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A pleuropneumoniae serotype 15 outbreak investigation in central Iowa
Machado I, Mil-Homens M, Silva AP, et al

Zinc responsive parakeratosis in growing pigs
Radke S, Forseth A, Hoogland M, et al

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TABLE OF CONTENTS

President's message 5

Executive Director's message 7

Advocacy in action 8

Outbreak investigations of *Actinobacillus pleuropneumoniae* serotype 15 in central Iowa in the winter of 2021-2022 10
Machado I, Mil-Homens M, Silva AP, et al

Zinc responsive parakeratosis in growing pigs 17
Radke S, Forseth A, Hoogland M, et al

News from the National Pork Board 23

AASV news 25

AASV Foundation news 29

Vice-Presidential candidates 34

Author Guidelines 37

Upcoming meetings 43

Cover photo is courtesy of Tina Smith
(taken at University of Missouri).

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JSHAP SPOTLIGHT

Brenna Werner Wachtendonk

2023 Top Student Poster Presenter
University of Minnesota

Brenna Werner Wachtendonk earned a BS ('18) in Animal Science from the University of Minnesota-Twin Cities and is currently a third-year veterinary student at the University of Minnesota. After graduation, Brenna plans to practice food-animal medicine in a rural veterinary shortage area, hopefully in the Midwest, working with both swine and cattle. "Being an AASV student member has allowed me to gain connections with swine veterinarians and helped me find and participate in the SVIP program the summer after my first year. I look forward to using AASV student resources to help find externship opportunities for my fourth year." Brenna was the Top Student Poster award winner at the 2023 AASV Annual Meeting.

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Speak up

We have many opportunities as veterinarians, community leaders, and association members to speak up as the expert in the room. Many others who are not close to our level of experience or education crave the ability to be heard, while some simply want to be seen and have nothing intelligent to say. If we choose to shy away from a necessary debate, important facts may be overlooked or worse, false information may influence an important decision. Influence does not need to be mean spirited or even confrontational. The opposite could be true in that speaking up to your own experiences and knowledge could be easy. You are the only true expert of your own experiences.

My challenge to AASV members this JSHAP issue is to think through your own experiences and education to prepare for critical conversations. Your investment in veterinary education can only be fully appreciated when you speak up and share. It seems the voices who would choose to minimize our value or attempt to overpower our influence are also gaining confidence. You are the expert to speak to what you see and what you know. You are also the trusted advocate for the pig. Prepare for those opportunities and speak up when you can.

Production, operations, and biosecurity

Many of our farmer clients and production teams hire us to be the voice of reason and guide difficult strategies for the health improvement of large populations of pigs. There are pig owners who make decisions based more on personal bias and history than on current scientific knowledge and real-time diagnostic facts. If you are the veterinarian placed in this debate, it can be uncomfortable to speak up. Driving the discussion to hear out the known facts, or clear and present danger, could save pigs.

Veterinary school rarely teaches us these types of conversations. I encourage you to network and find peers already sharing these challenges. The AASV Annual Meeting is famous for hallway talk. Leading up to the Annual Meeting, I have always enjoyed making a long list of people I want to find and conversations I needed to have. During the meeting it is like a game of hide-and-seek to find everyone on my list. I really like the opportunity to learn from peers in the veterinary community. We simply cannot afford to make all the same mistakes ourselves.

Advocacy and public policy

Even less formal education is focused on advocacy and public policy. We are invited to participate through the association and industry networks. The National Pork Producers Council and American Veterinary Medical Association both hold training programs for veterinarians to become more experienced in sharing their messages in support of our industry. I highly recommend these programs to any members interested in learning how decisions are really being made in government.

"Your investment in veterinary education can only be fully appreciated when you speak up and share."

We have recently learned with public attention on animal euthanasia and gestation sow housing that the message making it to the public may not be the fact-based message we would like to hear. We must learn how to best prepare and present messages about the great work we are doing for the animals in our care.

Association committees and meetings

The place where most of us are comfortable speaking our mind is in the association board room, committee room, or association meeting. We have a strong fellowship among our members. We welcome opinions and invite our members to be actively involved. If you have not joined a committee, please do so. If you are currently on a committee, please consider running for the board or searching for a special project. We are a small association and require everyone to do their part.

Committee work is easily outlined on the AASV website. If there is a topic of strong interest to you, please dive into the discussions and work on building the association to further develop the membership. We will only continue to grow our influence with our clients as we tackle tough challenges and set ambitious goals. By bringing forward these challenges to the meetings and driving discussion as an association, we will be able to provide leadership to advance the education, research, and service opportunities for members of the AASV.

Please speak up! We are a small but mighty group, your input is welcome.

William L Hollis, DVM
AASV President

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Clinical & Fecal Scores

Study days 58-70:
Clinical Scores: 0 Normal, 1 Mild, 2 Moderate, 3 Severe
Fecal Scores: 0 Normal, 1 Soft, 2 Loose, 3 Watery

Scoring	Saline	ENDOVAC-Porci®	Porcilis® Ileitis
Clinical	24.7^{a}	14.6^{b}	15.9^{ab}
Fecal	27.4^{a}	17.1^{b}	20.9^{ab}

Treatment means with different superscripts differ from each other ($P < 0.05$)

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- **50.8%** better fecal scores

Clinical & Fecal Scores

Study days 22-35:
Clinical Scores: 0 Normal, 1 Mild, 2 Moderate, 3 Severe
Fecal Scores: 0 Normal, 1 Soft, 2 Loose, 3 Watery

Treatment	Saline	ENDOVAC-Porci®	P-value
Clinical	1.19	0.29	.05
Fecal	1.95	0.96	.05

Effect of treatment ($P < 0.01$)

To review the studies that back up the science, scan the QR Code.

Veterinary midlevel professional

We are all aware of the workforce challenges impacting veterinary practice. These challenges are not uniform across the profession, however. There are unique challenges related to geography, lifestyle, and practice type. The inability to hire and retain veterinarians and staff can be exacerbated in rural areas and food-animal practice. Estimates regarding the future availability of, and demand for, veterinary services are often used to support calls for broad changes in the delivery of veterinary medicine. One such proposed solution is the development of a veterinary midlevel professional (MLP).

Simply saying that there will be a future shortage of veterinarians does not adequately consider the differing impacts on the broader profession and the upcoming increases in veterinary supply. Existing veterinary schools are increasing the student capacity and at least 15 new veterinary schools are in various stages of development, with 3 of those graduating their first class by 2025. In addition, there are legislative efforts to encourage veterinary students to consider rural practice and other identified shortage areas.

Regardless of the veterinary supply and demand question, an MLP has a number of inherent issues that may pose a risk to future veterinary practice or run afoul of regulation. It also ignores the availability of certified veterinary technicians (CVT) and veterinary technician specialists (VTS), which are already recognized and regulated in state-level veterinary practice acts. Using these folks to the extent of their training and ability could provide practices some relief for overworked veterinarians and address some level of understaffing.

It is currently unclear exactly how an MLP would or could be used in the delivery of veterinary medicine. There is no structure to provide evaluation and certification for MLPs or even an accredited curriculum. In addition, to offer services, every state would have to modify their veterinary practice acts to define their role. Similarly, federal regulations would have to change if MLPs were allowed to prescribe veterinary drugs or use drugs in an extra-label manner. Both of those activities currently require the involvement of a licensed veterinarian, as does the establishment of a veterinarian-client-patient relationship. Current regulation would also prevent an MLP from performing regulatory animal health certifications such as issuing certificates of veterinary inspection or performing regulatory diagnostic testing.

Furthermore, it seems likely that the establishment of an MLP could negatively impact the value of CVTs, VTSs, and veterinarians at a time when the cost of veterinary education has increased significantly. Decreased salary opportunities would further limit the ability of future students to enter the profession.

"Estimates regarding the future availability of, and demand for, veterinary services are often used to support calls for broad changes in the delivery of veterinary medicine."

The MLP is often compared to a physician's assistant (PA) in human medicine. As currently proposed, an MLP would have to work under the supervision of a veterinarian and the veterinarian would be legally responsible for delivery of the veterinary services. It is my understanding that, in most cases, supervising physicians are not automatically liable for the actions of the PA. It seems there are more effective and efficient tools already approved and available to help ease the workforce challenges impacting swine practice than the introduction of another level of veterinary professional.

The AASV Board of Directors recently established a subcommittee to propose a position on the issue of an MLP. After evaluating the workforce challenges facing swine veterinary practices, the available opportunities to use farm and clinic staff, the potential to better use CVTs and VTSs, and the challenges associated with developing and implementing an MLP, the subcommittee recommended, and the Board approved, a position statement expressing a lack of support for the proposed development of a veterinary midlevel professional. This, and all the AASV position statements can be viewed on the AASV website at **aasv.org/aasv/positions**.

Harry Snelson, DVM
Executive Director

AASV on the hill

The AASV Executive Committee members Drs Mike Senn, Bill Hollis, and Locke Karriker, joined Dr Harry Snelson, AASV executive director, and Dr Abbey Canon, AASV director of public health and communications, October 24-26, 2023 in Washington, D.C. The group joined the American Association of Bovine Practitioners (AABP) leadership for an annual visit hosted at the American Veterinary Medical Association (AVMA) Government Relations Division (GRD) headquarters.

The purpose of the trip was to provide AASV leadership with an opportunity to interact with federal regulators, government agency personnel, and legislators to discuss issues of concern to swine veterinarians. In addition, the Executive Committee heard from the National Milk Producers Federation (NMPF) and the American Association of Veterinary Medical Colleges (AAVMC).

The AVMA GRD staff welcomed the group and provided an overview of current federal and state legislative advocacy activity. Federally, five registered lobbyists advocate for animal health and veterinary medicine on behalf of veterinarians and the AVMA. At the state level, the AVMA GRD's role is to monitor state activity and support state veterinary medical associations and allied organizations. For example, 19 states have considered or are considering legislative action on xylazine this year, many states have taken positions on the veterinarian-client-patient relationship and telemedicine, and multiple states have deliberated legislation on mRNA vaccine technology or product labeling. The AVMA summarizes state legislative activity each month at **avma.org/advocacy/state-legislative-updates**.

Leaders of AASV and AABP seized an opportunity to ask questions and share concerns with Food and Drug Administration (FDA) Center for Veterinary Medicine representatives Drs William Flynn and Tristan Colonius. Participants engaged in lengthy discussion about supply chain issues for animal health products, such as ponazuril and penicillin. Both organizations suggested more outreach would be needed as retail stores near depletion of products now requiring veterinary prescription under Guidance for Industry #263. They also voiced concerns about the risk of losing veterinary products as drug sponsors respond to the draft guidance on defining durations of use; FDA reassured their goal is *not* to lose product. In fact, FDA showcased the recently published Animal and Veterinary Innovation Agenda as a potential pathway to bring more veterinary products to market.

John Sagle, US Customs and Border Protection (CBP), described activities of the agency's 2700 employees at 186 ports of entry, including 189 Beagle Brigade canine teams. While the veterinarians' interest was heavily centered around the importation of prohibited agriculture products and foreign animal disease prevention, Sagle also described illegal importation of other material items and the link to illicit drug smuggling and terrorism. Further, he expressed concern with researchers shipping and importing veterinary diagnostic samples and underscored the importance of appropriate notification, documentation, and CBP evaluation.

"The AASV advocates for animal health and welfare, public health, and veterinary practice by providing scientific information to decision makers."

Dr Andy Maccabe and Mr Kevin Cain, AAVMC, described the current state of veterinary education, including the addition of several more veterinary schools. The group engaged in lengthy conversation about swine medicine curriculum at non-swine state schools and discussed recruitment and retention of individuals in rural and mixed-animal practice.

Dr Jamie Jonker, NMPF, described the FARM 5.0 program, estimating that 99% of dairy farms were enrolled in the program. Dr Kis Robertson Hale, USDA Food Safety Inspection Service, provided an update on violative residues. Dr Maggie Behnke, National Bio and Agro-Defense Facility (NBAF), briefed the group on the transition to Manhattan, Kansas. Read more about AASV's interaction with NBAF in the 2023 November/December JSHAP issue.[1]

On Thursday, with assistance from the National Pork Producers Council, the AASV leadership traveled to Capitol Hill to meet with legislators to emphasize Farm Bill priorities for food-animal veterinarians and pork producers. Critical programs and top priorities for swine veterinarians in the Farm Bill are described as the "three-legged stool," which includes the National Animal Vaccine and Veterinary Countermeasures Bank, the National Animal Health Laboratory Network, the National Animal Disease Preparedness and Response Program, and the National Veterinary Stockpile. Other priorities include increased authorization to $5 million for the Food Animal Residue Avoidance Databank and improving dog importation standards to prevent the introduction and spread of diseases impacting animal, including swine, and human health through the Healthy Dog Importation Act.

The AASV advocates for animal health and welfare, public health, and veterinary practice by providing scientific information to decision makers. For more information about Farm Bill priorities, including actions you can take to inform and influence decision makers, review the 2023 March/April JSHAP issue.[2] All veterinarians can and should advocate for animal health and welfare.

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*2. Canon A. Farm Bill season [editorial]. *J Swine Health Prod*. 2023;31(2):103-105. **aasv.org/shap/issues/v31n2/v31n2advocacy**

* Non-refereed references.

Abbey Canon, DVM, MPH, DACVPM
Director of Public Health and Communications

From left: Drs Locke Karriker, Bill Hollis, Mike Senn, Harry Snelson, and Abbey Canon visited Washington D.C. in October 2023.

Peer reviewed **Case Study**

Outbreak investigations of *Actinobacillus pleuropneumoniae* serotype 15 in central Iowa in the winter of 2021-2022

Isadora Machado, DVM; Mafalda Mil-Homens, DVM, MS; Ana Paula Silva, DVM, PhD; Pete Thomas, DVM, MS; Levi Johnson, DVM; Lori Feldmann, DVM; Lauren Glowzenski, DVM, MS; Daniel Boykin, DVM; Tyler Bauman, DVM; Alyona Michael, DVM, PhD; Marcelo Almeida, DVM, PhD; Daniel Linhares, DVM, MBA, PhD; Gustavo Silva, DVM, PhD; Derald J. Holtkamp, DVM, MS

Summary

From November 2021 to January 2022, 20 growing-pig sites in central Iowa reported severe clinical respiratory disease and weekly mortality of up to 50%. *Actinobacillus pleuropneumoniae* serotype 15 was identified as the causative agent of the clinical disease. Given that *A pleuropneumoniae* serotype 15 has been infrequently diagnosed in the United States, an outbreak investigation was conducted to explore biosecurity hazards and epidemiological aspects associated with the surge of cases. The investigations revealed that all farms had significant gaps in biosecurity and relied heavily on third-party service providers, which may have contributed to the pathogen spread.

Keywords: swine, *Actinobacillus pleuropneumoniae*, outbreak investigation, biosecurity hazard analysis

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Resumen - Investigaciones de brotes de *Actinobacillus pleuropneumoniae* serotipo 15 en el centro de Iowa en el invierno de 2021-2022

Desde noviembre de 2021 hasta enero de 2022, 20 sitios de engorda de cerdos en el centro de Iowa reportaron problemas respiratorios clínicos graves, y una mortalidad semanal de hasta el 50%. Se identificó al *Actinobacillus pleuropneumoniae* serotipo 15 como el agente causal de la enfermedad clínica. Dado que el *A pleuropneumoniae* serotipo 15 ha sido diagnosticado con poca frecuencia en los Estados Unidos, se llevó a cabo una investigación del brote para indagar los peligros de bioseguridad y los aspectos epidemiológicos asociados con el aumento de casos. Las investigaciones revelaron que todas las granjas tenían deficiencias importantes en la bioseguridad, y que dependían en gran medida de proveedores de servicios externos, lo que puedo haber contribuido a la propagación del patógeno.

Résumé - Enquêtes sur des poussées de cas causées par *Actinobacillus pleuropneumoniae* sérotype 15 en Iowa durant l'hiver 2021-2022

De novembre 2021 à janvier 2022, 20 sites de porcs en croissance du centre de l'Iowa ont rapporté des cas cliniques sévères de maladie respiratoire et de la mortalité hebdomadaire allant jusqu'à 50%. *Actinobacillus pleuropneumoniae* sérotype 15 a été identifié comme étant l'agent étiologique de ces cas. Étant donné qu'*A pleuropneumoniae* sérotype 15 n'a été diagnostiqué que peu fréquemment aux États-Unis, une enquête a été menée afin d'examiner les risques en biosécurité et les aspects épidémiologiques associés avec cette poussée de cas. Les enquêtes ont révélé que toutes les fermes présentaient des déficiences en lien avec la biosécurité et se fiaient beaucoup sur les services de tiers parties, ce qui pourrait avoir contribué à la dissémination de l'agent pathogène.

IM, MM-H, APS, AM, MA, DL, GS, DJH: Veterinary Diagnostic and Production Animal Medicine, Iowa State University, Ames, Iowa.

PT: Iowa Select Farms, Iowa Falls, Iowa.

LJ: New Fashion Pork, Jackson, Minnesota.

LF: Protein Sources, Mapleton, Minnesota.

LG: TriOak Foods, Oakville, Iowa.

DB: Cactus Family Farms, Osceola, Iowa.

TB: The Maschhoffs, Carlyle, Illinois.

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Machado I, Mil-Homens M, Silva AP, Thomas P, Johnson L, Feldmann L, Glowzenski L, Boykin D, Bauman T, Michael A, Almeida M, Linhares D, Silva G, Holtkamp DJ. Outbreak investigations of *Actinobacillus pleuropneumoniae* serotype 15 in central Iowa in the winter of 2021-2022. *J Swine Health Prod.* 2024;32(1):10-16. **https://doi.org/10.54846/jshap/1362**

Actinobacillus pleuropneumoniae is the etiologic agent of porcine pleuropneumonia, distributed worldwide in pig-producing countries, and causes economic losses and negative impacts on pig health due to exacerbated respiratory clinical disease and mortality.[1,2] This gram-negative bacterium is classified into biotypes I or II based on the nicotinamide adenine dinucleotide requirement for growth.[3] *Actinobacillus pleuropneumoniae* serotype 15, classified as biotype I, was described first in Australia, where it is the predominant serotype.[4] Although less frequent, *A pleuropneumoniae* serotype 15 has also been reported in North America, South America, and Japan.[5-7]

The introduction of *A pleuropneumoniae* into a swine herd typically occurs through direct transmission, mainly when introducing a carrier animal into the herd.[8] The carrier animal acts as a reservoir for the pathogen and can transmit it through direct nose-to-nose contact with susceptible animals. Indirect routes of *A pleuropneumoniae* transmission are uncommon.[9] Reports suggest that aerosol transmission over short distances (up to 2.5 m) can occur.[10-12] *Actinobacillus pleuropneumoniae* has a relatively short environmental survival time, particularly under dry and warm conditions. However, it can survive on frozen surfaces up to -20°C for over 17 weeks,[13] suggesting possible long-term survival in frozen pig carcasses and other frozen items, thus indicating the possibility of indirect transmission.

The incubation period for *A pleuropneumoniae* and the appearance of clinical signs can be extremely variable. In experimental studies with naive pigs, clinical signs, such as fever, dyspnea, and cough, were reported 1 to 10 days post *A pleuropneumoniae* inoculation.[14,15] Gross pathologic findings in the lungs, such as consolidation and hemorrhagic areas, can be found up to 24 hours after endotracheal or intranasal inoculation with *A pleuropneumoniae*.[16] Although antibiotic therapy has been used to treat porcine pleuropneumonia, animals that survive the acute phase often remain carriers for several months, mostly with the *A pleuropneumoniae* detected or isolated in the lungs and tonsils.[17-19]

Since 2010, *A pleuropneumoniae* serotype 15 has occasionally been diagnosed at the Iowa State University Veterinary Diagnostic Laboratory (ISU VDL). From 2010 to 2020, *A pleuropneumoniae* serotype 15 was identified in affected lungs in 31 cases, and in 11 cases from January to October 2021. However, within a 60-day period from November 2021 to January 2022, an outbreak of 20 *A pleuropneumoniae* serotype 15 cases were diagnosed from grow-finish sites with weekly mortality of up to 50% of the pigs placed in the group. The cases from November 2021 to January 2022 were unusual from an epidemiological perspective since they originated from 9 unrelated production companies that submitted tissues for diagnostic workup from sites in a small geographic area (30-km radius) in central Iowa. Notably, no case reports outside of this area were observed in the ISU VDL during the same period. Therefore, an outbreak investigation was conducted to explore biosecurity hazards and epidemiological aspects associated with the surge of *A pleuropneumoniae* serotype 15 cases in central Iowa.

Animal care and use

An animal care protocol was not necessary as all samples used in this study were derived from routine diagnostic submissions to the ISU VDL. Animals involved in this case report were under the supervision of the herd veterinarian and were cared for in accordance with the Pork Quality Assurance Plus program.

Case description

Case definition

The case definition was applied to the site level. The start date of each case and age of affected pigs were determined by the first diagnostic submission to the ISU VDL or by the date on which clinical signs were first observed with subsequent diagnostic confirmation of *A pleuropneumoniae* serotype 15 as the etiology.

Thus, cases were eligible for this study if they met criteria based on clinical history, pathological findings (gross and microscopic evaluation), and diagnostic results. The clinical history provided by the herd veterinarians through the investigations included high acute mortality with or without the presence of respiratory clinical signs, such as dyspnea or respiratory distress. Macroscopic pathological findings were characterized by areas of firm to friable, dark red to black lung consolidation, and histologically by necrosis and hemorrhage rimmed by viable and degenerating neutrophils, often with streaming nuclei. Finally, diagnostic testing confirmed the growth of *A pleuropneumoniae* from affected lungs with subsequent gel-based serotyping polymerase chain reaction (PCR) confirming serotype 15.

Data collection

A total of 20 grow-finish sites from 9 production systems were classified as cases and included in the descriptive and spatial-temporal analyses. Epidemiological information for all 20 cases was collected from the herd veterinarian of each of the 9 companies. The information included the production stage, age of animals at the onset of the case, the number of pigs placed, mortality, diagnostic test results, the method used for carcass removal, and address for spatial analysis. Additionally, maps of the surrounding area of each case site were obtained using satellite images from Google Earth to evaluate the number of other swine sites within a 1.6 to 8 km radius and the number of public roads near each site. Moreover, the detection of *A pleuropneumoniae* serotype 15 by the ISU VDL in previous cases dating back to 2010 for the 9 companies was tracked as part of the investigation to assess any potential recurrences within the company.

Epidemiological investigation and biosecurity hazard analysis

Of the 20 cases that occurred in the 60-day period (November 2021 to January 2022), 7 cases, each from a different production system, agreed to share information through an intensive epidemiological investigation and biosecurity hazard analysis. Two companies declined to participate. In addition, information on clinical signs, mortality, treatment, unusual weather events and power outages, and characteristics of the herd, site, and area surrounding the site was collected. The investigation was conducted retrospectively as an epidemiological investigation and biosecurity hazard analysis of the production processes. The biosecurity hazard analysis consisted of a detailed assessment of the production processes and biosecurity control measures for each case. Information on circumstances and actions (or inactions) likely to result in failures that may have led to the introduction of *A pleuropneumoniae* serotype 15 into the herd was evaluated for each case.

An investigation form (available upon request from the corresponding author) was used to conduct the investigation interviews and report the results.[20] The

main objectives of the intensive investigations were to evaluate the biosecurity hazards and epidemiological aspects of the cases, explore potential routes of *A pleuropneumoniae* serotype 15 transmission, and comprehensively evaluate potential entry events, including swine movements, deliveries, people movements, and others that occurred during the investigation period. Briefly, the investigation form was organized by each type of epidemiological information and entry events. Entry events were defined by the entry of one or more pathogen-carrying agent(s) into the perimeter buffer area of the site. Pathogen-carrying agents were defined as any agent that 1) can be infected or contaminated with a pathogen and 2) carry the pathogen from one herd to another. Examples of pathogen-carrying agents include pigs, people, and livestock trailers. Based on *A pleuropneumoniae* transmission characteristics, incubation period, and severity of the disease, a 14-day investigation period was used for each investigation ending on the date clinical signs were first recognized or when a laboratory diagnostic result confirmed *A pleuropneumoniae* serotype 15. Only entry events that occurred during the investigation period were evaluated.

To identify the biosecurity hazards, the 3 failures concept was employed, which states that 3 failures must have occurred for *A pleuropneumoniae* serotype 15 to have been transmitted to a herd.[20] The 3 failures were 1) failure to prevent the infection or contamination of the pathogen-carrying agent with *A pleuropneumoniae* serotype 15, 2) failure to mitigate the contamination or infection of the pathogen-carrying agent, and 3) failure to prevent pigs in the herd from being infected with an infectious dose of the pathogen from the pathogen-carrying agent.

The intensive investigation interviews were conducted as an open-ended discussion of the production processes connected with each entry event as guided by the investigation form. The investigations were conducted from February to May 2022 by veterinarians from Iowa State University in collaboration with the herd veterinarians, site caretakers, production management, and members of the Swine Health Information Center's Rapid Response Team (RRT). The RRT consists of a nationwide network of veterinarians prepared and committed to moving within 24 hours notice to conduct epidemiological investigations.[21]

Data analysis

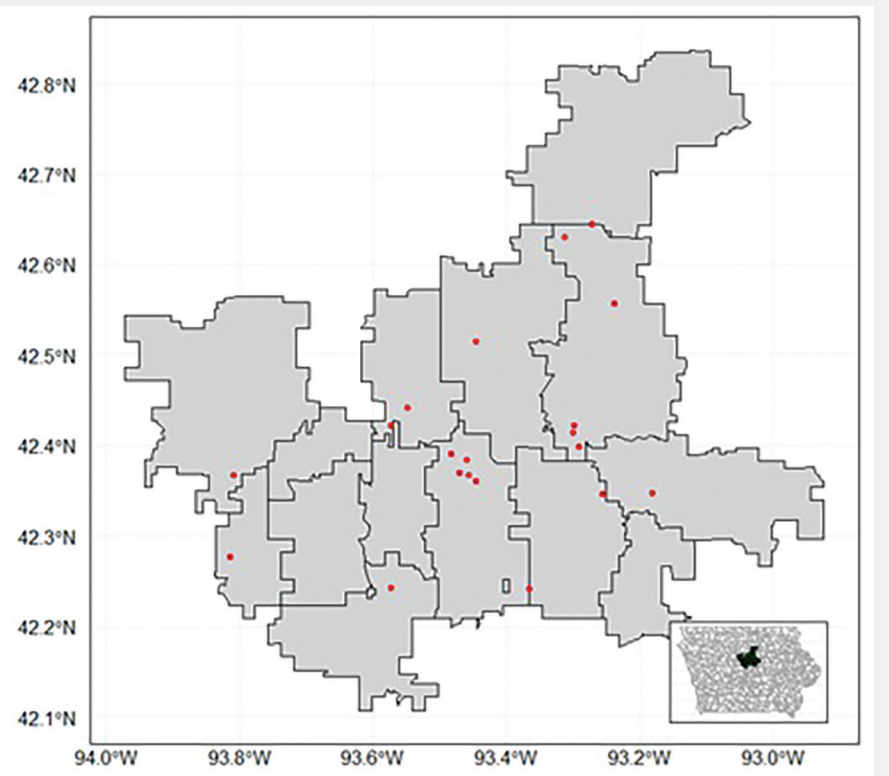
A descriptive analysis of the information collected during the investigation was done. Thereafter, a spatial-temporal statistical model was performed to evaluate the interaction between the distance and time of each *A pleuropneumoniae* serotype 15 case (n = 20). A space-time interaction K function (R package *splancs*) was used with geographic locations of sites (longitude and latitude, projection in datum NAD83) and time (case start and end dates).[22,23] For the case start dates, day 1 was defined by the herd veterinarian based on the observation of the first clinical signs or laboratory diagnostic tests. Although *A pleuropneumoniae* shedding is highly variable,[24] a recent study from our group (unpublished data) demonstrated that it was possible to detect *A pleuropneumoniae* by PCR from nasal swabs and tonsil scrapings up to 10 weeks after clinical signs were first observed. Thus, the lesser of 10 weeks or the time until the sites were emptied was used for the spatial-temporal statistical model. An area using Iowa postal zip codes that included at least one *A pleuropneumoniae* serotype 15 case was used to create a polygon delimiting the outbreak area (Figure 1). Analyses were performed in R program version 4.2.1 (R Core Team, 2022) with a $P \leq .05$ to establish statistical significance.

Discussion

The production phases of the 20 cases included wean-to-finish (n = 5) and finishing only (n = 15) sites where pigs were being raised for meat production. None of the cases occurred on gilt development, acclimation, or isolation sites. Pig ages ranged from 8 to 30 weeks of age at the onset of clinical signs with most cases occurring between 22 to 25 weeks of age (n = 7).

Typically, *A pleuropneumoniae* is directly transmitted by introducing a carrier animal into the herd.[8] Previous detections of *A pleuropneumoniae* serotype 15 by the ISU VDL were assessed to determine potential recurrences within a company. Five of the 9 companies involved had no previous detections of *A pleuropneumoniae* serotype 15. However, 4 companies did have previous detections: one company had 3 diagnoses in 2011, 2016, and 2020; another company had 2 diagnoses in 2021 through June; one company had a single diagnosis in 2017; and one company had 5 diagnoses in 2021 through September. Notably, 3 of the 4 companies that experienced recurrences had multiple cases in 2021-2022, while companies with no previous detections experienced a single case.

Figure 1: Polygon delimiting the outbreak area in the state of Iowa.



The magnitude of death loss varied among the 20 cases with a mean cumulative mortality of 25% (range, 2%-56%) and a mean single-week mortality peak of 17% (range, 1%-50%). Eleven of the 20 cases also had a porcine reproductive and respiratory syndrome virus (PRRSV) RNA-positive PCR result, one had an influenza A virus RNA-positive PCR result, and one had a *Mycoplasma hyopneumoniae* DNA-positive PCR result. The diagnosticians reported evidence of pneumonia consistent with PRRSV associated with *A pleuropneumoniae* serotype 15 lesions in 3 cases. Clinical signs of *A pleuropneumoniae* can be worsened when associated with other respiratory agents, such as *M hyopneumoniae*.[25]

Of the 20 growing-pig sites with cases of *A pleuropneumoniae* serotype 15 over the 60-day outbreak, 18 used the same third-party rendering service for carcass removal. Carcass removal from the sites followed specific routes within a rendering collection area (Figure 2). Rendering trucks and drivers were, with rare exceptions, dedicated to the rendering collection area. The carcasses were collected by trucks within the rendering collection area and were taken to a single collection point. After unloading the carcasses at the collection point, they were transferred to larger trailers for transport to the rendering plant located outside of the rendering collection area. All 20 cases were within the rendering collection area marked as a red square in Figure 2. The routes followed by the rendering trucks within the rendering collection area were unknown to the herd veterinarians, and the rendering company declined to provide more information on the timing of pickups and routes followed. In most cases, the carcass storage and rendering pickup locations were at the site's entrance. For all the cases, if the area around the carcass storage was contaminated with *A pleuropneumoniae* serotype 15 during pickup, the caretaker biosecurity procedures were insufficient to prevent the bacteria from being transmitted from the carcass storage area to the pigs in the barns.

The spatial-temporal analysis revealed a significant interaction between space and time of *A pleuropneumoniae* serotype 15 cases ($P < .01$). For the spatial-temporal analysis, the index case (a finishing site undergoing a case on November 25, 2021) was located at 0 km and 0 day in Figure 3. It was estimated that cases progressively occurred at all distances after 10 days of the first case (blue shade in Figure 3). The highest intensity of spatial-temporal interaction (red shade in Figure 3) occurred between 20 and 40 days after the index case (December 15, 2021 to January 4, 2022) and between 20 km and 40 km from the index case.

The descriptive results of the epidemiological investigations and biosecurity hazard analysis completed for 7 cases are shown in Table 1. The mean number of animals in the facilities was 4056 (range, 2445-5691 pigs). The total number of sources of pigs placed were either 1 (n = 4) or 2 (n = 3). Four cases were finishing only and 3 were wean-to-finish sites. The number of weeks after the pigs were placed on feed at the onset of each case ranged from 5 to 27 weeks. The mean death loss between these 7 cases was 18% (range, 2.2%-38.9%). The most common clinical signs reported were sudden death and high mortality, dyspnea, lethargy, anorexia, cough, and cutaneous hyperemia. Except for cases where pigs were actively being marketed (n = 3, range 3-8 loads prior to the case start date), the pigs were medicated with injectable antimicrobials (ceftiofur, oxytetracycline, and enrofloxacin) or orally administered antimicrobials (tiamulin, amoxicillin, and tilmicosin) after the onset of clinical signs.

In 2 of the 7 cases, not all barns on the site were affected. Clinical signs were observed in 1 of the 4 barns on the site in one case and 2 of the 3 barns on the site in the second case. In those 2 cases, the pigs remained on the site for 3 to 7 weeks after clinical signs were first observed, and it was reported that caretakers

Figure 2: The blue pin indicates the rendering collection point. The red square indicates the approximate rendering collection area: 30 km to the north, 130 km to the west, 70 km to the south, and 95 km to the east of the rendering collection point. The red pins indicate the locations of the *Actinobacillus pleuropneumoniae* serotype 15 outbreak cases.

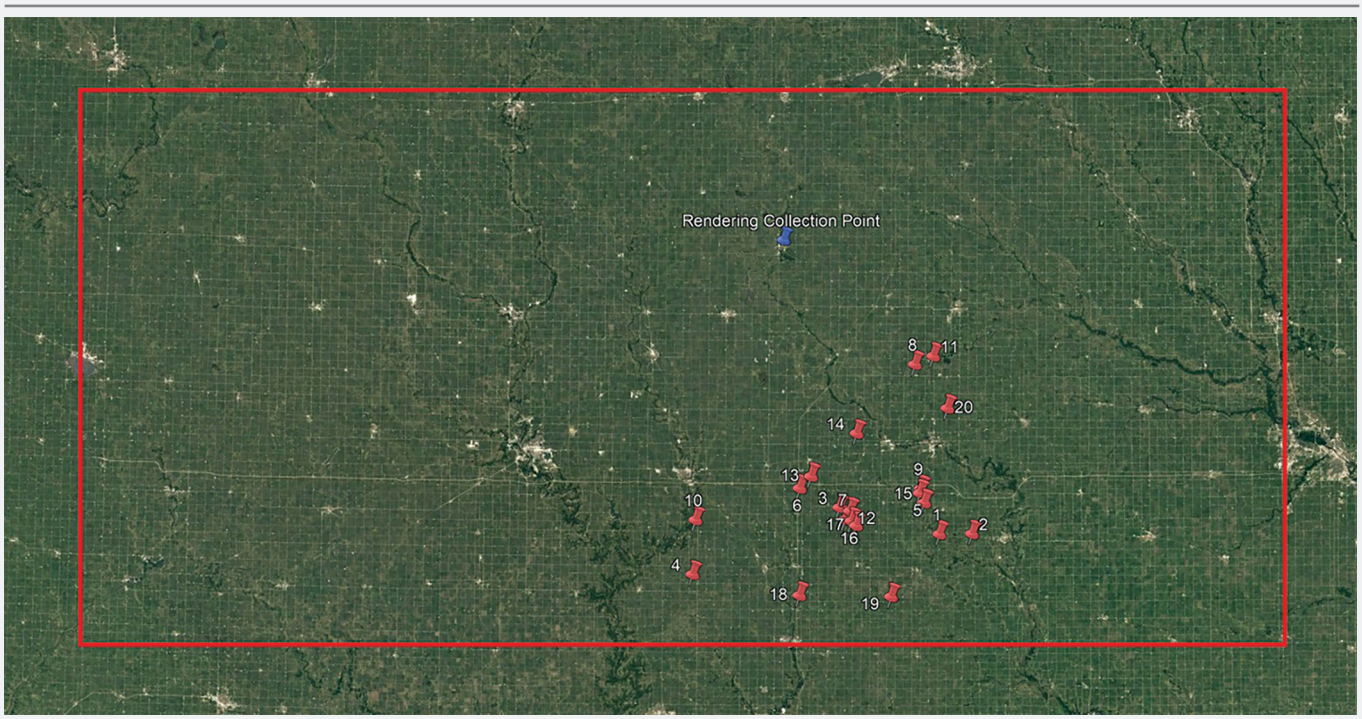


Figure 3: Contour plot showing the spatial-temporal clustering of *Actinobacillus pleuropneumoniae* serotype 15 cases in the outbreak. The cluster intensity from lowest (light blue) to highest (dark red) represents the correlation coefficient between the cases in terms of space and time ($P < .01$). The white area in the top right corner represents distance and dates with no significant correlation between cases ($P > .05$).

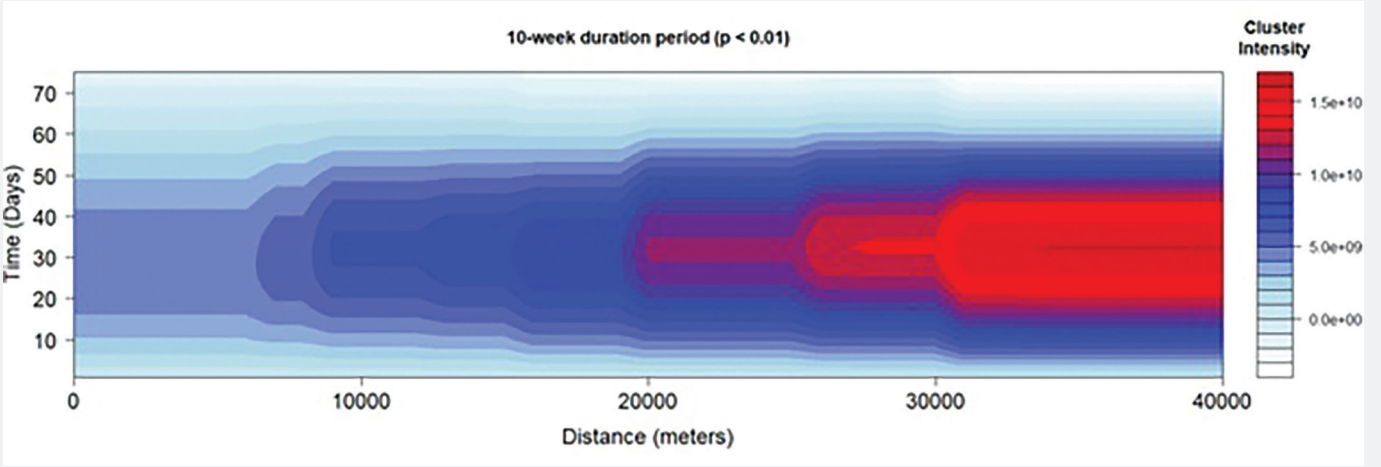


Table 1: *Actinobacillus pleuropneumoniae* serotype 15 outbreak information on 7 sites from 7 companies

	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Case 7
Outbreak start date	12/12/2021	12/16/2021	12/24/2021	12/30/2021	1/8/2022	1/9/2022	1/14/2022
No. animals placed	4800	3950	5691	4000	5057	2445	2451
No. animal sources	2	1	1	2	2	1	1
Production phase	Finisher	Finisher	Finisher	W-F	W-F	W-F	Finisher
Time of outbreak, wk post placement	8	17	12	24	5	27	10
Outbreak mortality, No. (%)	105 (2.2)	700 (18.3)	46 (2.8)	781 (19.8)	704 (14.3)	175 (30.0)	873 (38.9)
No. barns on site	4	4	2	3	2	2	2
No. affected barns	1	4	2	2	2	2	2
Stress events*	Yes	Yes	Yes	No	No	No	Yes
Market time†	No	No	Yes	Yes	No	Yes	No
History of *A pleuropneumoniae* serotype 15‡	Yes	No	No	No	Yes	No	Yes
Carcass removal method	Rendering	Compost	Rendering	Rendering	Rendering	Rendering	Compost

* Stress events included power outages, curtains failing to drop, water outages, and movement of pigs between barns.

† Market time means one or more loads of pigs had been marketed on or before the case start date.

‡ Diagnostic history from 2020 to 2021 was reviewed to identify previous detections of *A pleuropneumoniae* at the site.

W-F = wean-to-finish.

changed boots between barns and wore disposable gloves. No pigs were moved between the barns. This finding suggests that *A pleuropneumoniae* serotype 15 might not easily be indirectly transmitted on fomites and that biosecurity practices, such as changing boots between barns, may reduce the likelihood of transmitting *A pleuropneumoniae* to animals from different barns.[11,13]

Stress events are a potential cofactor in the pathogenesis of infectious diseases.[26,27] Stress events including power outages, curtains failing to drop, water outages, and movement of pigs between barns during the marketing phase were reported in 4 of the 7 cases up to 14 days before the case. Also, a notable weather event occurred on December 15, 2021. A derecho spawned tornadoes with wind speed up to 173 km/hr and moved quickly from the southwest to the northeast sections of Iowa according to the National Weather Service Forecast Office in Des Moines.[28] The herd veterinarian in one case reported that a power and water outage occurred 1 day after the derecho. These stress events could have exacerbated the magnitude of the outbreak.

The characteristics of the surrounding area were similar in the 7 cases. All cases occurred in pig-dense areas with an average of 6 known finisher sites within a 5-km radius and the nearest public road within 0.4 km from the case sites. Also, 6 of 7 cases were over 11 km from a collection point or a slaughter plant. All cases were in flat topography with none having full windbreaks. All used water from private wells with no water treatments.

Among the 7 cases, 3 were marketing pigs to multiple packing plants in Minnesota and in nearly every region of Iowa, all outside of the area where the outbreak occurred. The small geographic area where the outbreak occurred suggests that marketing events likely did not play a significant role in the transmission of *A pleuropneumoniae* serotype 15 from one herd to another. However, some very significant biosecurity hazards related to the transport of market pigs were discovered. Transport was conducted primarily by third-party contractors. The requirements for washing and decontaminating trailers between loads varied and were frequently absent. Oversight of the third-party contractors to verify that trailer washing and decontamination requirements were being met was absent. When washing and decontamination were required, downtime to allow the trailers to dry or thermal-assisted drying was absent.

Regarding movement of people, animal caretakers also cared for other finisher sites (up to 12 sites per person), with caretakers entering sites 1 to 3 times per day. The labor was contracted in 2 of the 7 sites. In one case, a caretaker also worked for a different swine production company, while the other 6 cases had caretakers visiting other growing-pig sites within the same company. In all cases, no other sites on their daily routes were known to be positive for *A pleuropneumoniae* serotype 15. However, from 2020 to 2021, there were reported cases of *A pleuropneumoniae* serotype 15 in 3 of the 7 companies. In 5 cases, off-farm employees, such as maintenance, visitors, and load crews, entered the barns during the investigation period. Six companies frequently relied on contracted third-party labor for loading pigs, maintenance, and vaccinations. Downtime for caretakers, off-farm employees, and other visitors before entering the sites was not required for any of the cases. Knowledge of how third-party contractors operated and their activities was lacking.

The investigation exposed other gaps in grow-finish biosecurity. Six cases had only one vehicle entrance, and none had a vehicle wash and disinfection area. Five cases received feed deliveries during the outbreak investigation period, all from different feed mills. One case had a propane delivery during the outbreak investigation period, 2 reported garbage collection, and 1 reported introducing tools and supplies from another pig site. The barn and office doors at the site of 4 cases were required to be closed and locked, the other 3 cases did not have this requirement. For 6 cases, personal items could enter the office and barns and required no decontamination procedures. Shower-in-shower-out of the site was optional in 5 cases, and a clear line of separation defining clean and dirty sides with a bench was in place in only 2 cases. If properly designed and used, a shower-in-shower-out structure with a bench system can significantly reduce the risk of introducing pathogens into the swine barn.[29]

After conducting intensive investigations, herd veterinarians from 6 of the participating production companies attended a meeting in April 2022 at Iowa State University. The primary objective of the meeting was to facilitate sharing of experiences and discuss pertinent information discovered during the investigations. It became evident during this meeting that companies shared connections among sites from different systems (labor) and poor biosecurity procedures were related to the lack of biosecurity auditing. Participants reported implementing various biosecurity control measures that may have mitigated further spread of *A pleuropneumoniae* serotype 15 among sites and companies. This meeting highlighted the indispensable role of effective and active communication among veterinarians and companies, which likely was essential to effectively respond to this emerging health challenge.

Cases of *A pleuropneumoniae* serotype 15 were clustered in time and space in a swine-dense area of Iowa and within a common rendering route. The outbreak investigations revealed a heavy reliance on contracted services, such as rendering and load-out crews, that created a potential for operational connections between production systems and exposing the facilities to biosecurity risks. However, one limitation of this study was that a case-control design was not employed. This limited our ability to gather information on risk factors and identify gaps in biosecurity among farms without *A pleuropneumoniae* serotype 15 cases in the same region during the same period. Consequently, this study provides valuable insights and speculative analysis regarding potential causes or risk factors associated with the observed cases. Moreover, the findings revealed a general need for more knowledge and compliance monitoring of biosecurity control measures on growing-pig sites. These gaps in grow-finish biosecurity can expose US swine production to emerging, re-emerging, and foreign animal diseases, such as the African swine fever virus.

Implications

The findings of this study suggest:

- Focus on carcass removal biosecurity must improve to prevent further outbreaks.
- Lack of biosecurity audits led to gaps that may facilitate pathogen introduction.
- The outbreak investigation facilitated a rapid response by veterinarians.

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Conflict of interest

None reported.

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* Non-refereed references.

Zinc responsive parakeratosis in growing pigs

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Summary

This case report describes a clinical case of nutritional zinc deficiency in growing swine caused by a feed mixing error. Mortality reached 19.3% during the investigation, with up to 80% of the population displaying clinical signs of varying degrees.

Keywords: swine, zinc, deficiency, parakeratosis
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Resumen - Paraqueratosis sensible al zinc en cerdos en crecimiento

Este reporte de caso describe un caso clínico de deficiencia nutricional de zinc en cerdos en crecimiento causada por un error en la mezcla del alimento. La mortalidad alcanzó el 19.3% durante la investigación, y donde hasta el 80% de la población presentó signos clínicos de diversos grados.

Résumé - Parakératose répondant au zinc chez des porcs en croissance

Ce rapport de cas décrit un cas clinique de déficience en zinc nutritionnelle chez des porcs en croissance due à une erreur de mélange d'aliment. La mortalité a atteint 19.3% durant l'enquête, avec jusqu'à 80% de la population présentant des signes cliniques à différents degrés.

Zinc deficiency in swine is characterized by a nonpruritic parakeratotic hyperkeratosis. Acute skin lesions initially present as macules and papules and develop into scales and thick crusts.[1] Animals may also present with weight loss, lameness, vomiting, and diarrhea.[2] Mortality directly associated with Zn deficiency is rare, though it may be observed in cases where the pig succumbs to secondary bacterial infection due to impaired function of the skin or when the severity of lesions warrants euthanasia. Zinc deficiency may be a result of inadequate intake of Zn through the diet or exposure to high levels of calcium or phytates that act antagonistically and impair Zn absorption.[3] Differential diagnoses include exudative epidermitis (*Staphylococcus hyicus*), ringworm (*Microsporum nanum* or *Trichophyton verrucosum*), pityriasis rosea, dermatosis nephropathy syndrome (porcine circovirus associated disease), insect bites, and swine pox (*Suipoxvirus*).[1] Despite an increased focus on nutrition throughout the industry, cases of nutritional deficiency still occur.

Animal care and use

Animals involved in this case report were under the supervision of the herd veterinarian and were cared for in accordance with the Pork Quality Assurance Plus program.

Case description

During summer 2016, veterinarians were asked to examine pigs in a commercial grower-finisher operation in central Iowa because pigs were reported to have skin lesions and diarrhea. Pigs were housed in 4 side-by-side barns with natural ventilation, deep manure pits, and fully slatted flooring. Feeder pigs, averaging approximately 29 kg, were placed between May 4 and May 11 with approximately 800 pigs being allocated to each barn. Staff initially observed skin lesions in the northernmost barn (barn 1) approximately 20 days post placement. Three site visits occurred over the course of 3 months to collect feed, fecal, and tissue (brain, colon, kidney, liver, lung, lymph node, skin, and small intestine) samples for further testing and to monitor both progression and regression of lesions. Site visits occurred on June 29, July 11, and August 5. During the initial visit, 80%, 65%, 35%, and 35% of the population in barns 1, 2, 3, and 4, respectively, exhibited skin lesions. Lameness, nonuniform pig size, loose stools, nasal discharge, and vomiting were also noted to a lesser degree by veterinarians and caretakers. Lameness appeared to be associated with severe skin lesions. Diarrhea was more evident throughout barns 1 and 2 (5%-10%). Although responsive, the overall activity level of pigs was depressed relative to normal. The skin lesions did not appear to be pruritic; affected pigs were not observed scratching or rubbing against other pigs or facility equipment. Lack of an overwhelming number of flying insects in the environment was noted as caretakers were also concerned that the lesions were the result of insect bites. During the second visit 12 days later, a reduction in skin lesions was observed in barns 1 and 2 with 40% and 20% of

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animals being affected, respectively. Between site visits, mineral testing of both feed and liver samples, histopathological examination of skin, and culture and sensitivity of skin samples continued. Feed and water intake and overall activity was noted to have increased. At this time, an increase in lesion severity and number affected relative to the first visit was observed in barn 4. Pigs within barn 4 were reported to have been placed 2 weeks after those in barns 1 and 2. More than 70 of 800 pigs were euthanized in barn 4 for welfare reasons, including the inability to rise or severe lameness. Improvement of skin lesions within barn 4 was observed on July 28 along with a relapse in diarrhea and lethargy in barn 2 as reported by the site manager. Evaluation of the skin samples submitted prior to conducting the field investigation revealed growth of *S hyicus* that was sensitive to both penicillin and ceftiofur. In response to these results, oral penicillin was administered in the water while severely affected individuals were treated with ceftiofur crystalline free acid (EXCEDE for Swine; Zoetis Inc) intramuscularly at 5 mg/kg of body weight. A second tissue submission, collected prior to the field investigation, revealed hemolytic *Escherichia coli* within the colon. Administration of penicillin and neomycin in the water was not administered concurrently. All medication dosages and duration of use were per label instructions using veterinary oversight and diagnostics. A diluted bleach solution lower than the labeled recommendation for reducing *Staphylococcus* species on surfaces was momentarily administered topically to deter further growth of *S hyicus* but was discontinued per veterinary instruction. Despite antibiotic treatment with penicillin and ceftiofur, resolution of skin lesions did not occur. On August 4, a Zn methionine complex (Zinpro) was supplemented through the water to all 4 barns for 1 week. This product was an organic form of Zn chelated with an amino acid. Observations during the third visit included decreased severity and prevalence of skin lesions, minimal diarrhea (<5%), and residual lameness cases, including swollen stifles and elbows of varying severity from toe-tapping lame to non-weight bearing. The site received feed from a single feed mill. No other sites within the associated production system received feed from this mill. No other sites within the system receiving pigs from the same sow farm reported having similar clinical issues.

Gross clinical lesions

Clinically affected animals initially exhibited multifocal to coalescing scabs and crusts surrounded by erythema in a bilateral and symmetrical fashion throughout the ears, hind limbs, and ventral aspect of the abdomen and thorax (Figure 1). Lesions were also noted on the dorsum and face (Figure 2). The size of the initial lesions ranged between 0.5 to 5.0 cm. Appearance of the lesions varied. Thick, dark-brown, crusting lesions were suspected to be associated with a more chronic presentation. Red-purple to pink multifocal, circular lesions were described as acute lesions. More severely and chronically affected individuals exhibited a dense 0.5 to 1 cm layer of crust that encompassed 60% to 90% of the body. Pigs in this state also exhibited breaks within the crust resulting in hemorrhage and exudation of serosanguinous fluid. Open sores exposing subcutaneous tissue, the result of sloughed skin, were predominately located in both the distal extremities and areas of high mechanical movement (Figure 3). Varying degrees of lameness were observed in association with sores. Individuals believed to be recovering during subsequent visits exhibited multifocal areas of alopecia with seemingly healthy skin (Figure 4). The crust within these areas appeared to have been removed. A rapid response following additional Zn supplementation was observed within 7 days. A full recovery with resolution of skin lesions took between 14 and 21 days. Overall, affected animals in all barns recovered following the supplementation of Zn.

Figure 1: Widespread crusted parakeratotic skin encompassing approximately 80% of the body surface. Sloughing of skin along the distal extremities was present.

Figure 2: Thickened and crusted skin throughout the face including ears, snout, and periorbital regions.

Figure 3: Sloughing of crusted skin throughout the caudal region resulting in eventual lameness.

Figure 4: Appearance of skin following zinc supplementation. The demarcations between previously parakeratotic (darkened areas) and unaffected (light areas) skin are apparent.

Pathological, microbiological, and nutritional examination

All diagnostic tests were performed at the Iowa State University Veterinary Diagnostic Laboratory. Tissues from affected individuals and feed samples were collected prior to and during site investigations for evaluation. A total of 12 feed samples were collected from feeders from the 4 barns throughout the investigation. The feeders were selected at random as all pens in each barn possessed affected animals. Feed originating from the same bulk bins was collected from several corresponding feeders and pooled. Feed samples from bins corresponding to different bulk bins were not pooled and were noted to be different batches of feed. Tissue samples from brain, colon, kidney, liver, lung, lymph node, skin, and small intestine were immediately collected from animals that were euthanized with a captive bolt and processed for histopathological evaluation. Tissues were placed in 10% buffered formalin for approximately 12 hours, trimmed/processed per regular histologic protocols, embedded in paraffin, sectioned at 5 µm, and stained with hematoxylin and eosin. Sections of lung and lymph node underwent immunohistochemistry staining for porcine circovirus type 2 (PCV2). For microbiological evaluation, samples of fresh skin were cultured to evaluate the presence of *S hyicus* and fungal agents. *Staphylococcus hyicus* was cultured from submitted skin samples as previously mentioned. Identification of isolated colonies was performed using matrix-assisted laser desorption ionization time-of-flight mass spectrometer. In addition, analysis of lymph nodes for PCV2, lung tissues for influenza A virus (IAV), and fecal material for porcine epidemic diarrhea virus (PEDV) and porcine delta coronavirus (PDCoV) were completed using polymerase chain reaction (PCR). Multiple fresh liver and feed samples were collected for trace mineral analysis through inductively coupled plasma mass spectrometry. Vitamin A analysis was performed via high performance liquid chromatography on 12 of 17 fresh liver samples collected.

Figure 5: Haired skin with exhibition of serocellular crust with severe diffuse hyperkeratosis and parakeratosis in addition to marked acanthosis. Multiple bacterial colonies are present within the crust. Neutrophils, macrophages, lymphocytes, and plasma cells are present throughout the dermis (hematoxylin-eosin, original magnification × 4).

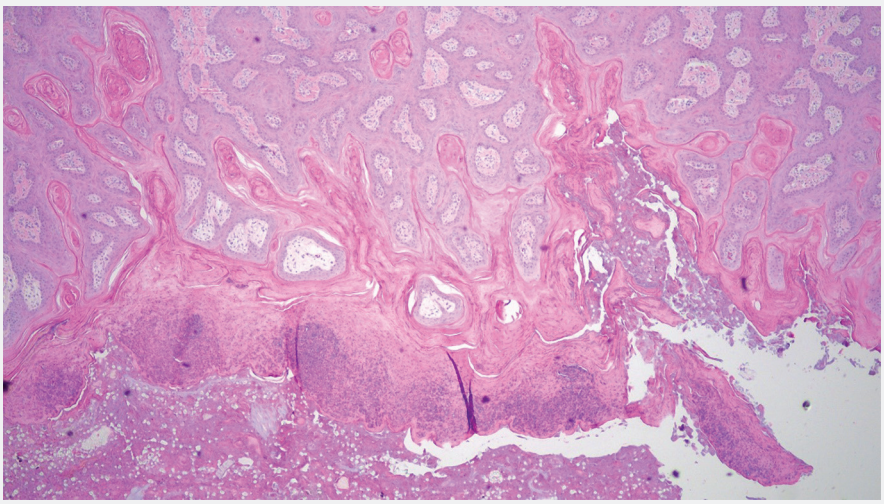
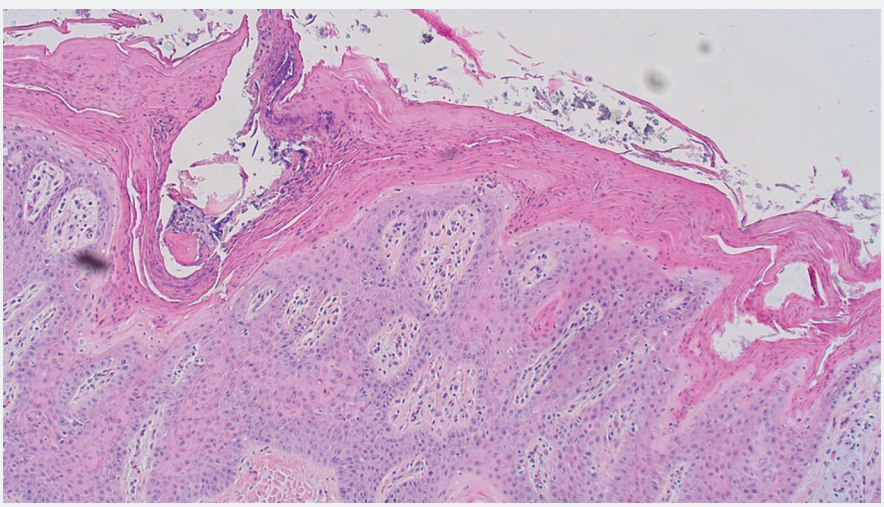


Figure 6: Haired skin with exhibition of serocellular crust with severe diffuse hyperkeratosis and parakeratosis in addition to marked acanthosis (hematoxylin-eosin, original magnification × 10).



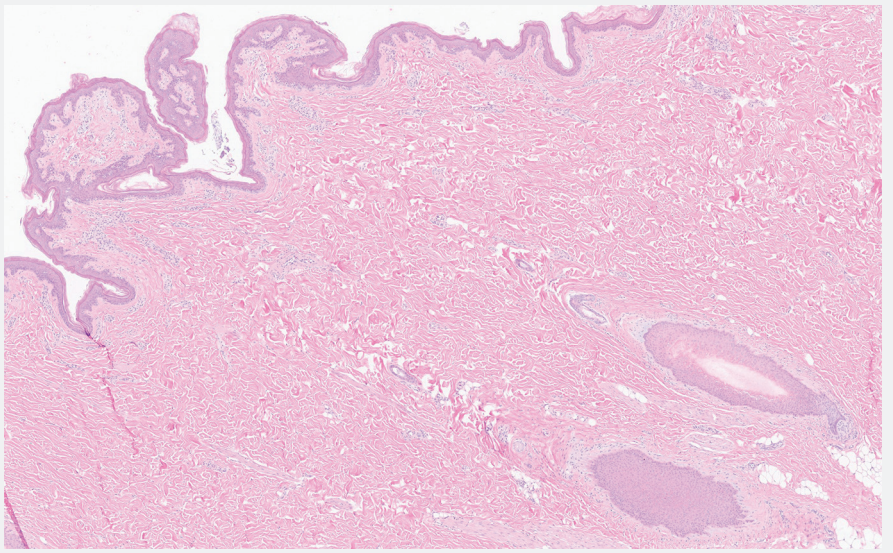
Histopathological results

Histopathology revealed hyperplastic and exudative dermatitis characterized by a dense serocellular to suppurative crust with mild to severe parakaratotic hyperkeratosis along with marked acanthosis (Figures 5 and 6). Bacterial colonies and corneal pustules were present. Both sebaceous and apocrine glands within the dermis exhibited neutrophil and macrophage infiltration. Aggregates of lymphocytes and plasma cells were scattered within the superficial dermis. A section of normal haired skin is provided for comparison (Figure 7). Histopathological examination of brain, colon, kidney, liver, and lung tissue was unremarkable.

Nutritional results

Zinc concentrations among the 17 livers analyzed ranged between 15 and 23 ppm with only 3 exceeding 20 ppm. The concentration of Zn within feed ranged between 14 and 117 ppm, with only 4 samples exceeding 50 ppm. The minimum concentration of Zn within feed intended for growing and finishing swine has been established at 50 ppm (mg/kg) by the National Research Council.[4] Multiple feed samples contained less than the established recommended levels with several possessing Zn concentrations as low as 14 ppm. These concentrations were significantly lower than those observed in a previous study in which lesions were observed when Zn feed concentrations were 34 to 44 ppm.[5]

Figure 7: Normal haired skin for comparison to the skin lesions observed (hematoxylin-eosin, original magnification × 4).



In healthy swine, hepatic Zn concentrations greater than 40 ppm are suggestive of adequate supplementation resulting in suitable stores. Swine may be considered Zn deficient when hepatic concentrations fall below 25 ppm.[6] From the liver samples, all 12 pigs were found to be deficient in Zn as hepatic concentrations were all less than 25 ppm. Hepatic Zn concentrations may increase during infection or inflammation. Throughout the investigation, sequestration of Zn within the liver may have occurred. However, even if sequestration did occur, the observed hepatic Zn concentrations remained at a deficient concentration and would further suggest an initial depletion.[3] With the exception of 2 samples, calcium concentrations within feed were below 10,000 ppm. Each of the 12 livers analyzed for vitamin A were below 60 ppm with concentrations ranging from 8 to 57 ppm.

Molecular and microbiological results

Porcine circovirus Type 2, IAV, PEDV, and PDCoV antigens were not detected by PCR testing. Moderate amounts of *S hyicus* and *Streptococcus equisimilis,* as well as low amounts of *Candida albicans* and Zygomycetes species were cultured from the skin.

Outcomes

Further investigation identified a feed mixing error as the cause of the clinical signs and the inconsistent mineral levels in the feed and liver samples. The feed mill received pre-prepared mineral packets which were being added at the end of the ration mixing cycle. As a result, the minerals were not spread homogenously throughout the feed. Little to no Zn, regardless of type, was available to pigs. Seeing how little Zn was present, antagonism by other minerals or phytate is likely to have been of little concern. The duration for which the mixing errors had occurred prior to morbidity and mortality is unknown. It is also unknown as to why Zn appeared to be the only deficient mineral following misformulations. Although it is possible that other mineral issues were present, the clinical presentation of signs and lesions and subsequent resolution to Zn administration were significantly pronounced.

Discussion

In this case, we confirmed and described a case of zinc responsive dermatosis in a group of commercial finishing pigs. To the authors' knowledge, there are limited reports of such cases in literature over the past 50 years. Although rare, an understanding of this condition is useful to veterinarians since it is both high impact and preventable.

Zinc is an essential trace mineral that serves as a critical component of numerous enzymes and proteins necessary for physiological processes.[3,4] Although the historical etiology of the skin lesions was not fully understood, resolution of lesions and other clinical signs was shown to occur following transfer of affected swine from dry lots to pasture.[2,7] Historically, the role of Zn in parakeratosis was made evident following the resolution of clinical signs when dietary Zn was increased.[5] Other etiological agents such as *S hyicus* can produce similar gross lesions to those observed in this case. However, microscopic lesions of diffuse parakeratosis differentiate this nutritional disease from other likely etiologies.[1] It is uncommon and unlikely that *S hyicus* would affect swine of this age and size to this degree. Microscopic lesions did not implicate a causative role for endemic infectious opportunists such as *S hyicus*, *S equisimilis*, or *C albicans* that were detected by culture. Gross and microscopic lesions present are consistent with those observed in previous studies of parakeratosis and Zn deficiency.[2,5,7,8] This case was also made challenging by the diagnosis of multiple pathogens. Other detected infectious agents may have also, to some degree, contributed to morbidity and mortality. This also demonstrates the importance of a complete sample set, including feed, water, and fresh and formalin-fixed tissue, for meaningful diagnostic investigations.

Zinc deficiency can arise or be exacerbated by one or more cofactors. Calcium and phytate both interfere with absorption of Zn. Previous studies have revealed that porcine diets containing greater than 1.1% calcium (11,000 ppm) have led to the development of parakeratotic lesions.[9-11] Absence or low amounts of Zn within diets can also lead to deficiency. As dietary calcium increases, the amount of Zn within the diet must increase as well to prevent development of Zn deficiency and parakeratosis.[5,9] Phytate is considered to have antagonistic effects on Zn absorption through chelation.[3] Although Zn requirements and ensuing development of parakeratosis for gilts and barrows differ slightly,[12] the differential number of gilts and barrows affected was not recorded during the case investigation. Addition of dietary Zn can help to restore Zn concentrations within the body and resolve associated lesions.[5,10] Increased absorption of Zn during periods of deficiency is accomplished through the upregulation of a number of Zn transporters within the intestine.[13]

Given that both feed calcium and Zn concentrations were consistently below 11,000 ppm and 50 ppm, respectively, coupled with consistently low hepatic Zn, it was determined that Zn deficiency and the ensuing skin lesions were likely not the result of antagonistic effects but

of low dietary Zn. This was further supported through the identification of an error during the feed mixing process and resolution of clinical signs when Zn levels were supplemented and restored. Due to the wide margin of safety with Zn in swine diets, Zn supplementation could have been an effective treatment strategy earlier in the case, despite varying levels of Zn in the tissue and the feed samples tested. Cases that include lesions and other clinical signs that may be associated with either infectious agents or nutritional imbalances can be difficult to diagnose. Practitioners should always consider the possibility of nutritional deficits when encountering such situations.

Errors leading to the misformulation of feeds do occur and can have devastating consequences. Sources of incorrect formulation of feed include factors associated with both mechanical or electrical failure and human error. Protocols implemented by feed mills, as well as producers, aid in reducing such situations. A best practice approach when milling feed includes routinely following all protocols, from evaluation of equipment condition and functionality to adding the correct components at the established amounts. Complacency, a common source of error, is avoided by routinely following set protocols. Due to the high volume of output by mills, ensuring that completed rations are formulated correctly through the testing of every sample is impractical. Periodic testing of feed offers an alternate means by which milling processes can be monitored. Another option that may be considered is the retention of samples by both feed manufacturers and recipients for a period. This allows for retrospective analysis of feed in the event health complications arise and a nutritional or toxic component can be ruled out.

Implications

Under the conditions of this study:

- Parakeratosis associated with Zn deficiency responded to Zn supplementation.
- Severe parakeratosis can lead to varying degrees of lameness.
- Paired feed and liver samples allowed for reliable mineral analyses.

Acknowledgments

We thank the Iowa State University Veterinary Diagnostic Laboratory staff for timely processing of the collected samples.

Conflict of interest

None reported.

Disclaimer

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Research and functional exercises prepare producers and animal health officials for potential FAD outbreak

Foreign animal disease (FAD) preparedness involves all aspects of herd health management including depopulation and eventual disposal. The time and logistics required to develop and implement a comprehensive FAD response plan can be intimidating. The National Pork Board (NPB) recognizes these challenges and has focused on creating various tools and resources to aid in the planning process. To test preparedness plans developed during the 2019 US Department of Agriculture's Swine Fever Exercise for Agricultural Response tabletop exercise and incorporate lessons learned during the COVID-19 outbreak response, NPB and managing partner, SES, worked with existing exercise formats to create a fully functional FAD outbreak mock exercise. The intended outcomes for the exercise included:

- Provide state-based responders and producers with hands-on opportunities to find gaps in their plans and identify issues with the availability of equipment, supplies, or land.
- Practice an FAD investigation on a pig farm.
- Explore NPB's AgView traceability platform to augment an FAD investigation or a subsequent epidemiological investigation.
- Provide an environment for participants to learn about, develop and practice FAD response plans in a real-life situation.
- Address the disposal logistics of other potentially contaminated materials including feed, manure, etc.

Targeted, scientific research plays a key role by providing answers to producer questions regarding topics including disease surveillance, cleaning and disinfection of equipment, depopulation, and carcass disposal. For 2022 and 2023, the NPB-sponsored, fully functional FAD exercises identified key gaps in knowledge. The FAD Research Task Force then requested, received, and funded projects to address those gaps. Key learnings were incorporated into subsequent exercises to improve federal, state, and producer FAD planning and response.

Knowledge gaps identified during the FAD exercises included topic areas of disposal-option efficacy and ability to denature African swine fever virus, the evaluation of alternative methods for mass depopulation, effective pest management for disposal locations, and alternative environmental surveillance strategies. Examples of funded projects include evaluation of efficacy and efficiency of various disposal methods, investigation of virus survivability with various disposal methods in Vietnam, environmental surveillance, scavenger management best practices, and refinement of foam procedures for depopulation.

The results from funded research and feedback from both 2022 and 2023 exercises will continue to provide a dynamic feedback loop for ongoing areas of FAD proposal funding. Prevention and preparedness for FADs can be a daunting task. The NPB functional FAD exercises have provided a hands-on method to actively run a preparedness plan, FAD investigation, and subsequent depopulation and disposal.

Additionally, the exercises uncover key gaps in knowledge in all aspects of preparedness and response that can be converted into targeted research with directly implementable outcomes. The NPB is committed to providing tools and resources for all producers such as AgView and the FAD Checklist to assist in the prevention of devastating FADs. To view the checklist and find more information on FAD preparedness planning, please visit **porkcheckoff.org/animal-disease-prevention** or scan the QR code.

AgView

The National Pork Board has invested in a solution to make disease traceback and pig movement data available to federal and state animal health officials on day one of a potential FAD.

AgView is a pig-contact-tracing platform for all pork producers, fully funded by Pork Checkoff dollars. Producers can download the app and opt in to provide disease status updates and pig movement data to state and animal health officials. The goal is to promote business continuity in case of an FAD outbreak.

Voluntary data-sharing features in AgView allow producers to share location and movement information with state animal health officials in real time. This will help keep information up to date at the state level about the site owner, pig owner, and related contact information for each premises, including:

- Premises
- Movement data
- Secure Pork Supply documentation
- Lab results

AgView is a solution for state veterinarians to use in an FAD to track swine movement and determine the extent of the outbreak.

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AASV committees to meet virtually before Annual Meeting

Once again, AASV's membership and issue-based committees will meet before the Annual Meeting, in addition to meeting in person in Nashville, Tennessee. Meeting times are posted on the AASV committee webpage at **aasv.org/aasv/committee.php**. Agendas will be posted on each committee page as they become available.

Learn about each committee, read their reports and workplans, and review committee guidelines on the AASV committee webpage. All AASV members and student members are welcome to attend any committee meeting, but only committee members are eligible to vote. If you are interested in joining a committee, please contact the committee chair or Dr Abbey Canon. Not sure which to join? The AASV staff can help you fill an open seat!

The AASV Board of Directors relies on the committees as topic experts and seeks their input regarding issues of importance to swine veterinarians. Committees are called upon to examine an issue and advise the board on official positions the association should take or to develop additional resources to educate membership.

AASV publishes 2023 Salary Survey results

The AASV's 8th triennial Salary Survey results are now available for members to view and download at **aasv.org/members/only/SalarySurvey2023.pdf**. The survey requested information about the 2022 calendar year from AASV Active Members in the United States and Canada. Of the association's 900 eligible members, 43% participated.

Earlier surveys collected salary and employment information. AASV has since expanded the survey to create a comprehensive compensation report. The 2023 report includes demographic, salary, benefit, employment, workload, and compensation satisfaction information.

As in past survey efforts, the membership was classified into 2 categories: practitioners and public/corporate veterinarians, with each category completing a slightly different survey. A few highlights from the 2023 Salary Survey are:

- Age distribution of respondents shows a peak at 30 to 40 years of age.
- Gender comparisons show that respondents in the 60+ age group are predominantly male, while the respondents in the younger age groups are predominantly female. The median age of male practitioners is 47.5, while the median age of female practitioners is 32. The median age of males in public/corporate employment is 55, while the median age of females in public/corporate employment is 39.
- Comparisons show that salaries for females continue to lag behind the salaries of their male counterparts in the same age and employment category, with the exception of those less than 30 years of age in the practitioner category and those 35-39 years in public/corporate employment.
- In comparison with previous surveys, the mean and median salaries for public/corporate respondents had a slight increase since a continued downward trend during 2013-2020. The median salaries for practitioner respondents increased over the adjusted values since the 2016 survey but are still less than the adjusted median salaries reported in 2007 and 2010.

AASV news continued on page 27

Eh? What did you say?

Monday, February 26
8:00 AM – 5:00 PM CST
Gaylord Opryland Resort

AASV Annual Meeting attendees:

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AMERICAN ASSOCIATION SWINE VETERINARIANS

For details, see aasv.org/annmtg/2024/hearing.php

AASV news continued from page 25

Early-career veterinarians met in September and November

Participants in the AASV Participant-Led, Early-Career Swine Veterinarian Development Program met in September and November. Truly led by the participants, the 25 early-career swine veterinarians selected topics they felt most important for the second and third modules of the program.

The second module was held immediately after the Allen D. Leman Swine Conference in St. Paul, Minnesota September 19-20, 2023. Luke Wells and Macy Dressen, Professional Ag Marketing, discussed risk management, from basic vocabulary and terminology to informed decision making. After completing the module, all participants reported an increase in knowledge, now having the resources and understanding needed to stay connected to future risk management hot topics.

The third module took place November 16-17 in Raleigh, North Carolina. Prior to the module, Program Facilitator Dr Clayton Johnson held virtual "ventilation Q&A sessions." Drs Billy Flowers and Suzanne Leonard, North Carolina State University, led an on-farm and classroom-based session focused on ventilation. Isaac Singeltary, Munters, described additional real-world ventilation troubleshooting techniques. While participants took away skills and a working knowledge to troubleshoot ventilation issues, they were reminded to not be attached to numbers and instead always evaluate the pigs.

Participants continued building their peer network at Sam Jones BBQ Thursday evening, where the pit master described the restaurant's pork needs and source and led a tour of the cooler and smoke house.

Early-career swine veterinarians visualize ventilation in a model barn by using a smoke stick.

The fourth of six modules will be held in Nashville, Tennessee Friday, February 23, 2024, before the AASV Annual Meeting.

The goal of the AASV Participant-Led Early-Career Swine Veterinarian Development Program, funded by the USDA National Institute of Food and Agriculture Veterinary Services Grant Program, 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. This program is free to selected participants. Participants attending modules in person are given a $500 stipend per module to offset travel, lodging, and any other costs associated with participation in this program. The current program runs through July 2025. AASV hopes to be able to offer this program to another cohort of early-career swine veterinarians in the future. Learn more about the program at **aasv.org/earlycareerdevelopmentprogram**.

AVMA Committee and Council positions open

The AASV designates representatives for several committees of the American Veterinary Medical Association. Current representatives are listed at **aasv.org/members/only/AVMAreps**.

Visit **avma.org/membership/volunteering-avma/avma-volunteer-opportunities-vacancies** for more details and descriptions of each committee.

Some committees have openings; please contact the AASV office if you are interested in representing AASV.

Scholarships available for MentorVet Leap; apply by February 2

The American Association of Swine Veterinarians and MentorVet collaborated in spring 2023 to offer 5 scholarships to swine veterinarians early in their careers. After a successful pilot, AASV has now approved funding of 5 additional scholarships for early-career swine vets to participate in the 2024 MentorVet Leap program.

The MentorVet Leap program is a six-month, entirely virtual, evidence-based mentorship and professional development program that aims to promote wellbeing and decrease burnout in the transition into veterinary practice. The mentorship program has been adapted to meet the needs of early-career swine veterinarians including swine-specific case examples and paired mentorship with a more experienced swine veterinarian.

In addition to paired mentorship, the program provides holistic support to veterinarians through a combination of professional skills training, financial and mental health coaching, and peer mentorship. Mentees engage in a self-paced online curriculum and then meet monthly with other early-career veterinarians to discuss shared challenges and share perspectives on how to create a sustainable career path.

Jenna Scott, DVM, a 2023 AASV MentorVet Leap scholarship recipient, shared, "MentorVet Leap is a great way to gain knowledge and learn skills to better navigate early-career veterinary practice. Through the MentorVet Leap program, I've also been paired with an excellent mentor whom I plan to stay in communication with after the program ends. I have found it very helpful to have a supportive person to talk to about goals and stresses associated with work."

During the pilot, small group discussions were facilitated by a MentorVet team member allowing early-career swine veterinarians to connect with one another and share experiences. After participating in the program in the spring, swine veterinarian Jordan Buchan shared, "Being able to discuss topics such as self-care, professional boundary-setting, and conflict resolution, amongst many others, with colleagues in the same discipline of veterinary medicine, was life-changing. In addition, being assigned an external professional mentor in the industry continues to be a great asset. I actively use the lessons learned during my participation in MentorVet every day in my career. I am very grateful to AASV for funding my enrollment in the program, and know it will continue to be transformative for many young swine veterinarians in the future."

The spring 2024 Leap program will take place February 11 to July 31, 2024. **The deadline to apply for the spring 2024 scholarship is February 2, 2024.** AASV members who have received their veterinary degree in the past 5 years (Classes of 2019-2023) can apply for a scholarship to participate in the MentorVet Leap Program by visiting **mentorvet.net/scholarships**.

It's time to vote!

Are you a veterinarian member of AASV who resides in Canada, Mexico, or the United States? If so, it is time to exercise your "civic duty" to elect your association leaders. Voting for your association leaders opens **January 8**. Here's how to vote:

Vice president and president-elect

Balloting for the vice president and president-elect begins in January. Dr Rebecca Robbins of Amarillo, Texas and Dr Stephen Patterson of Shelbina, Missouri are this year's candidates for vice president. Their candidate messages appear in this issue. The current AASV Vice President Dr Locke Karriker is on the ballot to ascend to the president-elect position. Dr Karriker is unopposed. All balloting is conducted electronically. Voting members may access their ballot by logging into their member account at **aasv.org/members**. The last day to submit or change a vote is **Friday, February 16.**

District directors

Voting members in 5 AASV districts may vote in January and February for their district's representative on the AASV Board of Directors. Elections are being held for candidates in District 1 (Northeastern US: OH, PA, WV, VA, MD, DE, NJ, NY, CT, RI, MA, NH, VT, ME); District 4 (IN, MI); District 6 (IA); District 8, (NE, SD); and District 10 (Mexico).

District members can access their ballot by logging into **aasv.org/members**. The last day to submit or change a vote is **Friday, February 16.**

The election results will be announced during the AASV Annual Meeting in Nashville, Tennessee.

Heritage Video Library expands

Pop some popcorn, prop up your feet, and prepare to be encouraged, inspired, and motivated as you view the new member recollection videos added to the AASV video library.

Dr Angela Baysinger shares her challenges, opportunities, and faith. Pushing boundaries, paving paths, and making a difference.

Dr Conrad Schmidt: From aspiration to innovation; his life philosophy, purpose, and motivation. A call to action.

Dr Lisa Tokach: A ceiling-breaking leader who has given tirelessly to AASV.

It is certainly worth your time to find out what makes these prominent swine veterinarians "tick." You cannot help but feel a sense of connection to each of them as they recount the experiences that led to their choice of profession and the opportunities that followed. And you will appreciate the sage advice they offer to colleagues following in their footsteps.

A fourth new video recounts the **History of the AASV Foundation** from its humble beginnings and $10,000 of seed money in the late 1980's to its position today as a 501(c)(3) charitable organization that disburses tens of thousands of dollars annually for research grants, scholarships, debt relief, and other programs benefiting the swine veterinary profession. As you watch the video, you will meet the many visionary leaders who had the foresight and drive to establish, promote, and expand the foundation to "ensure the future and create a legacy" for swine veterinarians.

The Heritage Video Series is an ongoing project of the AASV Communications Committee to record and preserve AASV history through the recollections of its members. Recent videos have been produced by Dr Sarah Probst Miller's company, AgCreate Solutions, with financial support from the AASV Foundation. The new videos are among more than 20 available for AASV members to view at **aasv.org/members/only/video**.

Dr Angela Baysinger

Dr Conrad Schmidt

Dr Lisa Tokach

AASV Foundation news continued on page 31

AASV Foundation Fundraising Auction

Let's have a Grand Ole Auction, Y'all!

February 26, 2024
Nashville, Tennessee

SILENT AUCTION

Bidding opens at **aasvf.cbo.io**
on Thursday, February 1

Bidding closes on
Monday, February 26 at 7:00 PM CST

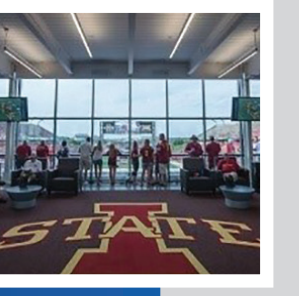
LIVE AUCTION

Monday, February 26 at 8:30 PM CST
(immediately following the AASV Awards Reception)

View ALL items and
START BIDDING
on February 1:

aasvf.cbo.io

Items will be shipped directly to
the winning bidder by the donor.



Contact the AASV Foundation
(foundation@aasv.org) to arrange for
remote bidding in the live auction.

AASV Foundation news continued from page 29

Y'all bid now, ya hear?

Get ready!

Bidding will open soon on the many items so generously donated for the 2024 AASV Foundation fundraising auction. This event is the key fundraiser to support the foundation's annual disbursements of research grants, scholarships, externship grants, debt relief, and more.

Get set!

Take a look at **aasv.org/foundation/2024/auctionlist.php** and prepare to bid! There is something for everyone, from trips, sporting events, and household décor to artwork, handcrafted items, and pig collectibles.

Go!

Silent auction bidding opens on February 1. As in recent years, the silent auction will be conducted entirely online using the popular ClickBid site at **aasvf.cbo.io**. Anyone can bid anytime until the auction closes at 7:00 PM CST on February 26. Donors will ship or deliver items to the winning bidders after the auction.

The live auction will be conducted at the Gaylord Opryland immediately following the Awards Reception on Monday evening, February 26. Bid in person or contact **foundation@aasv.org** to make arrangements to bid remotely or submit bids on live auction items.

Let's make this a Grand Ole Auction, y'all!

Remember, when you bid in the foundation auction, you are bidding on much more than a trip to a fun event or an item to display in your home. You are bidding to support research that will open a window on new information to help you understand and address the latest disease challenges. You are bidding on developing a veterinary student into a colleague ready to join your practice or research team. You are bidding on reducing the debt of the young swine veterinarian getting started in their career. You are bidding on helping a seasoned colleague (or yourself!) pursue advanced training.

Look past the "market value" of the auction item to see the true value of your bid: Priceless!

Y'all bid now, ya hear?

Two Acosta Scholars receive meeting attendance stipends

The AASV Foundation has awarded two $2500 stipends to veterinary students in Mexico to facilitate their attendance at the 2024 AASV Annual Meeting in Nashville, Tennessee. The students, Lizbeth Camarena Monjaras and Jose de Jesus Gonzalez Franco, were selected by the Martha Acosta Foundation, a nonprofit organization that supports the veterinary education of students in Latin America.

Dr Acosta, a longtime AASV member, will accompany Lizbeth and Jose to the meeting where they will be introduced during the AASV - AASV Foundation Luncheon. The two recipients are current AASV student members and will receive their veterinary degrees from the University of Guadalajara later this year. Following the meeting, they will write and submit a report on how the meeting and their membership in AASV has impacted their educational goals and career direction.

The foundation's goal in providing the stipends is to promote swine veterinary medicine and encourage increased international student membership in AASV.

Jose de Jesus Gonzalez Franco

Lizbeth Camarena Monjaras

AASV Foundation news continued on page 33

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54th Annual Meeting of the American Association of Swine Veterinarians http://amp.aasv.org/p/225_Chevalier.pdf

PHARMACOSMOS

PM-071-00

AASV Foundation news continued from page 31

AASV Foundation continues AASV luncheon partnership

For the second year, the AASV Foundation will cosponsor Monday's luncheon during the AASV Annual Meeting. Last year in Colorado, the well-attended luncheon proved to be the perfect opportunity to showcase the foundation's giving opportunities, recognize donors, and announce recipients of its many scholarships, research grants, and debt-relief awards. These presentations will continue to be made during the Monday luncheon at the 2024 meeting.

In addition, attendees at the luncheon in Nashville will learn more about some of the new programs initiated by the foundation, including the scholarship for AASV members pursuing American Board of Veterinary Practitioners certification in Swine Health Management, and the support provided to the Martha Acosta Foundation to encourage international student membership and attendance at the AASV Annual Meeting.

In previous years, the Foundation Luncheon was hosted on Sunday for Leman, Heritage, and Legacy donors to attend. By cosponsoring the Monday luncheon for *all* AASV meeting attendees instead, the foundation can make a broader cross-section of the AASV membership aware of its many scholarships, grants, and other opportunities for personal and professional growth.

Dr Rebecca Robbins

Much like those who have preceded me, I find myself both surprised and honored by the nomination for vice president. Over the years, I have dutifully served in various aspects of the American Association of Swine Veterinarians including serving as a member and chair of the Pharmaceutical Issues Committee, participating in the Annual Meeting Program Planning Committee, and chairing several Annual Meeting sessions. Although membership on a professional board is not part of my resume, I assure you that I bring an unrivaled passion for representing the interests of swine veterinarians, promoting swine health, and championing our swine producers and the broader industry.

My journey into this field did not start with an agriculture or veterinary background, as is more common these days. I am here today because of the unwavering support and belief of individuals who saw my potential as a veterinary leader. As a veterinary and graduate student, Drs Glen Almond, Butch Baker, and Matthew Turner nurtured my early interest in swine medicine and production. They saw beyond my lack of practical experience in the swine industry and instead recognized my enthusiasm for population medicine. Thanks to their guidance, I went on to work at Murphy-Brown (now Smithfield Hog Production), then to Seaboard Foods, and currently, Pig Improvement Company.

To sustain the progress and prosperity of the AASV, we must actively engage and retain the next generation of individuals who are eager to mentor, supervise, and lead within our relatively small, yet influential association. Our member numbers are a quarter of the American Association of Bovine Practitioners and only 1% of the American Veterinary Medical Association's member total; this highlights the need for each of us to be prepared to take on more responsibilities and wear a few more hats!

I was drawn to the profession by the breadth of roles and activities that a swine veterinarian can have. From food safety and antimicrobial resistance to pig behavior and business management, the scope of our professional responsibilities extends beyond bugs and drugs. I knew I would never be bored in a profession that has the power to influence so many aspects of pork production, agriculture, and veterinary medicine. A significant portion of this influential work is achieved by our members volunteering their time; I am thankful to my current and former employers for allowing me to advocate within the AASV, National Pork Board, Swine Health Information Center, and US Department of Agriculture.

While I cannot foresee the future, I anticipate the next vice president and executive team will have increasingly complex challenges to face on behalf of the membership. I view these inevitabilities as opportunities for the association to prepare for and not something which we should fear.

If elected, the primary areas I will encourage our association to focus on include:

1. Advocacy: Promoting committee membership, encouraging members to actively participate, and ensuring that our staff have the necessary resources, both financial and technical, to effectively represent the interests of practitioners.

2. Innovation: Securing financial stability that enables the organization and foundation to fund applied activities and groundbreaking research aimed at improving swine health and well-being.

3. Leadership: Fostering the abilities of our membership by encouraging their involvement in key national and international roles, not just within the swine industry, but in the broader veterinary and agriculture sectors.

4. **Mentorship:** Nurturing, supporting, and engaging student and new graduate programs that identify future leaders to sustain our field and the swine producers we serve.

5. **Continuing education:** Ensuring that we provide our members with material that interests them and addresses emerging issues to enhance our knowledge to better ourselves, our pigs, and our producer clients.

I would like to express my gratitude for considering me as your next vice president. If you would like to learn more about me, visit my LinkedIn profile (**linkedin.com/in/rebecca-robbins-5ba10216**) or reach out to me directly with any questions regarding my candidacy.

Rebecca Robbins, DVM, PhD

Dr Stephen D. Patterson

Keala Settle sings one of my all-time favorite songs, *This is Me*. Her words inspire me as I share my story with you today... this is me!

I am super excited and humbled to be nominated for AASV vice president. I am confident God has presented me with this opportunity for a purpose. He has opened a door and I am grateful for this chance to serve the AASV membership and will embrace whatever the outcome and future may hold.

I was raised on a diversified farm in northeast Missouri where my parents instilled my work ethic. By fifth grade, after reading James Herriot's *All Creatures Great and Small*, I knew I wanted to be a veterinarian. Under the early tutelage and mentorships of Drs Art Griswold and Mac Wilt, I attended the University of Missouri - Columbia and earned my bachelor of science degree in 1986 and DVM in 1989. Post graduation, I worked with Dr Joe Connor at Carthage Veterinary Service and then returned to Missouri to start my own business. Professional milestones for me include:

- 1992 - Purchased Northeast Veterinary Service, a mixed animal practice.
- 1993 - Graduated in the pioneer class of EVP at University of Illinois.
- 1996 - Developed Boar Max Boar Stud starting with 2 boars and has grown to 650 boars.
- 2004 - Started Pest Pro Solutions, a pest control company my son Michael now owns.
- 2009 - Began Passion for Pigs Seminars and Trade Shows to promote client education and relationship building with sponsors.
- 2016 - Developed Passion for Pigs Veterinary Service – the first 100% swine practice in Missouri.
- 2020 - Expanded Passion for Pigs Veterinary Service to Montana after hiring Dr Thomas Wurtz.

The AASV has been integral in my career growth and development. As a third-year veterinary student in 1988, I attended my first AASV Annual Meeting. I felt welcomed and left motivated, encouraged, and most importantly, felt at home with fellow swine practitioners.

The AASV has served me by not only providing education, but has also been the venue in growing my network and developing relationships with colleagues that are to this day some of my closest friends and confidants. I cannot express the feelings and emotions felt when AASV colleagues flew and drove all night to support me at my first wife Debbie's funeral in 1997. My relationship with AASV colleagues go beyond deep – you are family.

I am extremely thankful to be living my dream of being a swine practitioner. While God has blessed me with tremendous opportunities and has seen me through multiple challenges, I am even more thankful and proud of my family. My wife Jennifer teaches children with special needs at Shelbina Elementary. My oldest son Matt, also a veterinarian, has joined me in Passion for Pigs Veterinary Service. My son Michael is an entomologist and runs his own pest control company, Pest Pro Solutions. My daughter Miranda just started college where she plays basketball and is working towards a career in chiropractic medicine.

We all know the quote from the poem *To A Mouse* by Robert Burns, "The best laid plans of mice and men often go awry." But, should the opportunities allow and I am elected, I would like to personally and collectively promote our energies toward:

1. The challenges of recruiting and keeping young swine practitioners in our profession,
2. Continued emphasis on foreign animal disease prevention and protection measures, and
3. Efforts toward porcine reproductive and respiratory syndrome prevention, treatment, and biosecurity, as we have all seen too many pigs and clients devastated by this disease.

This is me! I am thrilled to be nominated as a candidate for AASV vice president. I will work hard in tackling the challenges our organization faces these upcoming years knowing that I can lean on you, our AASV family, for guidance and wisdom in handling any situation we face. I am confident in leading our organization and humble in realizing one person does not do this alone. Our AASV organization will stand strong as we march into the future. I thank you for considering me for your next AASV vice president and I would very much appreciate your vote.

Stephen D. Patterson, DVM

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Journal of Swine Health and Production Author Guidelines

Journal description

The *Journal of Swine Health and Production* (JSHAP) is published bi-monthly by the American Association of Swine Veterinarians (AASV) and is freely available online. The journal accepts manuscripts for peer review that encompass the many domains of applied swine health and production, ie, the diagnosis, treatment, management, prevention and eradication of swine diseases, swine welfare and behavior, nutrition, public health, epidemiology, food safety, biosecurity, pharmaceuticals, antimicrobial use and resistance, reproduction, growth, systems flow, economics, and facility design.

Types of papers

The *Journal of Swine Health and Production* currently accepts manuscripts that meet the descriptions and formatting requirements defined in Table 1.

Policies and procedures

Animal care and use

For animal experiments performed in research facilities or on commercial farms, include a statement indicating that the studies were reviewed and approved by an institutional animal care and use committee or equivalent. For case reports and studies performed under field conditions, in which animals are not manipulated beyond what would be required for diagnostic purposes, it must be clear that housing was adequate and that the animals were humanely cared for. If the study is exempt from animal care and use approval (eg, use of diagnostic records), authors need to clearly state the reasons in the manuscript. Place animal care and use statements in a separate section labeled with an "Animal care and use" heading. This section should immediately precede the "Materials and methods" heading or equivalent position depending on genre.

Authorship

According to the International Committee of Medical Journal Editors, all listed authors must have participated sufficiently to take public responsibility for the work. Individuals should only be listed as authors if contributions have been made in each of the following areas[1]:

1) Conception and design, acquisition of data, or analysis and interpretation of the data,
2) Drafting the manuscript or revising it critically for important intellectual content,
3) Approval of the version of the manuscript to be published, and
4) Agreement to be accountable for all aspects for the work, ensuring questions related to accuracy and integrity are investigated and resolved.

Ethics

Authors are expected to observe high standards with respect to research and publication ethics. Fabrication, falsification, or plagiarism in proposing, performing, or reviewing research, or in reporting research results is considered research misconduct.[2] All cases of research misconduct will be investigated and addressed accordingly.

Conflict of interest

Authors are required to declare the presence of any personal, professional, or financial relationships that could potentially be construed as a conflict of interest for the submitted manuscript, regardless of genre. This declaration is placed just before the reference section, and provides information concerning authors who profit in some way from publication of the paper. For example, one or more of the authors may be employed by a pharmaceutical company that manufactures a drug or vaccine tested in the study reported. Other examples include consultancies, stock ownership, honoraria, paid expert testimony, patent applications/registrations, and grants or other funding. If there is no conflict of interest to declare, the statement under the "Conflict of interest" heading is "None reported."

Copyright transfer

When a manuscript is submitted to the JSHAP, a pre-review copyright agreement and disclosure statement must be signed by all authors. It is the responsibility of the corresponding author to secure these signatures. This form is available from the publications manager. Scan and email signed copies to **jshap@aasv.org**. When the manuscript is accepted for publication, the corresponding author will be required to transfer copyright to the AASV, with the exceptions of US government employees whose work is in the public domain and portions of manuscripts used by permission of another copyright holder. Anyone acknowledged by name in the manuscript will need to sign an acknowledgment permission form.

Prior publication

We do not republish materials previously published in refereed journals. Sections of theses and extension publications that may be of value to our readership will be considered. Prior publication of an abstract only (eg, in a proceedings book) is generally acceptable.

Permissions

If copyrighted material is used, advise the editors of this at the time of manuscript submission. Authors are responsible for securing permission to use copyrighted art or text, including the payment of fees.

Publication fees

There is no fee for publication of manuscripts in the JSHAP.

Manuscript preparation

File types

All manuscripts must be submitted as a Microsoft Word document using 1-inch margins, Times New Roman 12-point font (unless otherwise specified), and left justification with double-spacing throughout. Include continuous page and line numbers. Do not use numbered or bulleted lists in the summary or the text. Do not include tables or figures in

Table 1: Manuscript genres and formatting requirements currently accepted by the *Journal of Swine Health and Production*

		Maximum words		Maximum No.		
Genre	**Description**	**Abstract**	**Manuscript body**	**Figures and Tables**	**References**	**Other requirements***
Original Research	Reports the results of original research on topics that are within journal scope.	250	4000	As needed	35	–
Brief Communication	Documents observations made in a narrowly defined research area or a mini-review of a subject area.	50	2000	2	15	–
Case Report	Describes an unusual or interesting case.	100	3000	As needed	As needed	Manuscript should not exceed 20 pages including figures, tables, and references.
Case Study	Describes unusual or interesting cases occurring on two or more farms.	100	3000	As needed	As needed	Manuscript should not exceed 20 pages including figures, tables, and references.
Literature Review	Review of the published scientific literature about a specific topic area in which important advances have been made in the past five years and is of current interest.	200	5000	As needed	As needed but most references should be recent (within 5 yrs) and avoid use of non-refereed references and personal communications.	Manuscript should not exceed 30 pages including figures, tables, and references.
Production Tool	Describes a practical, state-of-the-art technique for improving an individual swine enterprise or the swine industry at large.	100	3000	As needed	As needed	Manuscript should not exceed 20 pages including figures, tables, and references.
Diagnostic Note	Describes methods of diagnosis for swine diseases. A brief literature review may be included and use of non-refereed references and personal communications is not restricted.	100	3000	As needed	As needed	Manuscript should not exceed 20 pages including figures, tables, and references.
Practice Tip	Describes new technological methods likely to be of use to swine practitioners.	100	3000	As needed	As needed	Manuscript should not exceed 20 pages including figures, tables, and references.

Table 1: Continued

Genre	Description	Maximum words		Maximum No.		Other requirements*
		Abstract	Manuscript body	Figures and Tables	References	
Peer-reviewed Commentary	Commentary on diagnostic, research, or production techniques used in the field of swine health and production.	100	3000	As needed	As needed	Manuscript should not exceed 20 pages including figures, tables, and references.
Letter to the Editor (LTE)	Offers comment or useful critique on materials published in the journal.	-	500	0	5	The decision to publish an LTE rests solely with the executive editor. Letters referring to a published article will be forwarded to the author of the article, and both the original letter and the response will be published in the same issue if possible. Letters to the Editor are not peer-reviewed but are subject to editorial changes.

* Page limits are for Microsoft Word documents using 1-inch margins, Times New Roman, 12-point font (unless otherwise specified), and left justification with double-spacing throughout.

this file, but do include table and figure references, such as (Table 1) or (Figure 1), within the text. Software programs that automatically create endnotes, footnotes, and references should be avoided in the final submitted version of the manuscript as the embedded formatting cannot be read by the publication software.

If the manuscript includes tables, create and submit them in a second Microsoft Word document titled "Art". Multiple tables can be submitted in a single Word document.

If the manuscript includes figures (graphs or images), submit each figure in a separate file titled as the respective figure number. Graphs created in Microsoft Excel should be submitted in the original .xls file(s). A graph created in statistics software can be submitted as a .pdf file. Photographs and images need to be high resolution .jpg files. Figure caption and legend texts should be submitted in a Microsoft Word file titled "Art" (included with Tables if applicable).

Sample templates have been created for each genre to assist authors in formatting their manuscript and can be accessed at **aasv.org/shap/guidelines**.

Supplementary materials

Supplementary materials are additional materials that are not essential to the understanding of the manuscript but provide important context to the manuscript and may be submitted for online only publication. Examples of materials accepted include extended descriptions of experimental methods or statistical analysis, extended bibliographies, additional supporting tables and figures, reporting checklists, copies of surveys or questionnaires, handouts, and forms.

For supplementary materials that are too large or in a format not consistent with JSHAP publication (eg, data sheets, presentations, audio, or video), authors are encouraged to upload and publish these files to a repository, such as FigShare, and reference the DOI within the manuscript.

Supplementary materials must be formatted according to the JSHAP Author Guidelines. There is no word or page limit for supplementary materials, but they should be succinctly presented to facilitate peer review. Acceptance of supplementary materials for publication is at the discretion of the editor. All JSHAP published supplementary materials are subject to copyright.

General style

Manuscripts must be written in English and use American spelling and usage. The JSHAP uses the AMA Manual of Style for guidance on general style and form.[3] Please review the complete author guidelines and author checklist at **aasv.org/shap/guidelines** for full details on journal formatting requirements for submitted manuscripts.

Manuscript submission

Submission instructions

All submissions must be accompanied by a cover letter. The cover letter should be on official letterhead, not exceed 1 page, and include the following information:

- a statement acknowledging the manuscript is not currently under consideration for publication elsewhere,
- a statement that all co-authors have reviewed and approve the manuscript submission,
- the intended genre of the submitted manuscript,

- a brief description of how the manuscript relates to the scope of JSHAP (optional),
- suggestions for potential reviewers of the submitted manuscript (optional), and
- signature of the corresponding author.

All manuscript files should be submitted to the JSHAP publications manager via email: **jshap@aasv.org**.

Unless given alternate instructions at the time of submission, we will correspond with the corresponding author.

Questions about manuscript submission or status can be directed to the JSHAP publications manager:

Rhea Schirm
Journal of Swine Health and Production
c/o American Association of Swine Veterinarians
830 26th Street
Perry, IA 50220
Email: **jshap@aasv.org**

References

1. International Committee of Medical Journal Editors. Recommendations for the conduct, reporting, editing, and publication of scholarly work in medical journals. **http://www.icmje.org/icmje-recommendations.pdf**. Updated December 2017. Accessed June 20, 2018.

2. Office of Science and Technology Policy. Federal policy on research misconduct. *Fed Regist*. 2000;65(6):76260-76264.

3. Christiansen SL, Iverson C, Flanagin A, Livingston EH, Fischer L, Manno C, Gregoline B, Frey T, Fontanarosa PB, Young RK, eds. *AMA Manual of Style: A Guide for Authors and Editors*. 11th ed. New York, New York: Oxford University Press. 2020.

JSHAP Author Guideline Checklist

Updated January 2022

Title page

- □ My manuscript is a Word document with double spacing, footer page numbers, continuous line numbers, and Times New Roman 12 pt font.
- □ I have provided a short title of 90 characters or less (including spaces).
- □ I have included the genre of publication.
- □ I have created a title that is concise, specific, and informative without using abbreviations.
- □ I have properly formatted the author byline.
  - ○ Alpha B. Charlie, degree, degree; Juliett K. Lima, degree; Mike N. Oscar, degree
  - ○ List only the highest level of degree or professional certification except if additional degree denotes a different field of study or a specialty degree, license, certification or credentials.
- □ I have properly formatted the author affiliations.
  - ○ ABC, MNO: department, college, institution, City, State or Country. (State only if in the United States)
  - ○ JKL: company, City, State or Country. (State only if in the United States)
- □ I have properly formatted the Corresponding Author information.
  - ○ Corresponding author: Dr Alpha B. Charlie, street address, City, State Zip; Tel: 555-555-5555; Email: **email@email.com**.

Summary

- □ I have included a Summary not exceeding the word limit for the genre:
  - ○ 250 words for original research including these subheadings – Objective(s), Materials and methods, Results, and Implication(s).
  - ○ 200 words for literature review. No subheadings needed.
  - ○ 100 words for case report, case study, production tool, diagnostic note, practice tip, or peer-reviewed commentary. No subheadings needed.
  - ○ 50 words for brief communication. No subheadings needed.
- □ I have defined abbreviations at the first mention of the term being abbreviated in the summary.
- □ I have only introduced abbreviations if they are used again in the summary and have used the abbreviation whenever the term is mentioned in the summary except at the beginning of a sentence.
- □ I have included "swine" as the first keyword with up to 4 additional words or phrases for a total of 5 keywords.

Manuscript body

- □ I have included the required sections for the genre of manuscript.
- □ I have defined abbreviations at the first mention of the term being abbreviated in the body of the manuscript except in titles, headings, and subheadings.
- □ I have only introduced abbreviations if they are used again in the manuscript body and have used the abbreviation whenever the term is mentioned in the manuscript body except at the beginning of a sentence or as the sole term in headings and subheadings.
- □ I have included an animal care and use statement in a separate section preceding the Materials and methods section.
- □ I have provided the manufacturer's name for all equipment and reagents used in my study.
- □ When *P* values are reported, I have capitalized and italicized the *P* and have not included a zero to the left of the decimal point. The numerical value is rounded to 2 or 3 digits to the right of the decimal point with the smallest being $P < .001$.
- □ I have included spaces around signs of operation (+, <, >, =, etc).
- □ I have used commas to separate all parts of a series (eg, green, red, and yellow).
- □ I have spelled out all units of measure unless they are accompanied by a numerical value.
- □ I have not used numbered or bulleted lists in the manuscript.
- □ I have used brackets to indicate a parenthetical expression within a parenthetical expression: ([ ]).

Implications

- □ I have included up to 3 bulleted implications, each with a maximum of 80 characters or less (including spaces). This section is exempt only for literature review and practice tip manuscripts.

Acknowledgments

- □ I have mentioned any individuals, companies, or funding sources that I would like to acknowledge.
- □ I have disclosed all conflicts of interest for this paper. If none exist, I have included the statement "None reported."
- □ I have included the JSHAP disclaimer.

References

- □ I have checked that all reference numbers in the manuscript are listed in sequential order.
- □ I have formatted reference numbers in the manuscript as superscripts placed after periods and commas and before colons and semicolons.
- □ I have properly formatted references according to the table in the author guidelines.
- □ I have italicized and abbreviated all journal titles according to the US National Library of Medicine rules (**www.nlm.nih.gov/pubs/factsheets/constructitle.html**) and catalog (**www.ncbi.nlm.nih.gov/nlmcatalog/journals**).
- □ I have provided complete page numbers in all references (eg, 120-128, not 120-8).
- □ I have used a hyphen to separate page numbers in all references.
- □ I have identified all non-refereed references with an asterisk (*) to the left of the reference list number and have included the following notation at the end of the reference list.
  - ○ * Non-refereed references.

Tables

- □ I have included all tables in an "Art" file separate from the manuscript (may include figure legends).
- □ I have created tables that stand alone from the manuscript (ie, they do not rely on explanatory materials from the manuscript) and are numbered in the order they are referenced in the text.
- □ My table titles are brief, in sentence case with only the first word capitalized, and do not end with a period.
- □ I have created my tables using Microsoft Word.
- □ I have included the appropriate unit of measure for each row and column.
- □ I have no missing data in my tables (eg, empty cell, hyphen, period) and used the numeral "0" to indicate the value of the data is zero or "NA" to denote not available, not analyzed, or not applicable and have defined the abbreviation accordingly in the abbreviations footnote.
- □ I have used parentheses instead of the ± symbol throughout my table (eg, "1 (3.5)" rather than 1 ± 3.5").
- □ I have used footnotes to explain data in the table using symbols in the designated order (*†‡§¶) and doubled the symbols in that order if more were needed.
- □ When appropriate, I have provided a footnote to describe the level of significance and the statistical method of analysis used.
- □ When appropriate, I have used lower case letters as superscripts to designate significant differences and have created a footnote to explain the level of significance and the statistical method used.
- □ I have defined all abbreviations used in the table in the last footnote, which does not use a footnote symbol.
- □ I have ensured the abbreviations used in the table are consistent with any abbreviations used in the manuscript.

Figures

- □ I have included all figure legends in an "Art" file separate from the manuscript (may include tables).
- □ I have created figures that stand alone from the manuscript (ie, they can be understood without referencing information from the manuscript) and are numbered in the order they are referenced in the text.
- □ My figure title is descriptive, brief, and followed by the legend and abbreviations. The legend includes a brief description of treatments, level of significance, *P* values, and the statistical method used. All abbreviations used in the figure are defined.
- □ I have created a separate file for each figure in the acceptable file types (ie, .xls, .pdf, or .jpg).
- □ All axes are labeled with a description followed by the unit of measure, when needed, separated by a comma.

Manuscript submission

- □ I have included my manuscript file and a separate art file with my submission.
- □ I have included a cover letter that does not exceed 1 page and includes the requested information.

UPCOMING MEETINGS

AVMA Veterinary Leadership Conference 2024

January 4 - 6, 2024 (Thu-Sat)
Chicago, Illinois

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

Banff Pork Seminar

January 9 - 11, 2024 (Tue-Thu)
Banff, Alberta, Canada

For more information:
Tel: 780-492-3651
Email: **pork@ualberta.ca**
Web: **banffpork.ca**

2024 Pig-Group Ski Seminar

January 31 - February 2, 2024 (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 55th Annual Meeting

February 24 - 27, 2024 (Sat-Tue)
Gaylord Opryland Resort and Convention Center
Nashville, Tennessee

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**

International Symposium on One Health Research: Improving Food Security and Resilience

April 21 - 23, 2024 (Sun-Tue)
Moody Gardens Resort and Convention Center
One Hope Boulevard
Galveston, Texas

For more information:
Email: **UTMBOneHealth@utmb.edu**
Web: **utmb.edu/one-health/events/international-one-health-symposium/welcome-symposium**

Animal Agriculture Alliance 2024 Stakeholders Summit

May 8 - 9, 2024 (Wed-Thu)
InterContinental at the Plaza
Kansas City, Missouri

For more information:
Abby Kornegay
Email: **akornegay@animalagalliance.org**
Web: **animalagalliance.org/initiatives/stakeholders-summit**

27th International Pig Veterinary Society Congress & 15th European Symposium of Porcine Health Management

June 4 - 7, 2024 (Tue-Fri)
Congress Centre Leipzig
Leipzig, Germany

For more information:
Web: **ipvs2024.com**

World Pork Expo

June 5 - 7, 2024 (Wed-Fri)
Iowa State Fairgrounds
Des Moines, Iowa

For more information:
Web: **worldpork.org**

9th International Conference on Emerging Zoonoses

June 9 - 12, 2024 (Sun-Wed)
Grand Hotel Piazza Borsa
Palermo, Italy

For more information:
Email: **zoo@target-conferences.com**
Web: **zoonoses-conferences.com**

12th International Conference on Antimicrobial Agents in Veterinary Medicine

June 16 - 19, 2024 (Sun-Wed)
Athens, Greece

For more information:
Email: **aavm@target-conferences.com**
Web: **aavmconference.com**

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

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