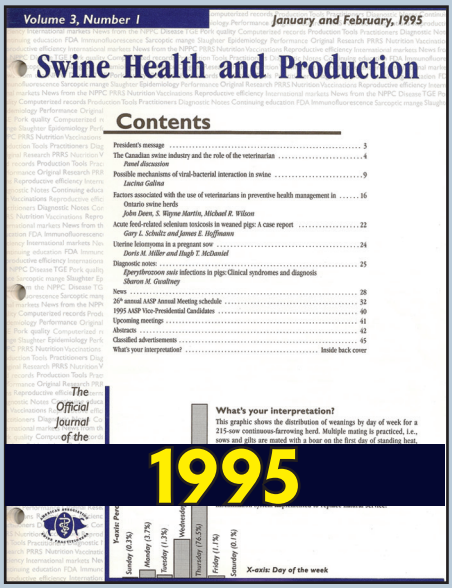

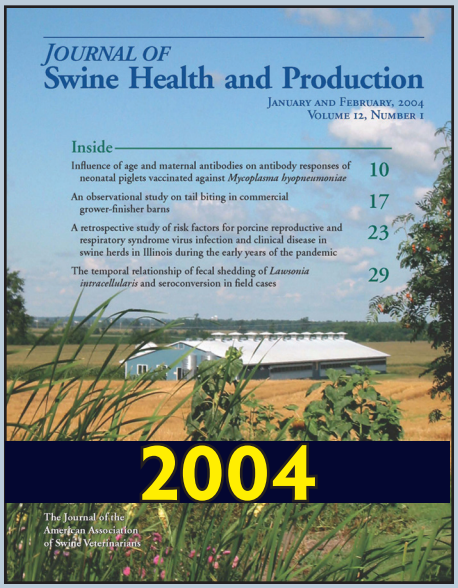

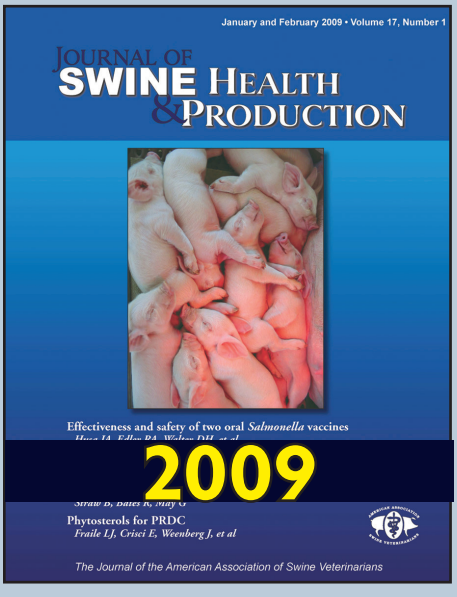

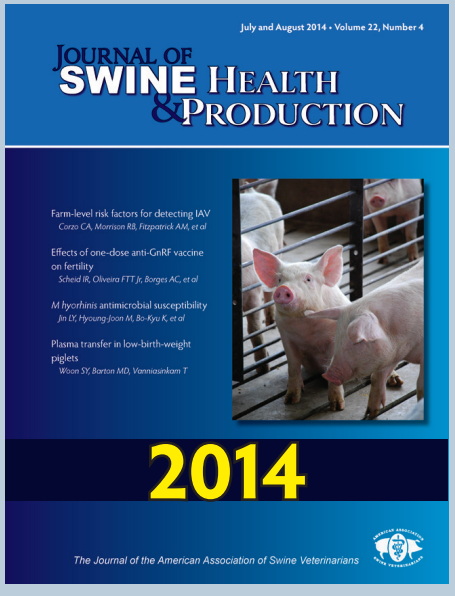

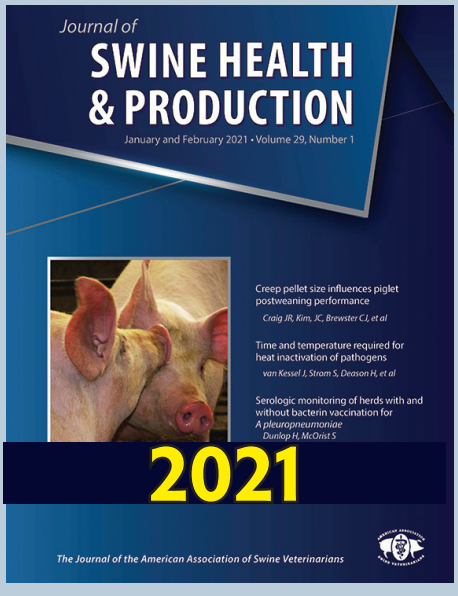

UPCOMING MEETINGS

ISU James D. McKean Swine Disease Conference

November 3 - 4, 2022 (Thu-Fri)
Scheman Building
Iowa State University
Ames, Iowa

For registration information:
Registration Services
Iowa State University
Ames, Iowa
Email: registrations@iastate.edu
Web: **regcytes.extension.iastate.edu**

For questions about program content:
Dr Chris Rademacher
Conference Chair
Iowa State University
Email: **cjrdvm@iastate.edu**

Passion for Pigs Seminar and Trade Show

November 30, 2022 (Wed)
Mathewson Exhibition Center
Sedalia, Missouri

For more information:
Julie Lolli
Tel: 660-651-0570
Email: **julie@passionforpigs.com**
Web: **passionforpigs.com**

Forum: Autogenous Vaccines in Swine Medicine: Why and How?

December 1, 2022 (Thu)
Hotel le Dauphin
600 Boul St-Joseph
Drummondville, QC J2C 2C1
CANADA

Organized by the Swine and Poultry Infectious Diseases Research Center (CRIPA)

For more information:
Cécile Crost
Email: **c.crost@umontreal.ca**
Web: **cripa.umontreal.ca**

North American PRRS/ NC229 International Conference on Swine Viral Diseases

December 2 - 4, 2022 (Fri-Sun)
Chicago, Illinois

For more information:
Web: **vetmed.illinois.edu/education/continuing-education/north-american-prrs-symposium/**

AVMA Leadership Conference

January 5 - 7, 2023 (Thu-Sat)
Chicago, Illinois

Hosted by the American Veterinary Medical Association

Web: **avma.org/events/veterinary-leadership-conference**

Pig Ski Conference

February 8 - 10, 2023 (Wed-Fri)
Copper Mountain, Colorado

For more information:
Dr Paul and Lori Yeske
Tel: 507-381-1647
Web: **pigski.com**

American Association of Swine Veterinarians 54th Annual Meeting

March 4 - 7, 2023 (Sat-Tue)
Gaylord Rockies Resort & Convention Center
Aurora, Colorado

For more information:
American Association of Swine Veterinarians
830 26th Street
Perry, Iowa
Tel: 515-465-5255
Email: **aasv@aasv.org**
Web: **aasv.org/annmtg/**

For additional information on upcoming meetings: aasv.org/annmtg/

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