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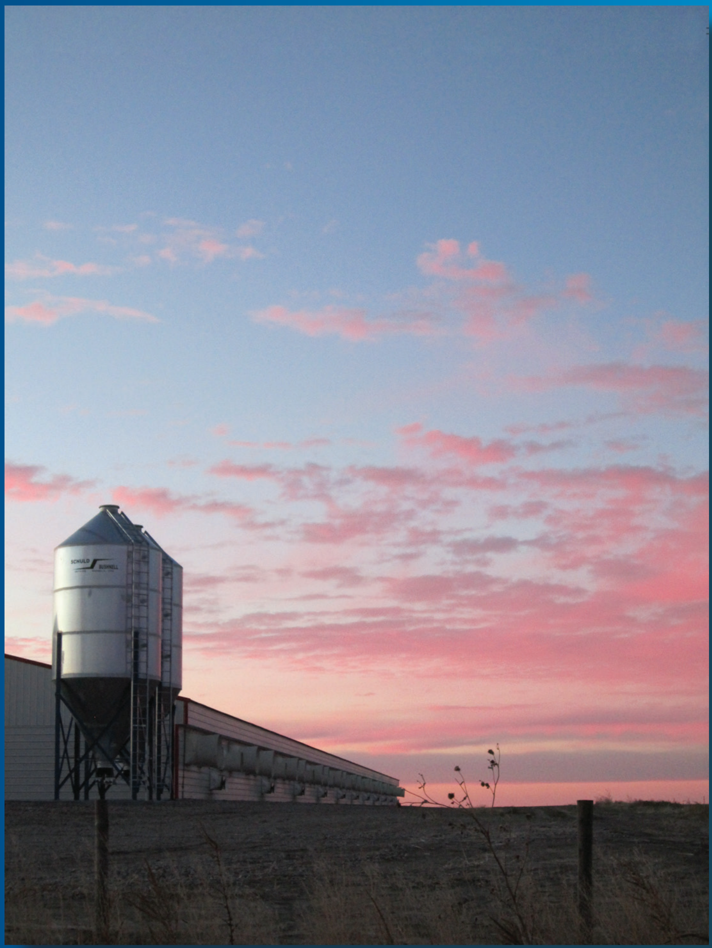

The Journal of the American Association of Swine Veterinarians

American Association Swine Veterinarians

Journal of Swine Health and Production

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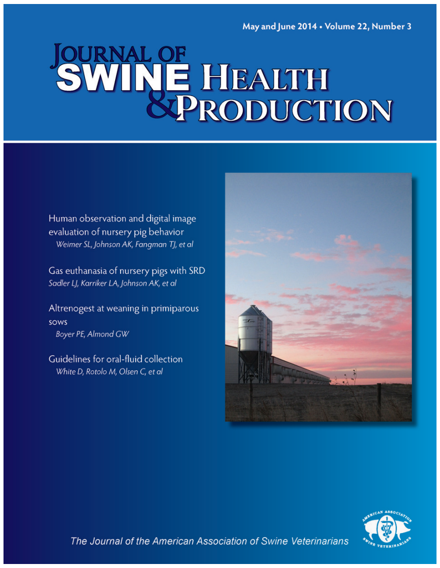

Spring comes to a 5000-sow breed-to-wean Nebraska farm

Photo courtesy of Dr Jess Waddell

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Table of contents

"Largely due to advancements in plant and animal genetics, it is possible to provide more pounds of pork per pig – a pig that makes a smaller carbon footprint than in decades past."

quoted from the President's message, page 109

Review and application of our oath in practice

I'm sure all of you can relate to my feeling of having hit the ground running upon my return from the 45th AASV Annual Meeting. I hope all who were able to attend enjoyed the conference and brought at least one new idea home to implement into practice in accordance with our veterinarian's oath.

One of my favorite parts of every AASV Annual Meeting is the awards reception on Monday evening. I enjoy trying to guess the identity of each award recipient as the speaker describes his or her personal characteristics and professional contributions. Every year I am excited for the awardees and proud that our association has so many incredibly deserving members. Congratulations again to those who were recognized this year. That showcase of talent and service followed by the AASV Foundation auction, abundant with donated items and generous bids, makes for a fun evening and, to me, is tangible evidence of the character of our members.

Another testament to the dedication of our membership is the attendance at our committee meetings Saturday morning prior to the conference. Serving on a committee doesn't pay well in cold hard cash, but it does pay dividends in getting to know your colleagues and expanding your knowledge on a particular subject – and, of course, it provides the gratification of serving the association in an important capacity. If you currently serve on an AASV committee, I would like to extend my sincere thanks for your contributions. If you are not currently a committee member, I would like to take this opportunity to invite you to peruse the various committees within the organization, select one of interest to you, and join!

"...it is clear to me that the way we do many things today is far better than they were done even a generation ago."

In addition to your active involvement in the AASV, I encourage you all to be active members of the American Veterinary Medical Association (AVMA). As Dr Daryl Olsen indicated Monday morning in his Howard Dunne Memorial Lecture, there is an increasing disconnect between the AASV and the AVMA as we continue to be a shrinking percentage of their total membership. There are several opportunities for AASV members to serve on AVMA councils and committees, as Dr Clark Fobian (AVMA president) said during our breakfast meeting on Tuesday morning. We are fortunate in that all our "reserved" seats are currently being filled by our members. I encourage you to volunteer to serve the next term on one of those committees and actively engage with AVMA staff and leadership. It is one of the most important ways for swine veterinarians to have a voice within the AVMA.

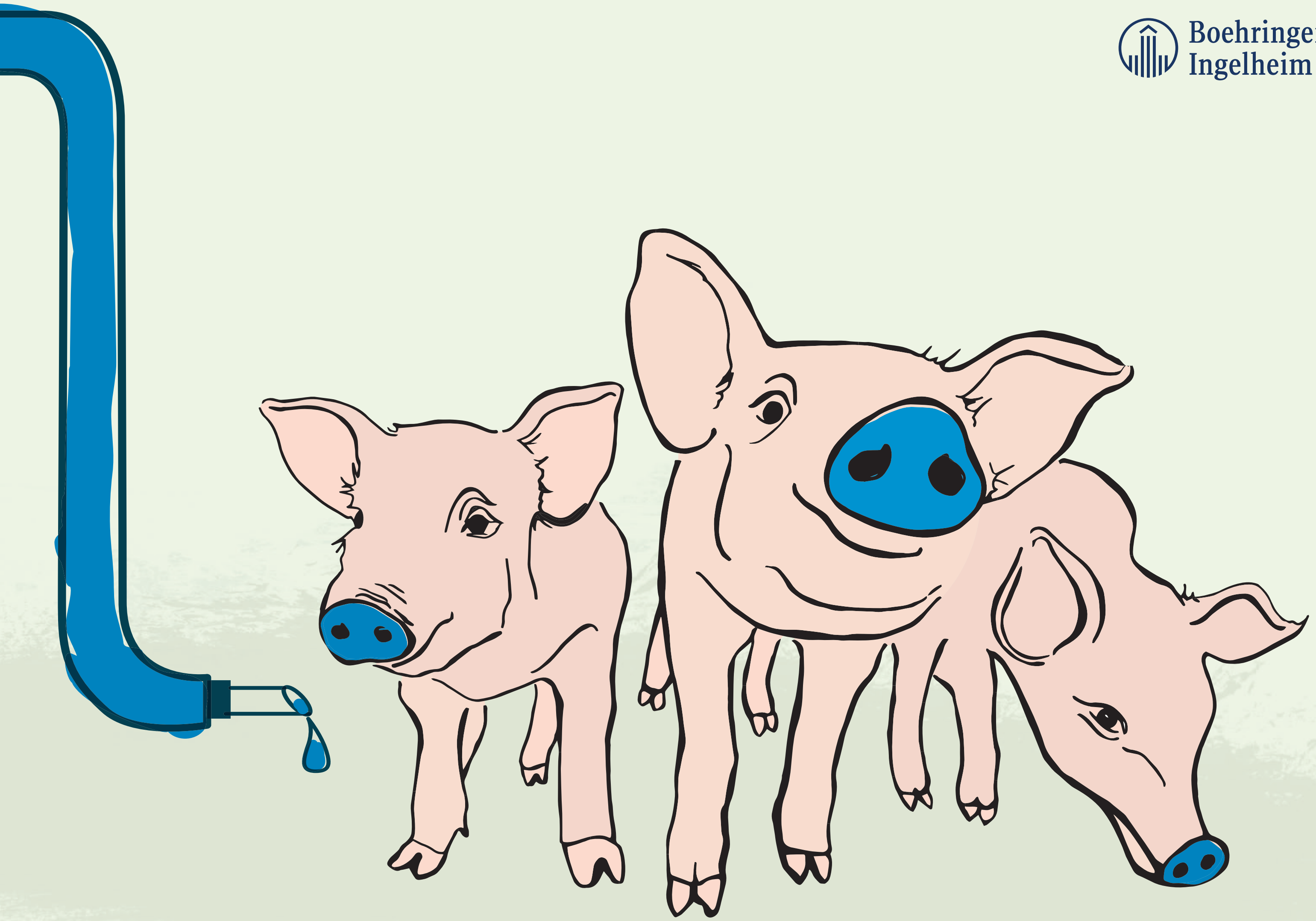
I would also like to echo the challenge that Trent Loos presented to us during the general session Tuesday morning. People within the agriculture community tend to get frustrated by the lack of understanding among the general public when it comes to modern production practices. It often seems people are excited about the latest and greatest technologies in cell phones, vehicles, and nearly every other item in our daily lives, but they get nervous when new technology is applied to farming. While my dad may take offense to this statement, it is clear to me that the way we do many things today is far better than the way they were done even a generation ago. I'm sorry, Dad, but it's true. There are far more tools available and standards in place to ensure appropriate animal husbandry, judicious use of antimicrobials, and protection of the environment.

Modern technology also allows us to do more with less. Largely due to advancements in plant and animal genetics, it is possible to provide more pounds of pork per pig – a pig that makes a smaller carbon footprint – than in decades past. Who can argue with fewer animals supplying the same amount of food? Conservation of animal resources is one of the pillars within our oath, and we should be proud of the advancements that have been made in that arena.

In addition to conserving animal resources, we also use our scientific knowledge and skills to protect animal health and welfare, prevent and relieve animal suffering, promote public health, and advance medical knowledge. We have all sworn to do these things to the best of our ability, and it is an oath I know we all take very seriously. Unfortunately, we do not do a great job of communicating our dedication to our oath in conversations concerning controversial swine industry practices. When we are trying to explain blunt force trauma to a consumer or gestation stalls to a brand manager, I think it is critically important that we describe to them our ethical responsibility to do what is best for the pig using the most current and relevant scientific data available, just as we have sworn to do.

Michelle Sprague, DVM
AASV President

Boehringer Ingelheim



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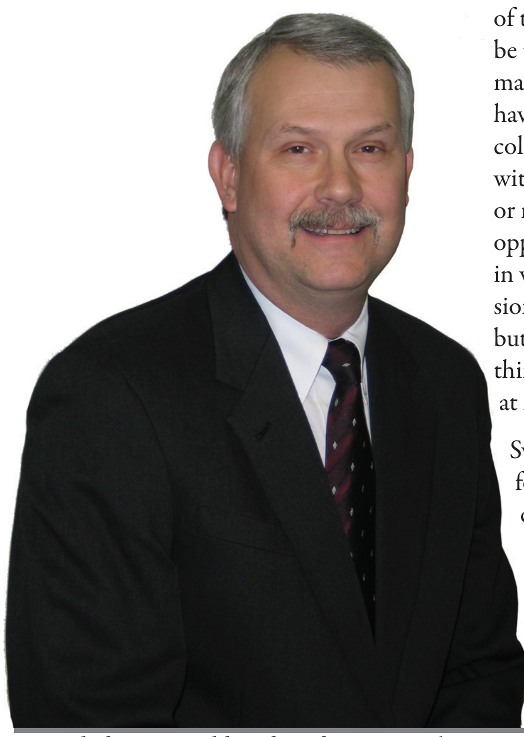
Being a swine veterinarian

At a recent social gathering, a woman I had just met asked me "just what is a swine veterinarian?" My quick answer in this type of situation is "we are pig vets." Her response was typical as she said "I didn't know pigs needed vets." This exchange has been played out countless times in my career in a number of settings. It has included people on airplanes, friends, journalists, and pre-veterinary students. While a common occurrence, this time it came right after our annual meeting in Dallas. It caused me to ponder the question a bit differently.

One of the great things about our annual meeting for me is that it reaffirms my respect for our members who dedicate their professional lives to swine health and production. The depth and breadth of our meeting and its attendees reveals an impressive display of what it takes to be a swine veterinarian. The meeting itself is an exercise in witnessing the characteristics of swine veterinarians. From the committee meetings, the seminars, the sessions, the board meeting, the technical show, and the hallway, you can see them in action. Since I only have one page to fill, I will highlight what I see in swine veterinarians. I am sure you can come up with other characteristics.



Swine veterinarians are focused on problem solving. This focus is intensified due to what is at stake on a farm and the veterinarians' personal stake providing the best service to clients. Science (ie, evidence-based medicine) is a large part of swine practice, but it is balanced by what I consider to be the art of practice. Combining the science and the art is a skill that is developed and refined over time. However, I am encouraged to see many young veterinarians entering swine practice who seem to already have an understanding of this aspect of swine practice. I believe that this is a result of effective mentorship and education.

"Swine veterinarians have a real compassion for both people and pigs, especially when confronted by difficult situations."

Another characteristic is the ability and inclination to challenge ideas and ways of doing things. This might be on an individual farm or in a practice or on the broader stage of the profession. It is driven by reluctance to be trapped by the status quo on things that matter. It is supported by a willingness to have open and frank discourse with farmers, colleagues, and other involved parties. I have witnessed numerous discussions where two or more swine veterinarians have started on opposite sides of an argument and engaged in vigorous debate. At the end of the discussion the veterinarians may not have agreed, but all benefitted by an expansion of their thinking and consideration of the problem at hand.

Swine veterinarians have a real compassion for both people and pigs, especially when confronted by difficult situations. One only has to hear the stories of porcine epidemic diarrhea virus devastation on farms to feel the empathy and concern for those on the affected farms, animal and human alike. It is evident in the description recounted to me by one of our members, telling a farrowing manager on a newly-infected farm that she would potentially lose every pig born for the next 4 weeks. I believe that this scene has been replayed on farm after farm over the last 10 months with similar emotions evoked by the loss.

I see our members willing to stand up for what is right for the pig. This was certainly evidenced at the 2014 annual meeting with its emphasis on the veterinarian's oath. In today's media-driven culture, this is not always the popular or easy thing to do. Increasingly we are dealing with an uninformed public that is far removed from the farm. This is complicated by increased activity by organizations that are anti-agriculture. The challenges are not just with the public, since the same phenomenon is being seen within our profession. Siding with the pig rather than bowing to activist pressure often exposes swine veterinarians to criticism as being "too close to the industry (ie, producers)." This disparaging criticism can include some who call into question our ability to be objective. Our members have excelled in their ability to withstand this pressure and maintain pig health and welfare as our utmost concern.

I have had the privilege to belong to the AASV for my entire career and to work for the association for 20 years now. Over that course of time, my admiration for swine veterinarians has grown. My interactions with our segment of the profession have left no doubt in my mind that swine veterinarians go to work every day with their hearts and minds set squarely on the pig. Whether it is seen in their attention to the small details on a farm visit or their willingness to think big on behalf of the profession and the producers they serve, swine veterinarians demonstrate the characteristics that set them apart.

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*Brumm MC, Yeske P, Loula TJ. Impact of in-feed antibiotic regimens on pig performance and expression of clinical and subclinical diseases. Paper presented at: 2012 AASV Annual Meeting; March 10 – 13; Denver, Colo.

**Johnson RW. The Energy Cost of Illness in Swine. Paper presented at: Swine Energetics, University of Illinois Pork Industry Conference; December 4 – 5, 1996; Urbana-Champaign, Ill.

1 Document Q2 2011 GfK Kynetek Data

2 Erlandson K, et al. Impact of Denagard® plus chlortetracycline in pigs on improving disease control as measured by improved growth performance. Paper presented at: 2012 AASV Annual Meeting; March 10 – 13; Denver, Colo.

3 Mechler D, Hammer JM, Jacela JY. A comparison of Denagard®/CTC and Pulmotil® on nursery pig growth performance and economic return. Paper presented at: 2011 AASV Annual Meeting; March 5 – 8; Phoenix, Ariz.

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Letter to the Editor

I hope the title of my message did not mislead you. This is not an actual letter to the editor but rather my message about letters to the editor – an editor's take on letters to the editor, if you will, and I encourage you to read on!

We don't always like, or agree with, what we read in print media such as magazines, on-line items, newspapers, and scientific journals. For those of you who have gone through the peer-review publication process, you know how rigorous the review process can be. Perhaps what may not be as obvious is that the evaluation of scientific manuscripts does not end at publication. There are different forms of post-publication review, and a letter to the editor (LTE) is one such form of post-publication review. The *Journal of Swine Health and Production* (*JSHAP*) will consider and accept letters to the editor (LTEs). *JSHAP* does not receive many LTEs; however, this issue of *JSHAP* does contain an LTE, including a response from the original author, which is why I chose to discuss the topic.

The submission of an LTE to a journal does not necessarily guarantee publication; however, recognizing LTEs is an essential aspect of the post-publication review process.

When an LTE is submitted to *JSHAP*, the LTE is read by the executive editor (myself), and other members of the editorial board if necessary, to undergo an initial assessment. When an LTE addresses a recently published item, the original author of the publication is then given the opportunity to respond to the LTE. This process proceeds quickly with short deadlines in order to meet publication timelines. Most LTEs are submitted to identify a publication error or to highlight and discuss disagreement or a counter argument. However, LTEs can carry a message of praise or agreement. Regardless, these conversations are important to have and can also carry strong and essential messages such as the dialogue in the LTE and author response in this issue of *JSHAP*.

"...the evaluation of scientific manuscripts does not end at publication."

Occasionally, an LTE can also serve as a portal to disseminate an important message to the readership. The LTE published in the September-October issue of 2012 was such a message[1] and highlighted concern for environmental sources of porcine reproductive and respiratory syndrome virus (PRRSV) antibody producing positive reactions in PRRSV oral-fluid antibody enzyme-linked immunosorbent assays (ELISAs). These types of LTEs usually contain references, and are also subjected to a short review process. It is important to validate such messages, but not to slow down publication of the message if it contains a time-sensitive message. Hence, at *JSHAP,* we handle these types of LTEs as mini-manuscripts. Similar to the authors of manuscripts, the authors of accepted LTEs sign statements of authorship responsibility and a copyright transfer agreement.

I encourage you to read the dialogue that has taken place in the LTE and author response in this issue of *JSHAP*. While attending the AASV Annual Meeting in Dallas, Texas, this March, I was engaged in conversations with other members of the AASV discussing similar issues as that presented by both the original author's response and the author of the LTE. It is a topic that deserves attention.

Reference

1. Johnson JK, Main R, Zimmerman J. Exogenous source of PRRSV antibody in positive oral-fluid ELISA results. Letter to the Editor. *J Swine Health Prod.* 2012;20:215.

Terri O'Sullivan, DVM, PhD
Executive Editor

Relevance of AVMA to swine veterinarians

Dr Tom Burkgren's message[1] in the January-February issue of the *Journal of Swine Health and Production* really caught my attention, as he talks about the relevance of both the American Association of Swine Veterinarians (AASV) and the American Veterinary Medical Association (AVMA).

As Dr Burkgren points out, all organizations strive for relevance, and, in the current climate, that has never been more true for professional associations like ours. I do take exception, however, with Dr Burkgren as to the AVMA's current relevance to our swine veterinarians and how we will maintain that relevance in the future. For the AVMA, being relevant to a diverse population of 85,000 members clearly creates unique challenges. Our members span four generations and many disciplines within our profession – and each has somewhat differing ideas about the products and services their national "umbrella" association should provide.

Although we are an organization built around individual members, it has never been as simple as taking a member vote to decide on a position. Instead, the AVMA has relied on science and the expertise within our membership to ensure our positions on issues are science-based and take into account all relevant perspectives.

The AASV, as well as similar organizations ranging from the American Association of Bovine Practitioners (AABP) to the American Association of Feline Practitioners, has an equal opportunity to voice its perspective in our House of Delegates – and will continue to have that voice under proposed governance changes.

The AVMA advisory councils that are part of the proposed new governance structure, as well as the task forces that these advisory councils will rely upon to deliberate on proposed policies relative to veterinary medicine, will allow the AASV and other allied groups to maintain a strong voice on issues of relevance to them. I personally believe that swine veterinarians and the AASV could have a greater voice under the proposed AVMA governance structure than you do under our current structure, and rightly so. In the meantime, if you haven't volunteered for AVMA councils, committees, and task forces, I encourage you to do so. If you have an interest or an opinion on any of our existing policies, I invite you to submit your comments to us. It's easy to do, and access to the policies is available to you through our Web site, `www.avma.org/policy`.

Let me also add that the AASV and the AABP have been afforded an elevated level of input through attendance at AVMA Executive Board meetings. Longstanding invitations to our board meetings have allowed both the AASV and the AABP to regularly interact with our board members and staff and to share in the dialogue. I appreciate that similar invitations are extended to the AVMA by both the AASV and the AABP boards.

A discussion on relevance of the AVMA to the AASV would be incomplete without pointing out that our Governmental Relations Division staff advocates on a daily basis for issues that are predominantly food-animal related, such as antimicrobial resistance and veterinary oversight of antimicrobials, veterinary issues in the Farm Bill, National Animal Health Laboratory Network authorization and funding, funding for animal-health research, transporting controlled substances (Veterinary Medicine Mobility Act), Animal and Plant Health Inspection Service funding, and many more. When we tell Congress that we represent 85,000 veterinarians engaged in all aspects of the profession, it carries a lot of weight for matters of importance to you.

All in all, it is safe to say that we dedicate a far larger proportion of AVMA resources to food-animal issues than membership numbers alone would justify. And with good reason. While we need to provide products, services, and programs that provide tangible benefits to all of our individual members, the AVMA also serves a "greater good" role for the profession and society at large. Helping you ensure that we continue to have the safest, most abundant and affordable food supply in the world is part of that greater good. It is part of what we have always done and will continue to do. Doing this, along with providing those tangible products and services, is how we will remain relevant to all of our members.

The AVMA and AASV won't always agree on all issues or how to best meet the challenges and opportunities we face as a profession. We have had a couple of recent examples, including differing positions on the Egg Products Inspection Act Amendments. But let's not let those rare instances cause us to forget the overwhelming number of issues and situations where we agree and have worked together to support not only swine veterinarians, but the profession as a whole. Even when we have differing perspectives, there is always room for discussion and opportunity to find mutually acceptable positions. I am committed to ensuring that these discussions continue to happen.

This dialogue makes a compelling case for AASV members to continue to be involved in AVMA. Relevance doesn't just happen; AASV must continue involvement in AVMA through active participation of your members on our committees, councils, and leadership positions. Engagement of AASV members in AVMA not only provides a critically important perspective, it will also help to ensure AVMA's relevance to you in the future.

W. Ron DeHaven, DVM, MBA
CEO, American Veterinary Medical Association

Reference

1. Burkgren T. Relevancy. Executive Director's message. *J Swine Health Prod*. 2014;22:7.

Dr Burkgren's response to Dr DeHaven's letter

I thank Dr DeHaven for penning a response to my message. In his letter to the *JSHAP* editor, I find areas where we have agreement. I also find justifications for my concern over the relevancy of our respective organizations to one another.

Dr DeHaven states that positions are not decided upon with anything as simple as a popular vote. However, under the proposed governance plan, the popular vote will elect two key governance entities: the AVMA Board of Directors (BOD) and the Volunteer Resources Committee (VRC). This may prove to be very troubling for an association like AASV that represents only 1% of the AVMA members eligible for the popular vote. The concentration of power into these two entities, both of which are elected by popular vote, raises the odds that the AASV's representation will be reduced within the AVMA.

I applaud Dr DeHaven's statement that the AVMA will "ensure our positions on issues are science-based." However, he goes on to state that AVMA will "take into account all relevant perspectives." AVMA leadership and staff are the arbiter of whose perspective is relevant, thus elevating my concerns for the future. At a recent Veterinary Issues Forum on animal welfare, the concept of a "social filter" was presented and promoted. This so-called filter would be based on public opinion and social ethics, neither of which takes into account science or what is best for the animals. If on-farm production practices are to pass through this filter before the AVMA can pronounce them to be acceptable, then there is the real chance of science being subordinated by uninformed opinion, or worse, by political agendas against animal agriculture.

I am very thankful that the AVMA Governmental Relations Division is actively and fully involved with food-animal issues. Their involvement and effectiveness is important to animal agriculture. This observation goes to the heart of my concern over AVMA. The vast majority of AVMA members have little interest and nothing at risk when it comes to making decisions that affect food animals and their veterinarians. At any time, the AVMA leadership or membership or both may decide that the expended resources are excessive and the "greater good" role is no longer relevant to their professional, personal, or financial interests and should be ceased. This would be a tremendous loss for swine veterinarians and would leave us with less of a voice in Washington, DC.

The current purpose of the AVMA, found in its bylaws, states "the objective of the Association shall be to advance the science and art of veterinary medicine, including its relationship to public health, biological science, and agriculture." A recent resolution put forth in the AVMA House of Delegates and endorsed by the AVMA Executive Board removes the word "agriculture" but retained "public health" and "biological science." I would hate to think that this deletion of agriculture could prove symbolic of the intended direction of the AVMA.

Dr DeHaven and I concur that our respective organizations will not agree on all issues, challenges, and opportunities. What is important is how our organizations take positions on issues of importance when we disagree. I will restate a basic premise from my original message: If staff and leadership of an organization are lacking experience and knowledge in an area of veterinary medicine, then they must recognize the shortcoming. The solution to this shortcoming is asking for and following the advice of those who do have the expertise and knowledge. No single organization holds all the answers. When advice is neither sought nor accepted, then once again I worry about the relevance of the AVMA and the AASV to one another. I, too, am committed to discussions, but I believe that actions speak much louder than mere words.

Tom Burkgren, DVM
Executive Director, American Association of Swine Veterinarians

Comparison of nursery pig behavior assessed using human observation and digital-image evaluation methodologies

Shawna L. Weimer, MS; Anna K. Johnson, PhD; Thomas J. Fangman, DVM, MS, Diplomate ABVP; Locke A. Karriker, DVM, MS, Diplomate ACVPM; Howard D. Tyler, PhD; Kenneth J. Stalder, PhD

Summary

Objectives: To design and implement a digital photograph system to document the pig response to a human observer in the home pen and then compare these results to a human observation in an approach-assessment paradigm.

Materials and methods: An observer entered the nursery pen and crouched down with an outstretched arm for 15 seconds. A digital image was recorded, and the observer counted all pigs touching, oriented, and not oriented to the human. Each digital image was used to determine the snout and tail-base proximity to the index finger of the observer for pigs classified as Touch, Oriented, and Not Oriented when pens were divided into thirds and quarters. Postures and behaviors of pigs classified as Not Oriented were further delineated. Human observation and digital image were compared.

Results: Most Not Oriented pigs in the digital image were standing, followed by sitting, with 2.5% piling. Both snout and tail-base proximities were closer for Touch pigs than for the other categories ($P < .001$). Regardless of how pens were divided, more pigs were located in the section farthest from the observer. There were no differences ($P > .05$) between human observation and digital-image evaluation for pigs classified as Touch. More pigs were classified as Oriented and fewer as Not Oriented for digital-image evaluation ($P < .001$).

Implication: Human observation is a faster and practical application, but digital-image evaluation allows for more information to be collected.

Keywords: swine, animal-human interaction, behavior, method

Received: August 29, 2012
Accepted: July 25, 2013

Resumen - Comparación de la conducta de cerdos en el destete valorada utilizando metodologías de observación humana y evaluación de imagen digital

Objetivos: Diseñar e implementar un sistema de fotografía digital para documentar la respuesta del cerdo al observador humano en el corral hogar y luego comparar estos resultados con la observación humana en un paradigma de acercamiento-evaluación.

Materiales y métodos: Un observador entró al corral de destete y se agachó con el brazo extendido por 15 segundos. Se tomó una imagen digital y el observador contó a todos los cerdos que lo tocaron, se orientaron, y no se orientaron hacia el humano. Cada imagen digital se utilizó para determinar la proximidad del hocico y la base de la cola al dedo índice del observador de los cerdos clasificados como tocar, se orienta, y no se orienta cuando los corrales se dividieron en tercios y cuartos. Las posturas y conductas de los cerdos clasificados según la orientación se describieron más a fondo. Se comparó la observación humana y la imagen digital.

Resultados: La mayoría de los cerdos no orientados en la imagen digital estaban de pie, luego sentados, y 2.5% amontonados. La proximidad de hocico y de base de la cola fue más cercana para los cerdos tocando que para las otras categorías ($P < .001$). Independientemente de cuantos corrales se dividieron, se localizaron más cerdos en la sección más lejana del observador. No hubo diferencias ($P > .05$) entre la observación humana y la evaluación de la imagen digital y en cerdos clasificados como que tocaron. Se clasificaron más cerdos como orientados y menos como no orientados en la evaluación de la imagen digital ($P < .001$).

Implicación: La observación humana es una aplicación más rápida y práctica, pero la evaluación de la imagen digital permite le recolección de más información.

SLW, AKJ, HDT, KJS: Iowa State University, Ames, Iowa.

TJF: Boehringer Ingelheim Vetmedica, Inc, St Joseph, Missouri.

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

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This article is available online at http://www.aasv.org/shap.html.

Weimer SL, Johnson AK, Fangman TJ, et al. Comparison of nursery pig behavior assessed using human observation and digital-image evaluation methodologies. *J Swine Health Prod.* 2014;22(3):116–124.

Résumé - Comparaison du comportement de porcelets en pouponnière évalué par observation humaine et par évaluation par image digitale

Objectifs: Élaborer et implémenter un système de photographie digitale afin de documenter la réponse de porcs à un observateur humain dans l'enclos et de comparer les résultats à une observation humaine dans un paradigme d'évaluation de l'approche.

Matériels et méthodes: Un observateur entra dans l'enclos de pouponnière et s'accroupit avec un bras étendu pendant 15 secondes. Une image digitale fut enregistrée, et l'observateur compta tous les porcs touchant, orientés, et non orientés vers l'humain. Chaque image digitale fut utilisée pour déterminer la proximité du groin et de la base de la queue à l'index de l'observateur pour les porcs classés comme touchant, orientés, et non orientés lorsque les enclos étaient divisés en tiers et en quarts. Le comportement et la posture des porcs classifiés comme non orientés étaient définis un peu plus. Les observations humaines et les images digitales étaient comparées.

Résultats: La plupart des porcs non orientés dans les images digitales se tenaient debout, suivi par la posture assise, et 2,5% étaient entassés. Les mesures de proximité du groin et de la base de la queue étaient plus courtes ($P < .001$) pour les porcs touchant comparativement aux autres catégories. Indépendamment de la manière dont étaient divisée les enclos, plus de porcs étaient situés dans la section la plus éloignée de l'observateur. Il n'y avait pas de différence ($P > .05$) entre l'observation humaine et l'évaluation des images digitales pour les porcs classifiés comme touchant. Plus de porcs étaient classifiés comme étant orientés et moins comme non orientés par évaluation d'images digitales ($P < .001$).

Implication: L'observation humaine est une application pratique et plus rapide, mais l'évaluation par image digitale permet d'amasser plus d'informations.

On-farm welfare assessment involves the practical evaluation of animal state, defined as health, performance, physiological, behavioral, and cognitive functions of the animals under commercial farm conditions. This is an exercise carried out by scientists and practitioners for many different reasons, including adherence to assessment welfare standards for the purpose of farm assurance schemes. When an animal is placed in a situation that it perceives as frightening or calming, it may react internally via physiological changes[1-4] that can be measured externally using behavioral assessment. When an animal is fearful, it may react in one of three ways: "fight," "flight," or "freeze." A variety of animal-human interaction tests have been used primarily to measure fear,[1] for example the open field,[5] human approach,[6] and novel approach[7] tests, respectively. Numerous investigators have published results that have compared the animal-human interaction using these tests, but it is difficult to compare and contrast the findings because of the different enclosure size,[8] time latencies for animals to make contact, and the observer's posture[9] (ie, sitting versus standing). de Passillé and Rushen[10] noted that although these issues may seem relatively minor, it is unclear how these extraneous variables affect the measures collected and thus the interpretations made. Nevertheless, animal-based measures, as opposed to resource-based measures, continue to be included in on-farm welfare assessment programs. For example, the recent Welfare Quality project[11] aims to develop reliable, standardized, on-farm welfare-assessment protocols using predominately animal-based measures of behavior for different farm species, including pigs. One such animal-based measure has been the animal-human relationship, in particular the assessment of fear, eg, proximity to the human, avoidance, piling, or escaping.[12-14] The underlying assumption of proximity is that the most fearful animals will keep the greatest distance from humans. However, this conclusion may be too simplistic, as an animal's "willingness to approach," touch, or avoid a human may not be solely reflective of fear.[2,3] Animals have competing motivational behavioral systems that include curiosity,[15] feeding,[16] and exploration of the environment.[17] Therefore, classifying pigs' proximity to the person, along with the behaviors and postures that the pigs are engaged in, would provide more information to determine levels of fear, eg, is a pig in the most distant corner of the pen trying to escape or is it eating? This information is critical for drawing correct conclusions on the animal-human relationship within the overall welfare assessment score of the farm, which in turn could affect market access. Many of the animal-human interaction tests are conducted using a live methodology, which allows the assessor to capture limited information, eg, the number of animals touching or not touching a human. If a digital method could be created and used on a commercial farm to capture pigs at a given time point (ie, a "snapshot in time"), then behavioral classifications, precise proximity to the human observer, and pig location within the home pen might provide a more objective and repeatable result than a human methodology. Therefore, the objectives of this study were to design and implement a digital photograph system to document the pig response to a human observer in the home pen, and then compare the results of the digital photograph system to human observation in an approach-assessment paradigm.

Materials and methods

Animal care and husbandry protocols for this experiment were overseen by the company veterinarian and farm manager. These protocols were based on the US swine industry guidelines presented in the *Swine Care Handbook*[18] and in Pork Quality Assurance Plus.[19] In addition, all procedures were approved by the Iowa State University Institutional Animal Care and Use Committee.

Animals

The study was conducted March 8, 2011, at a commercial nursery site situated southwest of Ames, Iowa. Pigs were 6-week-old barrows and gilts from a commercial crossbred genetic line (Midwest Farms, Burlington, Colorado), weighing approximately 25 kg. Pigs were not individually weighed before the study began. Average body weight was determined from previous performance records kept on-site for nursery pigs of that age and genetic cross.

Housing and feeding

A total of 79 nursery pens in two rooms (40 in Room 1 and 39 in Room 2) were used for the study, housing approximately 22 pigs per pen (0.3 m^2 per pig). Pens measured 1.8 m × 3 m, with steel dividers (81.3 cm height) between pens and one steel gate at the front of each pen (91.4 cm height). Ten pens were situated on the right side of the room, 10 on the left, and 20 in the center, separated by two alleyways (76.2 cm width). A fence-line round feeder (radius 55.9 cm, height 81.4 cm; Osborne Industries, Osborne, Kansas) with a feed capacity of 76 kg was located in each pen, 79 cm from the front gate. Pigs had ad libitum access to a meal-grind diet (1510 kcal per kg metabolizable energy and 18.1% crude protein) formulated to meet requirements.[20] Each pen contained one stainless steel nipple drinker (Suevia Haighes, Kircheim, Germany) on the side opposite to the feeder, except for the end pens, where the drinker was located on the side of the feeder farthest from the alleyway. Polygrate flooring (12.7 mm gauge slats; Faroex Ltd, Gimli, Manitoba, Canada) was utilized in all pens. The ceiling height in the nursery rooms was 2.6 m. Twenty fluorescent lights were turned on at 7:00 AM for daily chores and then were turned off at approximately 4:00 PM. Two night lights were on 24 hours per day. Rooms were mechanically ventilated using two variable-speed pit fans (Osborne Industries) with 18 inlets, and wall fans (Osborne Industries) set at 0.14 m^3 per pig. Average room temperature was 23.5°C (Guardian Forced Air Heaters; L. B. White, Onalaska, Wisconsin). Caretakers observed all pigs twice daily.

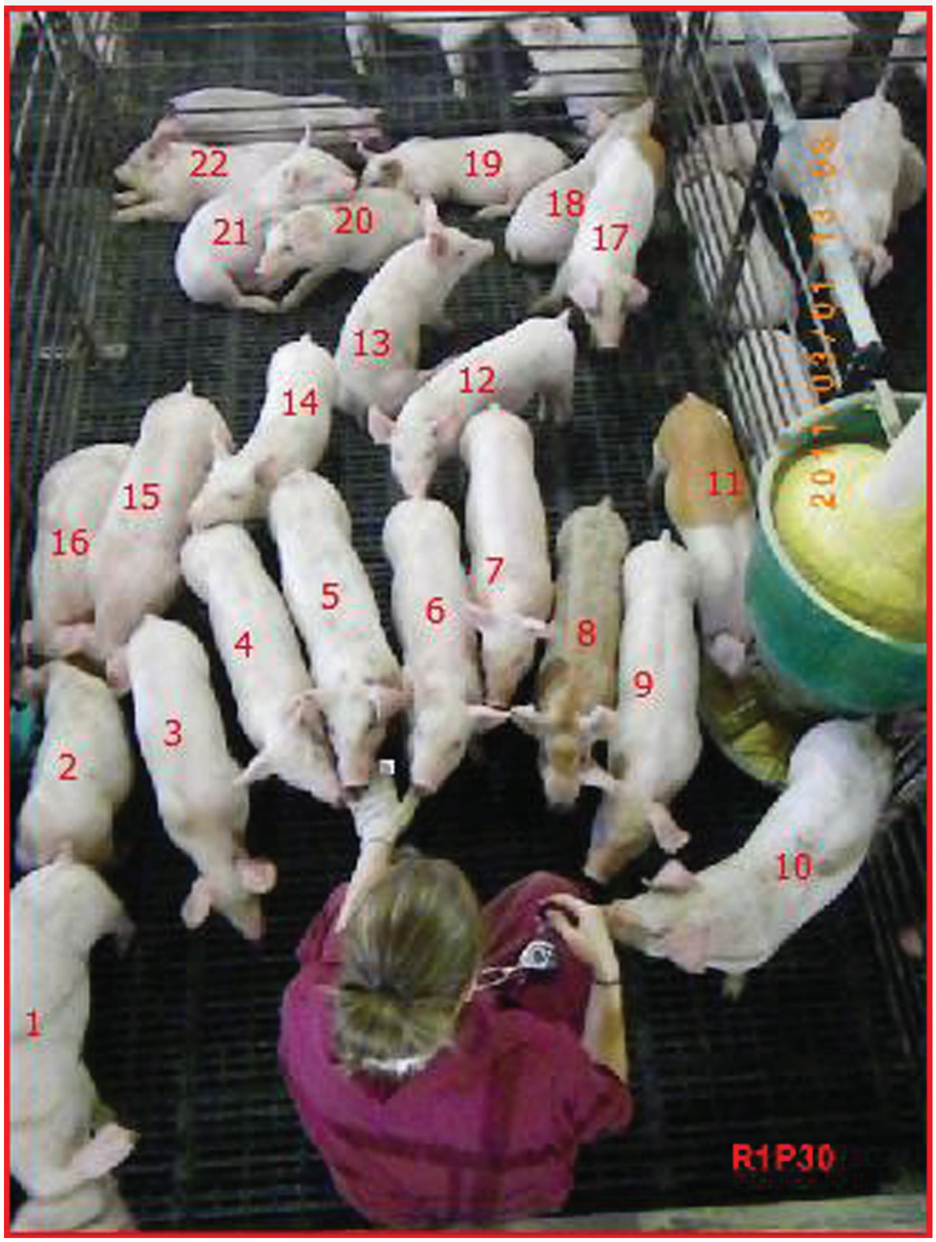
Experimental design

A complete randomized experimental design with the pen of pigs as the experimental unit (n = 79) was used. A nursery-pen image-capturing device was developed and used. Two treatments, a human observer and the digital image, were assigned within rooms and to all pens. The methodology followed that previously described by Fangman et al.[6] On the day of the approach assessment, a human observer approached the nursery home pen, positioned the image-capturing device at the midpoint of the front pen gate, and quietly stepped over the gate, immediately crouching down at the center of the gate. She extended and held still the left leather-gloved hand with the index finger extended, and began a stop watch, avoiding eye contact with the pigs for a 15-second period. The left hand and finger were extended to allow for the same anatomical location to be clearly visible on each digital image so that distances could be measured (Figure 1). At the end of the 15-second period, the observer looked behind her to ensure the sensor light on the digital camera had deployed and captured the digital image, then looked back at the pigs and recorded the live-observation counts for the Touch, Oriented, and Not Oriented categories for pigs that were touching, oriented to, or not oriented to the observer, respectively. After counting all the pigs, the observer retraced her steps and exited the nursery pen. The live observation numbers for pigs engaged in each of the three behaviors were recorded on a scan sheet located in the central alleyway. The observer then proceeded in a side-to-side fashion until all 79 pens in the room had been entered, scanned, and recorded. At the laboratory, each digital image was used to determine the snout and tail-base proximity from the index finger of the observer for pigs classified as Touch, Oriented, and Not Oriented, and the locations of the pigs relative to the observer when pens were divided into thirds and quarters. Postures and behaviors of pigs classified as Not Orientated were further delineated. Finally the two methodologies (human observation and digital image) were compared for pigs touching, oriented, or not oriented to the human in their home pen.

Nursery-pen image-capturing device

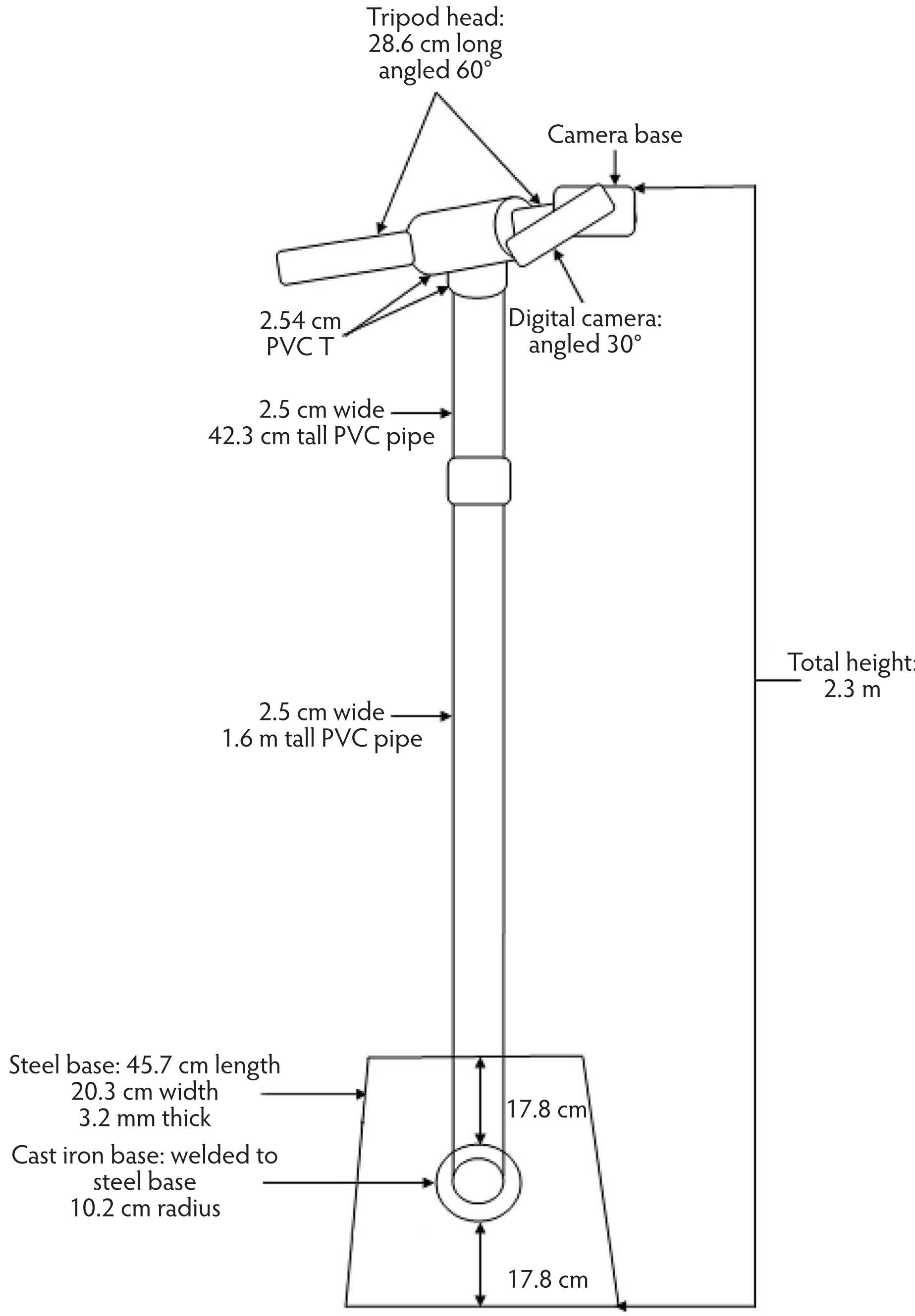
The goal was to construct an easily moveable device with the shortest height that would capture the entire nursery pen without distortion in the resulting digital image. Results of a pilot study (data not published) showed that the maximum height of the digital image-capturing device was 2.3 m, limited by the ceiling height of 2.6 m and allowing 3 cm space to aid in moving the device from pen to pen. The device was free standing in the alleyway next to each pen gate (Figure 2). This device had a steel base (20.3 cm × 45.7 cm × 3.2 mm depth; The Steel Works, Denver, Colorado). A cast-iron base (10.2-cm radius; LDRI Industries Inc, North Wikesboro, North Carolina) welded on top of the steel base 17.8 cm from both the right and the left sides provided increased stability. A PVC pipe (2.5 cm width × 1.6 m height; Silver-Line Plastics Davenport, Iowa) was screwed into the cast-iron base. Using a PVC connector, (radius 2.5 cm; Lasco Fittings Inc, Brownsville, Tennessee), a second PVC pipe (height 42.3 cm; Silver-Line Plastics) was added to the top of the 1.6-m PVC pipe to create a nursery-pen image-capturing device 2.3 m high. At the top of the PVC pipe, a PVC T (Lasco Fittings Inc) was inserted. An additional PVC T was inserted on the right side of the first PCV T so that the tripod

Figure 1: Examples of nursery pigs classified, using a digital image system, as Touch (numbers 4, 5, 6, and 10), Oriented (numbers 3, 7, 8, 9, 12, 17), and Not Oriented (numbers 1, 2, 11, 13, 14, 15, 16, 18, 19, 20, 21, and 22). The human observer knelt in the home pen with an outstretched arm for 15 seconds, then classified the behavior of the pigs, using a remote control to take the digital images, and also recording her observations on paper after leaving the pen.



head could be angled 60° relative to the vertical PVC pipe. The camera (Pentax Optio W90 model; Pentax Imaging Company, Golden, Colorado) was held in place by a tripod head (length 28.6 cm) and protruded 11.4 cm behind the nursery-pen image-capturing device. The camera was equipped with an infrared wireless shutter remote control (Pentax Imaging Company) to record the images while the observer was in the nursery pen. The digital camera was angled at 30° relative to the horizontal tripod head and was secured in position using tape. The camera focal length was 28 mm, with a resolution of 3 megapixels. The device was positioned in the alleyway at the midpoint of the front pen gate where there were no feeder obstructions, and the image captured the entire nursery pen. After taking multiple pictures with the tripod head angle ranging from 0° to 60°, a final angle of 60° relative to the vertical PVC pipe was determined. A series of digital images over the nursery pen determined a final 30° vertical camera angle relative to the horizontal tripod head. These device heights and angles produced a digital picture that allowed the whole nursery pen and all pigs to be captured without distortion.

Figure 2: Schematic of the nursery-pen image-capturing device used to capture a digital image that was compared to live human observation of nursery pigs, as described in Figure 1.



Measures

Behaviors and postures of pigs classified as Not Oriented. Using the digital image, pigs in the Not Oriented category were allocated to four mutually exclusive postures or two behaviors using digital-image evaluation (Table 1). To maintain the mutual exclusiveness of "head in feeder" and "mouth around drinker," the posture of the pig was not recorded. Pig percentages were calculated by dividing the total number of pigs in a given Not Oriented category by the total number of pigs in the pen. These data are presented descriptively.

Snout and tail-base proximity. Using the digital image, proximity (cm) from the index finger of the human observer to the snout and tail base for each pig was measured. Snout and tail-base anatomical locations were chosen because they were visible in more digital images than other anatomical locations, such as the pig ear or hoof. If a pig snout or tail base was not clearly visible in the digital image, proximity was replaced as an unobservable value in the data set. It was possible to collect 1793 total snout and tail-base anatomical data locations.

Snout was defined as the midpoint of the superior snout, and tail base was defined as the point of the pig's superior rear where the tail began. Snout and tail-base proximities were measured using the ruler tool in Adobe Photoshop CS5 (Adobe Systems Inc, San Jose, California). In order to determine the actual distance in cm for snout proximity, lengths collected from the digital image using the Adobe ruler were converted. The converted distance was calculated using the actual feeder radius (55.9 cm) and the feeder radius in pixels (556 pixels) from the digital image using the Adobe ruler tool. The conversion ratio was 9.9 (556 pixels ÷ 55.9 cm = 9.9).

Location of nursery pigs in relation to a human observer. Using the digital image, the length of the nursery pen was measured with the Adobe Photoshop ruler tool from the pen gate located directly behind the midpoint of the observer's back (defined as the dorsal medial point) to the opposite wall

Table 1: Behavior classification of nursery pigs in a live human interaction test*

Measure	Description
Touch	Any part of the pig's body touching the human observer
Oriented	Pig oriented toward the human. Using Adobe Photoshop (Adobe Systems Incorporated, Arden Hills, Minnesota) in the digital image, a line was drawn from the midpoint between the pig's eyes to the center of the snout and then extended out towards the edge of the pen. If the line intersected with the human, the pig was classified as Oriented.
Not Oriented	Pigs not exhibiting the above two behavioral classifications
Digital-image classifications of Not Oriented pigs	
Stand	Upright position with all four feet on the floor
Sit	Hind legs relaxed with body resting on the floor with buttocks or thighs
Pile	Two or more feet off the floor with body erected atop a pen mate
Lie	All legs relaxed with underside in contact with the floor
Head in feeder	Head down in feeder
Mouth around drinker	Mouth on nipple of drinker

* Pig postures and behaviors evaluated following completion of the 15-second animal-human interaction test, from both live observation and digital-image evaluation. Observation methods described in Figure 1. Ethogram adapted from Hurnik et al.[21]

of the pen. The total length of the pen was 220 cm. To compare the locations of pigs relative to a human observer, a transparency was fixed onto the monitor screen and the home pen was divided into quarters and thirds of the pen length. To create quarters, dividing lines were drawn at 55.0, 110.0, and 165.0 cm, providing four sections each 55.0 cm long. To create thirds, dividing lines were drawn at 73.3 and 146.6 cm, providing three sections each 73.3 cm long. Pigs were then counted within the section lines. A pig was considered in a section if both eyes and at least one complete ear were inside the line. Data for location of the nursery pig relative to the human observer when the pen was divided into thirds and quarters are presented descriptively.

Comparing a digital image to a human observation in an approach-assessment paradigm. Pigs were classified into three behavioral categories: Touch, Oriented, and Not Oriented using the human observer and the digital image captured by the image-capturing device. Pig percentages were calculated by dividing the total number of pigs classified in each category by the total number of pigs in the pen.

Statistical analysis

All data were evaluated for normal distribution before analysis by using the PROC UNIVARIATE procedure of SAS (SAS Institute Inc, Cary, North Carolina). A P value of < .05 was considered significant. Data used to evaluate Touch, Oriented, and Not Oriented failed to meet the assumption of normally distributed data. These data were analyzed by using the PROC GLIMMIX procedure of SAS (SAS Institute Inc). The generalized linear mixed model included the fixed effects of methodology (human observation and digital-image evaluation). Total number of pigs per pen was used as a linear covariate. A Poisson distribution was noted for pig counts and used in the evaluation using PROC GLIMMIX procedures. Further, the I-Link option was used to transform the mean and standard error (SE) values back to the original units of measure to better understand the results.

Data used to evaluate snout and tail-base proximity to the observer's index finger met the normal distribution assumption for the ANOVA test. These data were analyzed using the PROC MIXED procedure of SAS. Two statistical models were used to analyze snout and tail-base distance from the observer index finger separately. The fixed effect of room (Room 1 and Room 2) and pig behavior (Touch, Oriented, and Not Oriented) were included. Pen by room and position by pen by room were nested and were included as a random effect in the model. The PDIFF option was used to determine differences between pig positions.

Results

The time spent counting pigs differed, with the observer spending approximately 45 seconds in each pen conducting the live human observation method, in contrast to a digital image that can be analyzed infinitely. For this study, the researcher spent approximately 15 minutes examining each digital image to count and classify pigs.

Behaviors and postures. A total of 46.5% of pigs in a pen were classified either as Touch or Oriented using digital image evaluation, and 53.5% were classified as Not Oriented. For pigs classified as Not Oriented, the majority were standing, followed by sitting, with 2.5% piling (Table 2).

Snout and tail-base proximity. Both snout and tail-base proximities for Oriented pigs were closer to the observer's index finger than for pigs classified as Not Oriented ($P < .001$; Table 3). Snout proximity did not differ by room (Room 1, 56.1 ± 1.1 cm; Room 2, 57.8 ± 1.2 cm; $P = .26$). Tail-base proximity did differ by room: pig tail bases were closer to the observer's index finger in Room 1 (87.8 ± 1.0 cm) than in Room 2 (92.7 ± 1.1 cm; $P < .001$).

It was not possible, using the digital-image evaluation, to measure the proximity of the observer's index finger for 35.6% of tail bases (639 total pig data values or 7.8 pigs per pen) and 59.4% of snouts (1066 total pig data values or 13.1 pigs per pen). The majority of unobservable anatomical locations for snout were in the Not Oriented category (45.0%), compared to 9.6% in the Touch category and 4.1% in the Oriented category. The tail-base location followed a similar pattern, with pigs in the Not Oriented category having the most unobservable anatomical locations (22.0%), followed by the Oriented (10.4%) and Touch categories (2.8%).

Location of nursery pigs in relation to a human observer. Fewer pigs were in the section closest to the observer when the pen was divided into quarters (2.7 %; Figure 3) than when it was divided into thirds (6.4%; Figure 4). Regardless of how pens were sectioned, more pigs per pen were located in the section farthest from the human observer (41.8% for quarters, Figure 3; and 52.9% for thirds, Figure 4). When the pen was sectioned into thirds, a total of 15 pigs could not be clearly allocated to a section, compared to only four pigs when the pen was sectioned into quarters. The pigs that could not clearly be allocated were on the borderline (one and a half ears over or on the section line) of the section definition parameters (both ears over the section line).

Comparing a digital image to a human observation in an approach-assessment paradigm. There were no differences in the pigs classified as Touch when live human observation and digital-image evaluation were compared ($P > .05$). More pigs were classified as Oriented and fewer were classified as Not Oriented using digital-image evaluation than live human observation ($P < .001$; Table 4).

Discussion

The majority of pigs in this study (53.5%) were classified by the digital image method as Not Oriented. If this animal-human interaction test was to be used practically for assessing nursery-pig welfare, it would be advantageous for pigs classified as Not Oriented to be further delineated into discrete behaviors and postures. Determining what these pigs are engaged in would provide a "snapshot in time" for producers, veterinarians, or assessors of the pigs' overall comfort level. It might be erroneous to conclude that all pigs classified as Not Oriented are fearful of the human in their home pen and therefore are in a compromised state of welfare. As a caveat, classifying these Not Oriented pigs is time consuming, and the digital-image evaluation methodology would likely not be accepted as an industry on-farm assessment program. Therefore, if "negative" behavior(s), ie, attack ("fight"), pile, or escape, or avoidance ("flight")[6,7,22] were counted instead of behaviors and postures from motivational systems considered to be positive for pig welfare, then only a few pigs in a pen would likely need to be counted, and the remainder would be counted as "acceptable" or "not fearful." An additional reaction that fearful animals can engage in is a "freeze" response. With the current methodologies of this study, such animals are classified in the "stand" category, as it was not possible to distinguish between a standing versus a freezing animal. If the assessor wanted to determine whether an animal was standing versus freezing, then the digital methodology would need to be further refined. For example, taking digital images in rapid succession for a defined period of time would help to determine if it is possible to categorize a pig standing and relaxed versus standing and freezing. However, within the context of this experiment, 97.5% of pigs classified as Not Oriented were engaged in behaviors and postures not fearful of the human.

For all behavioral categories, the pig snout was closer to the human observer than was the respective tail base. Snout and tail bases were closer to the observer in the following order: Touch > Oriented > Not Oriented. This might seem like an intuitive result, that pigs faced the human. However, if pigs were fearful, they could be facing away from the observer, resulting in the tail base being the closest anatomical location across behavioral categories. Pigs use their snouts extensively to search for food, detect potential predators, and mark territory. This extensive snout use may help to explain why 45% of pigs classified as Not Oriented had more unobservable snout anatomical locations than did pigs classified as Touch and Oriented. Pigs

Table 2: Average number and percentage of commercial nursery pigs per pen classified as Not Oriented and exhibiting defined postures and behaviors identified using digital-image evaluation*

Measures	No. of pigs/pen	Percent of pigs/pen
Postures		
Stand	9.4	77.7
Sit	1.2	9.9
Pile	0.3	2.5
Lie	0.6	5.0
Behaviors		
Head in feeder	0.5	4.1
Mouth around drinker	0.1	0.8
Average total pigs	12.1	100

* Nursery pens measured 1.8 m × 3 m and housed approximately 22 pigs/pen with 79 pens total. Methods of observation and classification described in Figure 1 and Table 1. Postures and behaviors of Not Oriented pigs described in Table 1.

Table 3: Nursery-pig snout and tail-base proximities from the index finger of a human observer using a digital-image evaluation within the behavior categories Touch, Oriented, and Not Oriented *

	Categories			*P*
	Touch	Oriented	Not Oriented	
No. of pens	79	79	79	NA
Snout (cm)	13.6 ± 2.1[a]	61.0 ± 1.1[b]	96.3 ± 1.2[c]	< .001
Tail base (cm)	71.4 ± 1.8[a]	95.9 ± 1.0[b]	103.4 ± 0.9[c]	< .001

* Proximity of anatomical locations on the pig to the index finger of the human observer with her hand and arm outstretched. Snout and tail-base proximities measured using the ruler tool in Adobe Photoshop CS5 (Adobe Systems Inc, San Jose, California). To determine the actual distance for the snout, lengths collected from the digital image using the Adobe ruler were converted by using the actual feeder radius (55.9 cm) and the feeder radius in pixels (556 pixels). The conversion ratio was 9.9 (556 pixels ÷ 55.9 cm). Nursery pens (1.8 m × 3 m) housed approximately 22 pigs/pen. Behavior categories described in Table 1.

[abc] Within a row, values with different superscripts differ significantly ($P < .05$; ANOVA).

NA = not applicable.

classified as Not Oriented were engaging in different behaviors (eg, head in feeder) resulting in the observation that their snouts were obstructed. These findings are in agreement with previous "touch, oriented, and not oriented" data for pigs housed in smaller nursery pens.[23]

On-farm animal-human interaction tests are described and implemented in a variety of ways.[24,25] Many use a live observation with a human in the pen, but comparing and contrasting a digital image to a live observer and determining its accuracy has not been previously reported.

In this study, by taking a digital image, snout and tail proximity were additional measures that could be collected. Prior to data collection, the authors considered future questions for creating a calculation sheet that could assign tail distance from the human to "willing to approach on own merit" versus "non-intentional contact with human," ie, being pushed or knocked by another pig at the time of the assessment. However, if an on-farm welfare assessment program were to include an animal-human interaction test with precise proximity measures, this study showed that there were fewer unobserved tail-base data values, and tail-base measurements would be favored over snout measurements. It should be cautioned that both snout and tail-base measurements were not accurate, with 1066 snouts and 639 tail bases unobservable among the 1793 possible observations. In contrast, all pigs in a pen could be allocated to a Touch, Oriented, or Not Oriented category. Finally, to measure all snout and tail-base anatomical locations with approximately 22 pigs per pen took approximately 10 minutes per pen. Therefore, until a computer program is designed that could automatically recognize and measure anatomical locations on the pig to further calculate the proximity between the animal and human, the proximity measure between animal and human is not a practical recommendation.

Mazurek et al[26] hypothesized that the flightiest animal or the dominant animal of a group could have an influence on the reaction of the other animals in the group. In dairy goats, Mazurek et al[27] showed that the animals most reactive to humans were the most dominant individuals. Therefore, an avoidance-distance test may be influenced by the response of these animals. If that is the case, it could be concluded that the

Figure 3: Percent of nursery pigs located within a nursery-pen section when the pen was divided into quarters for the approach assessment described and illustrated in Figure 1. The length of the nursery pen (220 cm) was measured with the Adobe Photoshop ruler tool (Adobe Systems Inc, San Jose, California) from the pen gate located directly behind the midpoint of the observer's back (defined as the dorsal medial point) to the opposite end of the pen. A transparency was taped to the computer monitor and dividing lines were drawn at 55.0 cm, 110.0 cm, and 165.0 cm to create four equal sections of the pen length, with the observer located in the first quarter (0% to 25% of the pen length). Pigs were counted within the section lines. A pig was considered in a section if both eyes and at least one complete ear were inside the line.

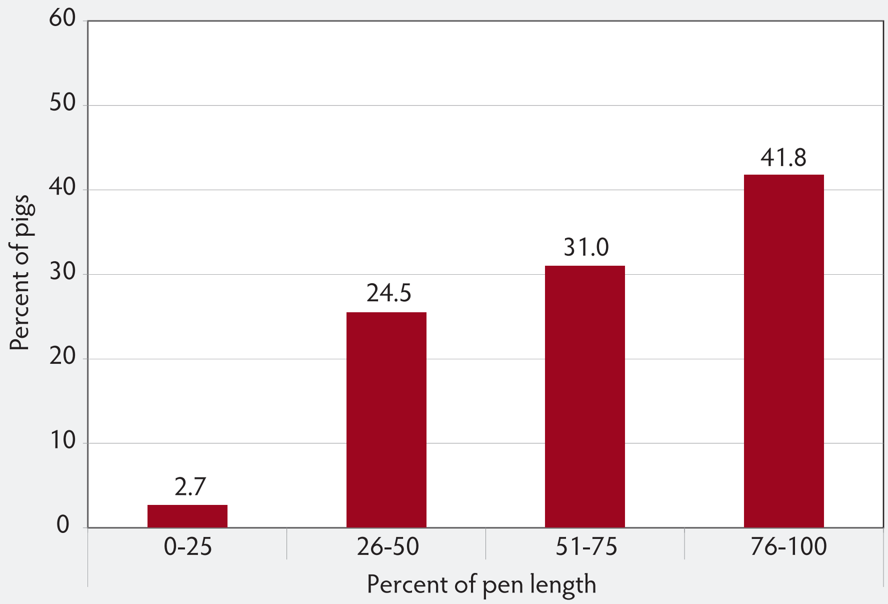


Figure 4: Percent of nursery pigs located within a nursery pen section when the pen was divided into thirds. The length of the nursery pen was measured with the Adobe Photoshop ruler tool (Adobe Systems Inc) from the pen gate located directly behind the midpoint of the observer's back (defined as the dorsal medial point) to the opposite end of the pen. The total length of the pen was 220 cm. A transparency was taped to the computer monitor and dividing lines were drawn at 73.3 cm and 146.6 cm to create three equal sections of the pen length, with the observer located in the first third (0% to 33.3% of the pen length). Pigs were counted within the section lines. A pig was considered in a section if both eyes and at least one complete ear were inside the line.

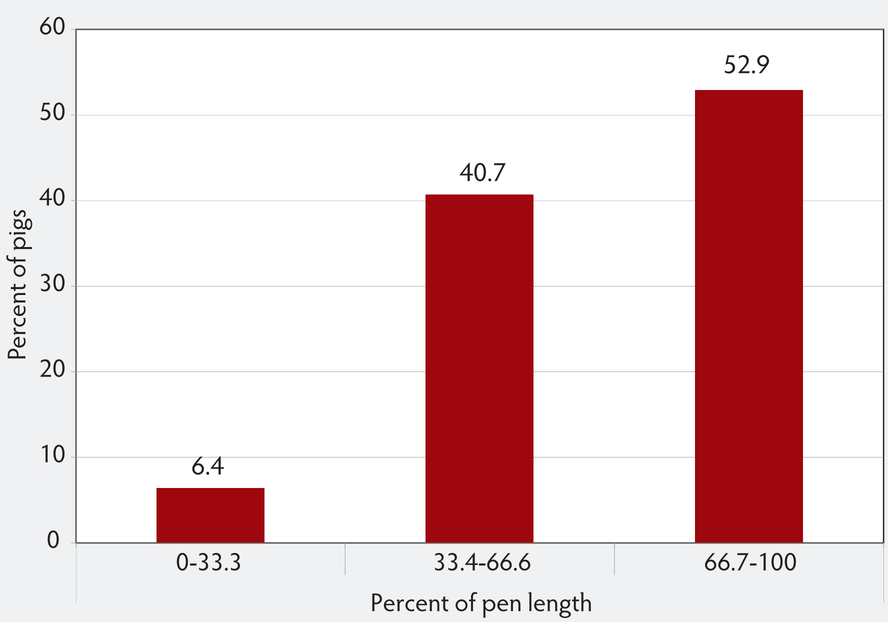


Table 4: Least squares means ± standard error of numbers of nursery pigs per pen classified as Touch, Oriented, and Not Orientated by a human observer in the pen and by digital-image evaluation (n = 79 pens)*

Classification of pigs	Human observation	Digital	*P*†
Touch	1.8 ± 0.6 (8.4 ± 3.1)	2.1 ± 0.7 (10.0 ± 3.1)	.11 (0.15)
Oriented	6.3 ± 0.3 (27.9 ± 1.5)	8.3 ± 0.4 (36.5 ± 1.5)	< .001 (< .001)
Not oriented	14.5 ± 0.9 (63.4 ± 2.6)	12.1 ± 0.8 (53.5 ± 2.6)	< .001 (< .001)

* Commercial pens measuring 1.8 m × 3 m, each housing approximately 22 pigs (0.3 m^2/pig). Human observation counts were made in real-time; digital-image evaluation counts were made from the digital image captured at the time of live observation. Method of human observation described and illustrated in Figure 1. Behavior classifications described in Table 1.

† Generalized linear mixed model with a *t* test. The *P* values in parentheses represent comparisons on the basis of percent of pigs/pen in each classification. A *P* value of < .05 was considered statistically significant.

quality of the human-animal relationship is poor if the animal leader is fearful. The avoidance-distance test is one behavioral test that is applicable for producers, and it has been used to reliably quantify the quality of the human-animal relationship by measuring the size of the animals' front flight zone. The creation of new areas within a home pen are dictated by the objectives of the test; for example, in some instances, creating areas around the feeder or drinker may be useful if the goal is to determine maintenance or aggressive behaviors around a key resource. In this study, regardless of the pen divisions, the majority of pigs were located in the farthest section from the human observer. However, using only animal location from the human in an animal-human interaction test is rather meaningless unless specific behaviors and postures are also captured to explain the motivational state of the animals.

Finally, a concern with the pig-location method used in this study was that the camera was at a 30-degree angle. This created a length distortion that was magnified the farther the pigs were located within the pen. The standard setting used in the snout and tail-base proximity was determined using the 9.9 ratio of the feeder length and pixel length in the digital image. The feeder was the standard, as it was located in the middle of the pen at the midpoint of camera-angle distortion. To account for distortion, additional measures should be taken (eg, back pen and side gates in cm and digitally in pixels) and compared to obtain the most accurate pixel-to-cm ratio. This effect would likely be magnified if the pen were divided into smaller areas, eg, increments of 30 cm. In this study, home pens were divided into larger spatial locations (thirds and quarters) and the angle of the camera was held constant across all images. Therefore, it could be argued that any possible distortion factor was low and consistent across all digital images. However, camera angle and distortion effects should be considered in the future when improving this methodology.

Forkman et al[7] have suggested that the first animal response to a novel or unfamiliar object is more accurate when repeatability of an animal-human interaction is being evaluated. Livestock are prey species with different sensory perceptions than humans, and thus they may react differently to novel or unfamiliar stimuli.[4] Reactions may differ with age,[28] group size,[29] location of the human observer within the pen,[30] individual pig differences, and previous caretaker-pig interactions.[31] In addition, not all reactions are negative. Recently, three studies attempted to validate the animal-human interaction test. Lensink et al[32] measured calves' responses to humans. The authors concluded that the scores obtained in the approach-and-touch phase were strongly related to the calves' response to a person in a novel arena, and this approach test could be considered repeatable and reliable. Graml et al[22] validated three tests for non-caged hens. All tests measured the reactions of hens towards a stationary person, a moving person approaching the hens, and a stationary person trying to touch individual hens. The authors concluded that the tests all effectively measured the human-hen relationship and that the hens' reactions to humans could be actively influenced by the quality of the human contact in non-caged systems. Scott et al[33] wanted to determine which human-animal test was most reliable and practical enough to be included in an on-farm welfare assessment scheme for sows. The authors concluded that either the animals approaching the human hand or animals approaching the human in their home pen was the most practical and reliable.

In this study, the "approach or touch hand" method was used, similar to that described by Scott et al.[32] Furthermore, three behavioral classifications, Touch, Oriented, and Not Oriented, were favored over previous "willingness-to-approach" terminologies used by Fangman et al.[6] Although the willingness-to-approach terminology reports a more positive animal-human relationship, the term "willing" is an affective state and in turn may be criticized. In this study, more pigs were classified as Oriented and fewer as Not Oriented using digital-image evaluation. An explanation for this difference between methods may be due to the combination of time for the observer to turn and look at the digital camera, with her head movement and slight change in the angle of the outstretched hand that might in turn have affected the approach or interest of the pigs in the pen. In order to simplify this method and make it more practical on-farm, the current three behavioral categories may be combined into two, "approach" (the summation of "Touch" and "Oriented") and "Not Oriented," while making sure the live and digital methods are performed simultaneously rather than consecutively. This should be considered in further refinement of this animal-human interaction test.

When ranking these measures as meaningful to reveal how pigs are coping on-farm, proximity to the human or location within the pen are meaningless for concluding whether a pig is fearful or not. The animal-human interaction measurement system most meaningful to on-farm welfare is assessment of Touch, Oriented, and Not Oriented behavior, combined with further describing the behaviors and postures of Not-Oriented pigs. This information provides a better assessment of pigs not approaching because of fear, or not approaching because they are engaged in other, non-fear-related behaviors.

Implications

- The digital image allows for more animal-human interaction measures to be collected (ie, behaviors and postures, proximity, and location) but is more time-consuming than human-observation methodology.
- Postures and behaviors of pigs classified as Not Oriented should be further described to avoid concluding that pigs not classified in the Touch or Oriented categories are fearful or experiencing a compromised state of welfare.

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Conflict of interest

Dr Fangman was employed by Boehringer Ingelheim Vetmedica, Inc during this study.

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Swine respiratory disease minimally affects responses of nursery pigs to gas euthanasia

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Summary

Objectives: To assess effects of swine respiratory disease (SRD) on nursery pig responses during gas euthanasia and to compare responses to carbon dioxide (CO_2) and argon (Ar) gas euthanasia in terms of efficacy and welfare.

Materials and methods: Fifty-four pigs identified for euthanasia were classified as having SRD or euthanized for other reasons (OT). These pigs were distributed among three treatments: prefill CO_2 (P-CO_2), gradual fill CO_2 (G-CO_2), and prefill Ar (P-Ar). Behavioral and physiological indicators of efficacy and welfare were assessed directly and from video. Modified atmosphere CO_2 and O_2 concentrations (%) were collected throughout the process.

Results: Respiratory disease status did not affect behavioral or physiological responses associated with efficacy or welfare with P-CO_2 or G-CO_2. Conversely, SRD pigs lost consciousness faster than OT pigs with P-Ar ($P < .05$) and duration of open-mouth breathing was shorter ($P < .05$), but duration of ataxia tended to be longer ($P < .10$). Regardless of disease status, P-CO_2 was associated with superior animal welfare, with shorter latency to loss of consciousness than P-Ar, and shorter duration of ataxia and duration and intensity of righting responses.

Implications: Standard operating procedures for gas euthanasia utilizing CO_2 or Ar do not require adjustment for nursery pigs with respiratory disease. Minimum exposure of 10 minutes at > 70% CO_2 concentration is required to reliably produce respiratory arrest in nursery pigs. Argon is not recommended as a euthanizing agent for nursery pigs. Duration of exposure to Ar required to reliably produce respiratory arrest remains unknown.

Keywords: swine, respiratory disease, gas euthanasia, carbon dioxide, argon

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Resumen - La enfermedad respiratoria porcina afecta de manera mínima las respuestas de los cerdos de destete a la eutanasia por gas

Objetivos: Evaluar los efectos de la enfermedad respiratoria porcina (SRD por sus siglas en inglés) a la respuesta de los cerdos del destete a la eutanasia por gas y comparar la respuesta a la eutanasia por gas con bióxido de carbono (CO_2) y argón (Ar) en términos de eficacia y bienestar.

Materiales y métodos: Se clasificaron cincuenta y cuatro cerdos identificados para eutanasia por SRD o sometidos a eutanasia por otras razones (OT por sus siglas en inglés). Estos cerdos se distribuyeron en tres tratamientos: pre-llenado CO_2 (P-CO_2), llenado gradual CO_2 (G-CO_2), y pre-llenado Ar (P-Ar). Se evaluaron los indicadores de conducta y fisiológicos de eficacia y bienestar, directamente y del video. Se recolectaron las concentraciones modificadas de O_2 y CO_2 de la atmósfera a lo largo del proceso.

Resultados: El status de enfermedad respiratoria no afectó las respuestas fisiológicas o de conducta asociadas con la eficacia o el bienestar con el P-CO_2 ó el G-CO_2. Por el contrario, los cerdos con SRD perdieron conciencia más rápido que los cerdos OT con P-Ar ($P < .05$) y la duración de la respiración con la boca abierta fue más corta ($P < .05$), pero la duración de la ataxia tendió a ser más larga ($P < .10$). Independientemente del estatus de enfermedad, el P-CO_2 fue asociado con un bienestar animal superior, con latencia más corta de pérdida de conciencia que P-Ar, y duración más corta de ataxia y duración e intensidad de respuestas de orientación.

Implicaciones: Los procedimientos de operación estándar para la eutanasia de gas utilizando CO_2 ó Ar no requieren ajuste para cerdos en destete con enfermedad respiratoria. Se requiere una exposición mínima de 10 minutos a una concentración de > 70% CO_2 para producir de manera fiable un paro respiratorio en cerdos de lactancia. El argón no es recomendable como un agente de eutanasia para cerdos de lactancia. La duración de la exposición al Ar requerida para producir de manera fiable un paro respiratorio sigue siendo desconocida.

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Sadler LJ, Karriker LA, Johnson AK, et al. Swine respiratory disease minimally affects responses of nursery pigs to gas euthanasia. *J Swine Health Prod.* 2014;22(3):125–133.

Résumé - Les maladies respiratoires porcines n'affectent que minimalement les réponses des porcelets en pouponnière à l'euthanasie par les gaz

Objectifs: Évaluer les effets des maladies respiratoires porcines (SRD) chez les porcelets en pouponnière durant l'euthanasie au gaz et comparer les réponses au dioxyde de carbone (CO_2) et à l'argon (Ar) pour l'euthanasie en terme d'efficacité et de bien-être.

Matériels et méthodes: Cinquante-quatre porcs identifiés pour euthanasie ont été classés comme ayant une SRD ou euthanasiés pour d'autres raisons (OT). Ces porcs furent distribués parmi trois traitements: pré-remplissage CO_2 (P-CO_2), remplissage graduel CO_2 (G-CO_2), et pré-remplissage Ar (P-Ar). Des indicateurs comportementaux et physiologiques d'efficacité et de bien-être furent évalués directement à partir de vidéo. Les concentrations de CO_2 et d'O_2 (%) des atmosphères modifiées ont été mesurées durant tout le processus.

Résultats: Le statut quant à une maladie respiratoire n'a pas affecté les réponses comportementales ou physiologiques associées à l'efficacité ou le bien-être avec P-CO_2 ou G-CO_2. À l'inverse, les porcs avec SRD perdirent conscience plus rapidement que les porcs OT avec P-Ar ($P < .05$) et la durée de respiration la bouche ouverte était plus courte ($P < .05$), mais la durée de l'ataxie avait tendance à être plus longue ($P < .10$). Indépendamment du statut quant à la maladie, P-CO_2 était associée à un meilleur bien-être animal, une période de latence plus courte pour la perte de conscience que P-Ar, et une plus courte durée d'ataxie et durée d'intensité des réponses de redressement.

Implications: Les procédures opérationnelles normalisées pour l'euthanasie au gaz utilisant le CO_2 ou l'Ar ne nécessitent pas d'ajustement pour les porcs en pouponnière avec des maladies respiratoires. Un temps d'exposition minimum de 10 minutes à une concentration >70% CO_2 est requis pour induire un arrêt respiratoire fiable chez les porcelets en pouponnière. L'argon n'est pas recommandé pour euthanasier les porcs en pouponnière. La durée d'exposition à l'Ar requise pour causer un arrêt respiratoire fiable demeure inconnue.

Swine producers and veterinarians generally agree that euthanasia is appropriate for low-viability pigs, especially when there is suffering due to injury or illness. The National Animal Health Monitoring System reports that respiratory disease is the primary producer-identified cause of mortality in nursery pigs (44.2%).[1] However, there is little empirical evidence for evaluating euthanasia techniques for pigs in this compromised state. Carbon dioxide (CO_2) is the most commonly implemented gas for swine euthanasia in the United States,[2] and the American Veterinary Medical Association notes "... parameters of the technique need to be optimized and published to ensure consistency and repeatability. In particular, the needs of pigs with low tidal volume must be explored."[3] A pig suffering from swine respiratory disease differs from a healthy pig in several physiological parameters that may be important when utilizing gas as a euthanizing agent. Perhaps most importantly, the damaged lung likely reduces gas exchange rates.

With CO_2 as the method of euthanasia, loss of consciousness and death result from hypercapnia when pigs are gradually exposed to the gas (such as gradual fill at 20% box-volume exchange rate [BVR] per minute) or from a combination of hypercapnia and hypoxia when pigs are placed in a prefilled box at 80% concentration.[4] Carbon dioxide is mildly acidic, which may cause irritation to the mucus membranes.[5] At 10% CO_2 concentrations, human subjects report experiencing breathlessness, described as being unpleasant, and the majority of subjects report 50% CO_2 concentration as being very pungent and painful.[6] This has led to questions about whether CO_2 is appropriate for pig euthanasia.[7] Argon (Ar) has been proposed as an alternative gas euthanasia method.[8] The European Food Safety Authority recommends stunning pigs with a 30:60 ratio of CO_2 to Ar or a 90:10 ratio of Ar to air.[9] Argon is a noble gas, and as such is likely unreactive throughout the physiological systems.[10] Loss of consciousness and death are produced through hypoxia, creating the physiological state of hypocapnic anoxia.[11] As the mechanisms of CO_2 and Ar are different, it is important that both be examined in the compromised pig.

Euthanasia is composed of two stages: first, induction of unconsciousness (insensibility) and second, death. The induction phase is critical to ensure the welfare of the pigs. The entire process, including death, is important to ensure practical implementation. The primary objective of this research was to examine the welfare implications of CO_2 and Ar for euthanasia of nursery pigs suffering from swine respiratory disease. A secondary objective was to compare welfare implications of CO_2 and Ar for euthanasia of nursery pigs regardless of disease status.

Materials and methods

The protocol for this experiment was approved by the Iowa State University Institutional Animal Care and Use Committee.

Experimental design

The experiment was conducted over 4 days in July 2012. Pigs identified for euthanasia were allocated to two disease-status categories: swine respiratory disease (SRD) and other (OT). Pigs of each disease status were enrolled in three gas treatments. The first treatment was a 100% CO_2 prefilled box (P-CO_2), followed by a 20% BVR per minute. The second treatment was 100% CO_2 at 20% BVR per minute (G-CO_2), and the third was a 100% Ar prefilled box (P-Ar) followed by 50% BVR per minute. Eleven SRD-OT pig pairs were enrolled in each CO_2 treatment, and five SRD-OT pig pairs were enrolled in the Ar treatment for a total of 54 pigs (two disease statuses × two CO_2 gas treatments × 11 replicates per CO_2 treatment plus five replicates of Ar treatment). Pigs from both the SRD and OT categories were arbitrarily selected and paired. Gas treatments were applied to the pig pairs in a randomized order created with a random number generator. The original protocol called for the exchange rate for G-CO_2 to be 35% BVR per minute, and the P-CO_2 treatment followed by 50% BVR per minute. However, due to technical difficulties during the trial, only a 20% BVR per minute was achieved in the system.

Study animals and enrollment criteria

Pigs were housed in and sourced from a commercial nursery farm located in north central Missouri. Genetics were a custom Landrace × Yorkshire cross × Duroc sire performance line. Pigs were eligible for enrollment if they were weaned and 3 to 10 weeks of age. Enrolled pigs were chosen from a pool of pigs identified by farm staff as candidates for euthanasia and placed in a cull pen. These pigs were then assigned a disease status, SRD or OT, based on the *Guidance for industry: Recommended study design and evaluation of effectiveness studies for swine respiratory disease claims.*[12] This document provides guidance for indications of SRD in live pigs, based on the parameters of rectal temperature and four-point scoring systems for both respiration and depression. Briefly, a respiration score of 0 denotes a normal respiration rate and pattern; 1 denotes mild, slightly increased respiratory rate; 2 denotes a moderate increase in respiratory rate indicated by some abdominal breathing; and 3 denotes severe respiratory distress indicated by increased respiratory rate with abnormal effort. A depression score of 0 denotes a normal, alert, active pig, well-hydrated and with a normal coat and appetite. A depression score of 1 denotes mild depression, indicated by the pig moving more slowly than normal, with a slightly rough coat; the pig appears lethargic, but upon stimulation appears normal. A depression score of 2 denotes moderate depression, indicated by a pig that that may be recumbent but is able to stand, is gaunt, and may be dehydrated. A score of 3 denotes severe depression, indicated by a down pig or a pig reluctant to get up and gaunt and dehydrated. These scores were collected under both normal and stressed conditions. First, a respiratory score was assigned while the pigs were minimally disturbed in the cull pen; second, assessment was conducted while each pig was restrained by a technician and was presumably in a stressed state. The pigs were also assigned a depression score while in the cull pen, concurrent with the respiration score. Pigs were enrolled as SRD if rectal temperature was ≥ 40.00°C, respiratory score was ≥ 2, and depression score was ≥ 2. Pigs were enrolled as OT if rectal temperature was < 39.72°C, respiratory score was 0, and depression score was ≤ 1. Pigs with respiration score 1 or temperatures ranging between 39.72°C and 39.99°C were not enrolled.

Euthanasia equipment

Gas was administered to the pigs via a modified Euthanex AgPro system (Value-Added Science and Technology, Mason City, Iowa). This gas delivery apparatus was designed by Euthanex Corporation (Palmer, Pennsylvania), a manufacturer of gas delivery systems for rodents and small animals. The system allows for variable administration of gas types, mixtures, flow rates, and delivery times, and once set, ensures precise and controlled administration of gases to the box.

To facilitate behavioral observations, the box's top and front panel were constructed of clear plastic. The top panel was hinged for placing pigs in the box. A foam gasket created an airtight seal. The remaining four panels were constructed of opaque plastic (Figure 1). The gas flowed through 3.25 m of 0.64-cm diameter rubber hoses prior to entering the box. The floor was fitted with a custom foam mat (1.3 cm thick) overlaid with a thin rubber mat (0.16 cm thick) and a layer of wood sawdust (approximately 1 cm deep; TLC Premium Horse Bedding, Centerville, Arizona) to aid in traction and comfort for the pigs.

Constant and precise gas flow was provided by compressed gas cylinders equipped with compressed gas regulators and meters. The CO_2 gas was industrial grade (99% pure), and the Ar gas had a guaranteed analysis of 99.99% pure. Prior to each treatment, sawdust was removed from the box by a vacuum (5.24 m^3 per minute), and the rubber mat and box were then cleaned (Windex; S. C. Johnson, Racine, Wisconsin) and disinfected (Roccal; Pfizer Animal Health, New York, New York), and fresh sawdust was added. The vacuum was also utilized to remove gas traces, pulling air from the bottom of the box for a minimum of 3 minutes.

Environmental conditions

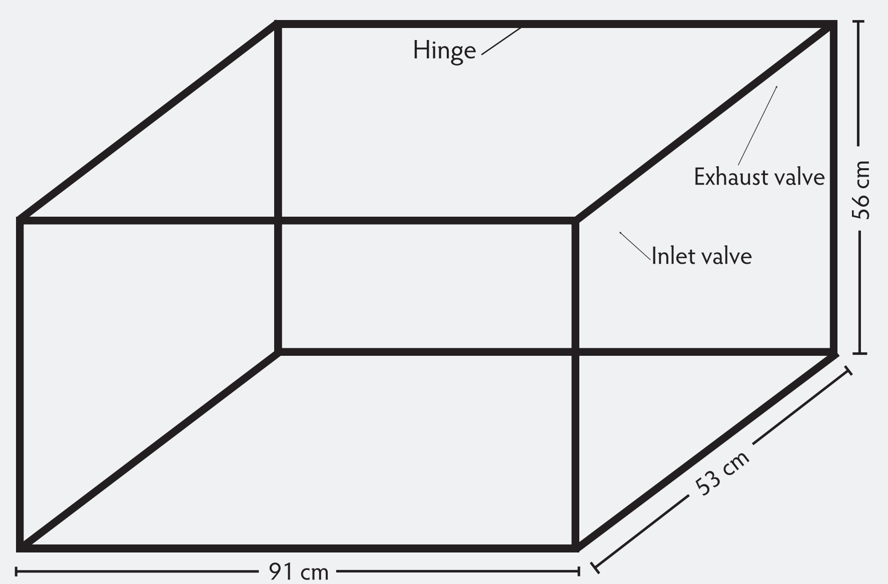
A HOBO data logger (U23-001; Onset Computer Corporation, Cape Cod, Massachusetts) was used to record temperature (°C) and relative humidity (%) within the box. The data logger was set to record every 10 seconds. Oxygen concentrations (%) were collected with an oxygen sensor (TR25OZ; CO2Meter.com, Ormond Beach, Florida) attached to a HOBO data logger (U12; Onset Computer Corporation), which collected the oxygen concentration every second. Data were collected continuously throughout the treatment day and exported into Microsoft Office Excel (version 2007; Redmond, Washington). A CO_2 meter (CO2IR-WR 100%; CO2Meter.com) monitored concentrations (%) every 1.25 seconds. All sensors were placed at the head level of the standing pig. Over all days, the average temperature in the box was 32.0°C, ranging from 25.7°C to 38.5°C. Relative humidity averaged 41.7%, ranging from 12.9% to 73.3%.

Euthanasia procedure and confirmation of insensibility and death

For identification during behavior observations, pigs were marked with an animal-safe marker (LA-CO Industries Inc, Elk Grove, Illinois). The testing area provided isolation, minimizing noise and distractions. A 10-second respiration rate, 10-second pulse rate, rectal temperature, and body weight were recorded for each pig prior to placement in the box. During this assessment, pigs were held by a technician. To achieve a prefilled environment, CO_2 was supplied to the box at 20% BVR for at least 13 minutes and Ar gas at 50% BVR for at least 5 minutes. Upon placement of the SRD-OT piglet pair into the box, gas was immediately started or restarted (gradual or prefill, respectively) and delivery was continued until the pigs were confirmed dead. Two minutes after the last movement (respiratory arrest), pigs were removed individually from the box and examined for signs of insensibility.[13-16]

Three insensibility tests were conducted: first, a corneal reflex response, in which the cornea of the eye was touched with the tip of a finger for absence of an eye blink or withdrawal response; second, a pupillary reflex, in which a light-beam (Mini MAGLite; Mag Instrument, Inc, Ontario, California) was shone into the eye for absence of pupil constriction; and third, a nose prick, in which a 20-gauge needle was touched to the snout distal to

Figure 1: Diagram showing the dimensions of a plastic box for administration of euthanasia gases to nursery pigs 3 to 10 weeks of age. The front and top panels were transparent and the top panel was hinged at the front. The inlet valve (diameter 0.64 cm) was located on a side panel, 7.6 cm from the back panel and 7.6 cm from the top of the box. The exhaust valve (diameter 0.64 cm) was located on the same side panel, 44 cm from the back panel and 3.8 cm from the top of the box.



the rostral bone for absence of a withdrawal response. After insensibility was confirmed, cardiac arrest was confirmed by auscultation with a stethoscope. If the pig showed signs of sensibility or cardiac activity, it was placed back into the box for an additional minute of gas exposure. This process was repeated until confirmation of cardiac arrest, allowing us to establish duration of exposure required for death to occur after maximum change in gas concentration (dwell time).

For ethical and practical reasons, the protocol was terminated if pigs displayed signs of consciousness (regained posture, made righting attempts or vocalizations, or had not transitioned to gasping) after 10 minutes of gas exposure. Additionally, a maximum value of 10 minutes was allowed for death (cardiac arrest) after loss of consciousness. For pigs that did not achieve these outcomes within the designated times, captive bolt was utilized as a secondary euthanasia method, in accordance with the American Veterinary Medical Association's guidelines.[3]

Assessment of lungs

Immediately upon confirmation of death, necropsy was performed. Lungs were removed and a single technician, blinded to disease status, scored the lungs for total macroscopic lesions as described by Opriessnig, et al.[17] This scoring system was based on gross visible damage and the approximate volume each lung lobe contributes to the whole lung. The right cranial lobe, right middle lobe, cranial part of the left cranial lobe, and caudal part of the left cranial lobe contribute 10% each to total lung volume; the accessory lobe contributes 5%; and the right and left caudal lobes contribute 27.5% each. Each lobe was scored as follows: 0% indicating no gross damage; 50% indicating > 0 to ≤ 50% of the lobe grossly affected; 100% indicating > 50% grossly affected. These lobe scores were aggregated for a total lung-damage score, ranging from 0% to 100%. Four samples of the lung tissue were collected, with diseased tissue sampled when grossly visible. If no gross lesions were visible, two samples were collected from each of the left and right middle lobes.

Samples were fixed in 10% buffered formalin until scored. Histological examination was performed by pathologists at the Iowa State University Veterinary Diagnostic Laboratory, who were blind to disease status and gas treatments. Sections of formalin-fixed lung were embedded in paraffin, processed routinely, and stained with hematoxylin and eosin. To confirm gross observations as lesions, a pathologist examined lung sections for evidence of antemortem hemorrhage or atelectasis and also characterized the lesions of pneumonia as nonsuppurative interstitial pneumonia or suppurative bronchopneumonia. Pleuritis, when present, was also noted.

Behavioral observations

Behavioral data were collected by direct observation and via video recording. For direct observation, one observer per pig stood approximately 1.5 m from the box and recorded behavioral indicators of welfare, physiological responses (Table 1), and insensibility. Videos were created utilizing a Noldus Portable Lab (Noldus Information Technology, Wageningen, The Netherlands). Two color cameras (WV-CP484; Panasonic, Kadoma, Japan) were connected to a multiplexer, allowing the image to be recorded onto a personal computer using Handi-Avi (version 4.3; Anderson's AZcendant Software, Tempe, Arizona) at 30 frames per second. Behavioral data were collected from video recordings by a single trained observer, blinded to disease status and gas treatments, using Observer software (version 10.1.548; Noldus Information Technology). Data were collected for the individual pig for behavioral and physiological indicators of efficacy and welfare of the euthanasia process (Table 1). Latencies for all behaviors were determined from the point when each pig was placed into the box.

Statistical analysis

Behaviors were quantified as latency, duration, and frequency of occurrence, or percent of pigs displaying the behavior as indicated for the parameter. Data were analyzed using linear mixed models fitted with the GLIMMIX procedure (duration, number, prevalence; SAS Institute Inc, Cary, North Carolina) or with a Cox proportional hazard model (latency) fitted with the PHREG procedure of SAS. Individual pig was the measurement unit for SRD versus OT pigs, while pig pair served as the experimental unit for gas type. Least squares means estimates for each treatment group and the corresponding standard error (SE) are reported. The linear model included the fixed effect of disease status (SRD, OT) and gas treatment (P-CO_2, G-CO_2, P-Ar) and all two-way interactions. A random blocking effect of pig pair was included. The Kenward-Rogers method was utilized for determining the denominator degrees of freedom. Statistical significance was established at $P < .05$ and a trend at $P < .10$. The GLIMMIX procedure of SAS was utilized to establish correlations between latency to behaviors and total lung damage, with the fixed effect of gas treatment and a random blocking effect of pig pair.

Results

Rectal temperature, respiration rate, and weight were greater in SRD pigs than in OT pigs (Table 2). Pulse rate did not differ by disease status ($P > .05$). Lung damage was greater in SRD pigs than in OT pigs (Table 2). Grossly scored lung damage was confirmed by histological examination, with 100% agreement between gross and histological damage scores. Total lung damage was a predictor for loss of posture ($P < .05$), associated with approximately 0.5-second shorter latency for every 10% of identified damage. Differences were not observed ($P > .05$) between gas treatments for the pigs' parameters of rectal temperature, respiration rate, weight, pulse rate, or lung damage.

Within a gas treatment, O_2 and CO_2 concentrations in the box at the time of loss of consciousness did not differ for SRD and OT pigs. Oxygen concentrations at loss of consciousness (means ± SE) were 5% ± 5%, 17% ± 1%, and 3% ± 3% for P-CO_2, G-CO_2, and P-Ar, respectively. Carbon dioxide concentrations at loss of consciousness were 63% ± 4%, 46% ± 2%, and 0% ± 0% for P-CO_2, G-CO_2, and P-Ar, respectively.

In P-Ar, latency to loss of consciousness was shorter for SRD pigs than for OT pigs, but did not differ in P-CO_2 or G-CO_2 (Table 3). Comparing gas treatments independent of disease status, latency to loss of consciousness was shortest in P-CO_2 (P-CO_2 versus G-CO_2, $P < .001$; P-CO_2 versus P-Ar, $P < .001$), whereas latency to loss of consciousness did not differ between G-CO_2 and P-Ar ($P > .05$). Latency to last limb movement and respiratory arrest did not differ between SRD and OT pigs in any gas treatment ($P > .05$). Comparing gas treatments independent of disease status, latency to last limb movement was shorter in P-CO_2 than in G-CO_2 ($P < .001$). There was a trend for latency to last limb movement to be shorter in P-CO_2 than in P-Ar ($P < .10$), whereas a difference was not observed between G-CO_2 and P-Ar ($P > .05$). Latency to respiratory arrest did not differ between gas treatments regardless of disease status. In P-CO_2, latency to cardiac arrest was shorter for SRD than for OT pigs (Table 3). However, differences

Table 1: Ethogram developed for investigating latency (L), duration (D), prevalence (P), and frequency (F) of behavioral indicators of welfare or sensation during gas euthanasia of swine*

	Definition
Behaviors (states)	
Open-mouth breathing (D,P)	Upper and lower jaw held open with the top lip pulled back, exposing gums or teeth and panting (pronounced inhalation and exhalation observed at the flanks)†‡
Ataxic (D,P)	Lack of muscle coordination during voluntary movements§
Righting response (D,P,F)	Pig making an attempt to maintain either a standing or lying sternal posture but is not successful in maintaining the position. The event was defined as each time effort was made and the muscles relaxed.
Sham licking and chewing (D,P)	Pig going through motions of licking and chewing but not making contact with any substrate or object
Out of view (D)	Pig could not be seen clearly enough to identify the behavior or posture; or pig was removed from box
Behaviors (events)	
Oral discharge (P)	Discharge from the mouth, may be clear and fluid, viscous, or blood. Type of discharge noted.
Nasal discharge (P)	Discharge from the nasal cavity, may be clear and fluid, viscous, or blood. Type of discharge noted.
Ocular orbit discharge (P)	Discharge from the ocular orbit, may be clear and fluid, viscous, or blood. Type of discharge noted.
Sneezing or coughing (P)	Air forcibly expelled from the mouth and nose in an explosive, spasmodic involuntary action
Vomiting (P)	Ejection of gastrointestinal contents through the mouth¶
Escape attempt, bout (P,F)	Pig raising its forelegs on the side of the wall of the box or pushing quickly and forcefully with the head or nose on the side or lid of the box; forceful coordinated movement against the walls of the box; occurrences within a 10-second period were scored as a single bout¶
Loss of consciousness (L)	Pig has lost posture: pig slumped down, making no attempt to right itself, may follow a period of attempts to maintain posture;†** no vocalizations; pig gasping: rhythmic breaths characterized by very prominent and deep thoracic movements, with long latency between, may be stretching of the neck
Last limb movement (L)	No further movement observed of the pig's extremities
Respiratory arrest (L)	No thoracic movement visible, verified for a 2-minute duration
Cardiac arrest (L)	No cardiac activity confirmed by auscultation, verified for a 30-second duration

* Ethogram applied to 54 nursery pigs (3 to 10 weeks of age) classified as having swine respiratory disease (SRD; 15.4 ± 1.4 kg) or euthanized for other reasons (OT; 10.0 ± 1.4 kg) during three gas euthanasia treatments: prefilled carbon dioxide (CO_2), gradual CO_2 (20% box volume exchange rate per minute), or prefilled argon (Ar). Gas administered via a modified Euthanex AgPro system (Value-Added Science and Technology, Mason City, Iowa). To facilitate behavioral observations, the box top and front panels were constructed of clear plastic (Figure 1). Behavioral data collected by direct observation and via video recordings.

† Adapted from Velarde et al.[18]

‡ Adapted from Johnson et al.[19]

§ Adapted from Blood et al.[20]

¶ Adapted from Hurnik et al.[21]

** Adapted from Raj and Gregory.[8]

Table 2: Means and standard errors by disease status for descriptive parameters of pigs identified as in need of euthanasia, data collected prior to gas application*

Parameter	SRD (n = 27)	SE	OT (n = 27)	SE	P†
Female	16	NA	18	NA	NA
Male	11	NA	9	NA	NA
Pulse rate/10 sec	28	1	30	1	> .05
Respiration rate/10 sec	16	1	13	1	.0494
Rectal temperature (°C)	40.4	0.2	39.2	0.2	< .001
Weight (kg)	15.4	1.4	10.0	1.4	< .01
Total lung damage (%)	64	7	24	7	< .001

* Nursery pigs (described in Table 1) were identified for euthanasia for either SRD or OT and assigned into a disease status category by a single technician in accordance with the document *Guidance for industry: Recommended study design and evaluation of effectiveness studies for swine respiratory disease claims.*[12]

† Linear mixed model; statistical significance established at *P* < .05 and a trend at *P* < .10.

SE = standard error; SRD = swine respiratory disease; OT = pigs identified for euthanasia for reasons other than SRD; NA = not applicable.

by disease status were not observed for G-CO_2 or P-Ar. Comparing gas treatments independent of disease status, latency to cardiac arrest was shortest in P-CO_2 (P-CO_2 versus G-CO_2, *P* < .05; P-CO_2 versus P-Ar, *P* < .05), but did not differ (*P* > .05) between G-CO_2 and P-Ar. Two OT pigs in P-Ar required secondary euthanasia procedures; one did not achieve loss of consciousness and one did not achieve cardiac arrest in the allotted time. All pigs displayed open-mouth breathing and ataxia. In P-CO_2 and G-CO_2, duration of open-mouth breathing did not differ between SRD and OT pigs (*P* > .05). However, in P-Ar, duration was greater for OT pigs than for SRD pigs (Table 4). Independent of disease status, duration of open-mouth breathing was shorter in P-CO_2 than in G-CO_2 (*P* < .05), but did not differ between P-CO_2 and P-Ar (*P* > .05). Duration of ataxia did not differ between SRD and OT in P-CO_2 or G-CO_2 (*P* > .05). In P-Ar, there was a trend for greater duration of ataxia in SRD versus OT pigs (*P* < .10). Independent of disease status, duration of ataxia was shorter in P-CO_2 than in either G-CO_2 or P-Ar (P-CO_2 versus G-CO_2, *P* < .05; P-CO_2 versus P-Ar, *P* < .05), but did not differ between G-CO_2 and P-Ar. In P-CO_2, 46% of both SRD and OT pigs displayed a righting response. In G-CO_2, 82% of SRD pigs and 64% of OT pigs displayed a righting response. In P-Ar, all pigs displayed a righting response. When examining intensity of the righting response (number of efforts per pig), differences were not observed (*P* > .05) between SRD and OT pigs within any gas treatment: mean efforts were one for SRD in P-CO_2, one for OT in P-CO_2, two for SRD in G-CO_2, one for OT in G-CO_2, three for SRD in P-Ar, and four for OT in P-Ar. Independent of disease status, duration of righting response was shorter in P-CO_2 and G-CO_2 than in P-Ar (P-CO_2 versus P-Ar, *P* < .01; G-CO_2 versus P-Ar, *P* < .05). Duration did not differ between P-CO_2 and G-CO_2. When examining intensity of righting response, P-Ar showed greater intensity than P-CO_2 or G-CO_2 (P-CO_2 versus P-Ar, *P* < .001; G-CO_2 versus P-Ar, *P* < .01), whereas P-CO_2 and G-CO_2 did not differ (*P* > .05).

Prevalence of escape attempts did not differ (*P* > .05) for disease status or gas type, with 45% of SRD pigs in P-CO_2, 36% of OT pigs in P-CO_2, 55% of SRD pigs in G-CO_2, 9% of OT pigs in G-CO_2, 20% of SRD pigs in

Table 3: Mean latencies (± SE) in seconds for parameters of gas euthanasia efficacy comparing disease status of nursery pigs within gas treatments*

Parameter	Prefill CO_2†			Gradual CO_2‡			Prefill Ar§		
	SRD (n = 11)	OT (n = 11)	P¶	SRD (n = 11)	OT (n = 11)	P¶	SRD (n = 5)	OT (n = 5)	P¶
Loss of consciousness	35 ± 16	36 ± 16	> .05	149 ± 13	158 ± 13	> .05	130 ± 34	270 ± 34	< .01
Last limb movement	145 ± 40	157 ± 40	> .05	367 ± 33	329 ± 33	> .05	274 ± 53	255 ± 53	> .05
Respiration arrest	426 ± 81	314 ± 81	> .05	434 ± 68	433 ± 68	> .05	317 ± 110	408 ± 121	> .05
Cardiac arrest	485 ± 39	574 ± 39	.0497	623 ± 32	647 ± 32	> .05	619 ± 52	700 ± 58	> .05

* Means are for non-zero values. Study described in Table 1. Pigs were assigned into a disease status category by a single technician in accordance with the document *Guidance for industry: recommended study design and evaluation of effectiveness studies for swine respiratory disease claims.*[12]

† Box (described in Figure 1) was filled with CO_2, pigs placed within, and then CO_2 supplied at 20% box-volume exchange rate (BVR)/minute.

‡ Pigs placed within, and then CO_2 supplied at 20% BVR/minute.

§ Box was filled with argon, pigs placed within, and then argon supplied at 50% BVR/minute.

¶ Cox proportional hazards model; statistical significance established at *P* < .05 and a trend at *P* < .10.

SE = standard error; CO_2 = carbon dioxide; Ar = argon; SRD = nursery pigs identified for euthanasia suffering from swine respiratory disease; OT = pigs identified for euthanasia for reasons other than SRD.

Table 4. Mean durations (±SE) in seconds for welfare behavioral measures of gas euthanasia comparing disease status within gas treatments*

Parameter	Prefill CO_2†			Gradual CO_2‡			Prefill Ar§		
	SRD (n = 11)	OT (n = 11)	*P*¶	SRD (n = 11)	OT (n = 11)	*P*¶	SRD (n = 5)	OT (n = 5)	*P*¶
Open-mouth breathing	16 ± 13	14 ± 13	> .05	47 ± 11	58 ± 11	> .05	15 ± 18	62 ± 18	.0491
Ataxia	12 ± 22	15 ± 22	> .05	48 ± 20	62 ± 20	> .05	118 ± 30	31 ± 33	< .10
Righting response	5 ± 5	2 ± 5	> .05	11 ± 4	8 ± 4	> .05	16 ± 6	28 ± 6	> .05

* Study described in Table 1. A single technician assigned pigs to a disease-status category (SRD or OT) that was based on the document *Guidance for industry: Recommended study design and evaluation of effectiveness studies for swine respiratory disease claims.*[12]

† Box (described in Figure 1) was filled with CO_2, pigs placed within, and then gas supplied at 20% box-volume exchange rate (BVR)/minute.

‡ Pigs placed within and then CO_2 supplied at 20% BVR/minute.

§ Box was filled with argon, pigs placed within, and then gas supplied at 50% BVR/minute.

¶ Cox proportional hazards model; statistical significance established at *P* < .05 and a trend at *P* < .10.

P-Ar, and 40% of OT pigs in P-Ar displaying this behavior, nor did the range of number of attempts per individual pig differ (zero to three). Oral discharge was a rare event, observed in six pigs: one SRD pig in P-CO_2, one OT pig in P-CO_2, one SRD pig in G-CO_2, and three OT pigs in G-CO_2. Of these, three occurred prior to gas treatment application. Ocular and nasal discharges were each displayed by one pig, both in G-CO_2. Blood was never visible in the discharges. Sneezing, coughing, and vomiting were not observed in this study.

Prefill conditions required the box to be filled with the designated gas and then the lid opened for placement of the pigs, allowing atmospheric air to enter and quickly changing conditions within the box. Over all trials, O_2 concentrations in the box, after pig placement and with the lid closed, were 5% to 8%, 20% to 21%, and 5% to 7% for P-CO_2, G-CO_2, and P-Ar, respectively. The protocol utilized in the present study required the lid to be opened for confirmation of death, making it difficult to maintain continuous O_2 and CO_2 concentrations throughout each run. Opening the lid resulted in increased O_2 concentrations (Ar and CO_2 treatments; < 7%) and decreased CO_2 concentrations (CO_2 treatments; > 55%). Gas concentrations were regained (< 60 seconds) as gas flow was maintained throughout the procedure.

Discussion

The objectives of this study were to examine and assess the efficacy of gas euthanasia and welfare of nursery pigs suffering from SRD during euthanasia with either CO_2 or Ar, and to compare efficacy and welfare, regardless of disease status, of gas euthanasia with either CO_2 or Ar. It was hypothesized that SRD pigs would have less respiratory membrane available for gas exchange than pigs not suffering from a respiratory ailment, resulting in greater latency to measures of efficacy and inferior welfare during gas euthanasia. Contrary to our hypothesis, disease status did not affect behavioral or physiological responses associated with efficacy or welfare when euthanizing with P-CO_2 or G-CO_2. However, when utilizing Ar, minimal differences were observed between disease statuses, with a greater time spent conscious for the OT pigs than for the SRD pigs. Also in Ar, minimal differences were observed in measures of welfare between SRD and OT pigs, with SRD pigs displaying shorter open-mouth breathing but greater ataxia. When comparing prefilled conditions, CO_2 resulted in better welfare than Ar by shorter latency to loss of consciousness, shorter duration of ataxia, and shorter duration and lower intensity of righting response, whereas differences were not observed in the other measures of welfare that were collected. Differences between disease statuses were small enough to not warrant changes to gas euthanasia procedures.

Weights of the SRD pigs were greater than those of the OT pigs. This is likely due to variability in disease processes in these two groups. Pigs with swine respiratory disease develop clinical signs gradually, and often are not identified nor warrant euthanasia until late in the nursery phase. Conversely, OT pigs were identified for euthanasia for multiple reasons, including acute reasons such as injury, and thus OT pigs regularly occur and are identified over the entire nursery phase. Previous research has indicated that weight is not a significant factor in gas euthanasia of healthy nursery-age pigs.[22] Additionally, in the current study, differences were observed between disease statuses only in the Ar treatment, thus it is unlikely that differences in weight account for differences in responses by SRD and OT pigs.

In this study, the euthanasia process was evaluated in two phases: conscious and unconscious. There is a transition phase prior to loss of consciousness during which a number of behaviors are typically observed, including open-mouth breathing, ataxia, and righting response. The level of awareness, hence capacity of animals to suffer during this transition, is unclear, and we chose a conservative estimate by including all measures up to the point of loss of consciousness to ensure appropriate pig welfare. Behaviors chosen for welfare assessment included physiological distress such as open-mouth breathing, and psychological distress such as escape attempts and righting response.[15,23-30] Although more invasive methods to assess efficacy and welfare, such as EEG or ECG monitoring, can provide robust data in the laboratory, they are not practical on farm and cannot be used in tandem with measurement of naturally occurring behaviors that are induced during gas euthanasia procedures. Behavior was chosen as the primary outcome of interest for welfare since behavioral observations provide more sensitive measures of the animal's experience than physiologic responses, particularly since euthanasia with inhalant gases can produce confounding effects on physiologic responses.[31]

When CO_2 was utilized at either flow rate, disease status did not affect any welfare parameters measured. Open-mouth breathing is a physiological reaction associated with breathlessness, and has been identified as an indicator of compromised welfare in the pig.[27] When pigs were exposed to CO_2, duration of open-mouth breathing was similar to that previously observed in nursery pigs for both prefill and gradual conditions (12 ± 2 seconds and 34 ± 2 seconds, respectively).[22] In P-Ar, duration of open-mouth breathing was approximately four times greater for OT pigs than for SRD pigs. To the authors' knowledge, the duration of open-mouth breathing in P-Ar has not been previously reported in nursery pigs, though observed values in this trial are approximately three times less than that reported in suckling pigs (110 ± 21 seconds).[32]

Ataxia is likely an indicator of impaired function of the cerebellum; however, it is unclear how this correlates with impaired cortical function. If ataxia indicates that the pig is aware of its surroundings, but is unable to react in a coordinated manner, this could be distressing to the pig. In this study, we defined ataxia as a potential stressor for the pig, and hence, a shorter duration of this behavior would correlate with improved welfare. In P-Ar, duration of ataxia was approximately four times greater in SRD pigs than in OT pigs. This longer display of ataxia may be attributed to the general health status of the SRD pigs.[33,34] With a greater depression score, they may have been more likely to display ataxia even without application of gas. Regardless of disease status, inferior welfare was observed with the use of Ar and the gradual flow rate compared to that in P-CO_2. The lack of righting response has been cited as a critical indicator that a pig is successfully rendered unconscious prior to slaughter.[13,27] Hence, duration and intensity of the righting response (number of efforts) were used as indicators of welfare in this study. Righting response was not affected by disease status in any gas treatment. In the prefilled gas treatments, inferior welfare was observed with the use of Ar, as indicated by a six-fold greater duration of righting attempts and four-fold greater number of attempts than for CO_2. The inferior welfare observed in the gradual flow rate was not surprising, since it is consistent with previous research in our laboratory in which welfare was superior with the use of prefill or a faster flow rate (50% BVR per minute).[22] Other flow rates not examined in this study may be advantageous to the pig. Given that disease status did not affect pig responses in the two extreme flow rates tested with CO_2, it is likely SRD disease status would not be a factor at any rate between these extremes.

In addition to minimizing the potential distress caused by the gases, an important goal for euthanasia includes minimizing latency to loss of consciousness to ensure the most humane process is achieved. In Ar, pigs in the OT category took more than twice as long to lose consciousness, being conscious for nearly 4.5 minutes. Latency to loss of consciousness was greater with Ar and the G-CO_2 than with P-CO_2. This is similar to what was observed in suckling pigs.[32] During the gas euthanasia process in pigs, once regular breathing (including open-mouth breathing) controlled by the respiratory center of a mammal's brain fails, gasping is recruited, thus indicating a loss of brain function coordinating with loss of consiousness.[35,36] Respiratory arrest (cessation of gasping) represents the point at which gases can no longer be introduced into the pig's respiratory system. This point is critical to the euthanasia process, because the pig will not recover without intervention. During gas euthanasia, gasping will become slower and shallower until breathing finally ceases. In this study, respiratory arrest was the last observed movement by the pig, and this is consistent with observations of suckling pigs undergoing gas euthanasia.[32] Current recommendations for CO_2 advise exposure for > 5 minutes.[3,15] In the present study, the longest observed latency to respiratory arrest, 585 seconds, was observed in CO_2, suggesting that a minimum of 10 minutes exposure to high CO_2 concentrations is indicated for euthanasia. Current recommendations for Ar advise exposure for > 7 minutes.[3] In the present study, one Ar pig was still conscious after 10 minutes of exposure and thus a longer, unknown duration would need to be implemented when using this gas. Surprisingly, despite the difference in diseased lung tissue between SRD and OT pigs, the only observed difference occurred in latency to cardiac arrest when CO_2 was the euthanizing agent. Since cardiac arrest occurs post loss of consciousness and respiratory arrest, it is likely this difference is not of consequence to either welfare or practical implementation, because the pig is insensible and gases can no longer be introduced into the pig's system.

Pigs that had been clinically identified as SRD were confirmed to have severely diseased lungs, almost three times more damage than the OT pigs. The visible assessment of the lungs was confirmed through histology, with 100% agreement on identification of gross lesions. During respiratory disease, the pulmonary membrane becomes inflamed and highly porous, allowing fluid to leak into the alveoli, effectively decreasing functional respiratory membrane. Additionally, respiratory disease causes inflammation and decreased diameter or blockage of infected airways. This obstruction makes expiration difficult, trapping air which may be reabsorbed, leading to collapse of the affected lung sections. The consequences of less functional respiratory membrane include hypoxemia and hypercapnia.[37] To compensate for the hypoxic and hypercapnic state, the SRD pigs displayed tachypnea. Pigs were assessed for a respiratory score as part of the selection process. It is interesting to note that the physiological and compensatory effects of lung damage were observed in both normal and stressed conditions. Assessment of respiratory rate under stressed conditions is the likely cause of this value being greater for both SRD and OT pigs than the expected values (25 to 40 breaths per minute in a normal nursery pig versus SRD 96 and OT 78 breaths per minute).[38] Although total lung damage significantly affected loss of posture, the effects were minor (statistically modeled: 5 seconds difference between 0% and 100% lung damage) and not substantial enough to merit modifications of standard operating protocols for euthanasia.

Implications

- Under the conditions of this study, with respect to efficacy and pig welfare, a successful gas euthanasia protocol that utilizes CO_2 does not need to be adjusted for pigs with respiratory disease.
- A minimum exposure of 10 minutes at > 70% CO_2 concentration is required to reliably produce respiratory arrest in nursery pigs.
- Producing O_2 concentrations necessary for euthanasia with Ar is difficult with current on-farm equipment.
- Duration of exposure to Ar required to reliably produce respiratory arrest remains unknown.
- Under the conditions of this study, Ar results in lower efficacy and inferior welfare compared to CO_2 and is not recommended as a euthanizing agent for nursery pigs.

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Conflict of interest

The authors report no conflict of interest.

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Use of altrenogest at weaning in primiparous sows

Perle E. Boyer, DVM; Glen W. Almond, DVM, PhD

Summary

Treating primiparous sows with altrenogest for 7 days after weaning increased not only the subsequent total number of piglets born, but also the number of piglets born alive and the number of sows returning to estrus after cessation of altrenogest treatment. Farrowing rates were not affected by treatment.

Keywords: swine, altrenogest, second-litter size, primiparous sows

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Resumen - Utilización del altrenogest al destete en hembras primerizas

Tratar a las hembras primerizas con altrenogest durante 7 días después del destete no solamente incrementó su siguiente número total de lechones nacidos, sino también el número de lechones nacidos vivos y el número de hembras que regresaron al celo después de la interrupción del tratamiento de altrenogest. El porcentaje de fertilidad no se afectó con el tratamiento.

Résumé - Utilisation d'altrenogest au sevrage chez des truies primipares

Le traitement de truies primipares avec de l'altrenogest pendant 7 jours après le sevrage augmenta non seulement le nombre subséquent total de porcelets nés, mais également le nombre de porcelets nés vivants et le nombre de truies revenant en oestrus après le traitement à l'altrenogest. Les taux de naissance ne furent pas affectés par le traitement.

Altrenogest (Matrix; Intervet/Schering-Plough Animal Health, Millsboro, Delaware), a synthetic progestin, is widely used in the pork industry on a worldwide basis. This product is approved for use in sexually mature gilts that have had at least one estrus cycle. It is administered orally for 14 days in North America and up to 18 days in Europe in order to inhibit estrous cyclicity of gilts and synchronize the subsequent onset of estrus. Indeed, after an 18-day treatment regimen, 95% of gilts showed signs of estrus within 4 to 9 days.[1] The treatment was not only effective for estrus synchronization, but the group treated with altrenogest had higher farrowing rates and litter sizes than did the control group.[1] As part of the seasonal infertility complex, primiparous sows often experience a decrease in the number of pigs in their second litter compared to their first litter.[2] Primiparous sows are also more susceptible to summer infertility than sows of higher parity. Primiparous sows experienced delayed returns to estrus after weaning and reduced conception rates in the summer months in North Carolina.[3] One method used to avoid the reduction in litter size during the second parity was to extend the weaning-to-service interval.[2] In addition, administration of exogenous gonadotropins at the time of weaning has been used to induce estrus; however, farrowing rates and litter sizes may be negatively affected by the use of exogenous gonadotropins.[4] Therefore, the purpose of the present study was to determine if oral administration of altrenogest to primiparous sows for 7 days after weaning maintained farrowing rates during the summer and increased the number of piglets born alive at the subsequent pregnancy.

Materials and methods

The farm was PQA Plus certified (National Pork Board; `www.pork.org`) and animals were treated in accordance with the *Guide for the Care and Use of Agricultural Animals in Agricultural Research and Teaching*.[5]

Animals

The study was conducted on a commercial farm of 4000 sows. The farm, which was part of a parity-segregation program, had four farrowing buildings, with eight rooms in each building. For the study, sows were weaned after their first parity between March and August 2012. A total of 3063 primiparous sows (Landrace × Large White) were assigned to either the control group (Control; 1541 females) or the altrenogest group (Altrenogest; 1522 females), with every second sow assigned to the Altrenogest group, while the sows were in the farrowing rooms. Previous lactation length affects the subsequent reproductive performance of a sow during the following cycle. To be certain that our groups were equivalent, this reproductive information was recorded. Lactation lengths were 21.1 and 21.0 days ($P = .47$) in the Control and Altrenogest groups, respectively.

Study design

Sows were moved at their first weaning from the farrowing rooms to the breeding barns and assigned to a group as described. Starting at that time, and each morning for 7 consecutive days, treated sows received 15 mg of altrenogest within a small part of their ration. Control sows were not given a placebo. Anorexic sows were removed from the study. Estrus was detected with boar exposure twice a day starting on the second day after weaning for the control group and the second day after the cessation of altrenogest treatment for the treated group. The first insemination took place on the first day of standing estrus. Sows were artificially inseminated twice at 16- to 24-hour intervals with 3×10^9 sperm cells in each dose.

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Data and statistical analysis

For the first and second litters, information gathered for every sow was group (Altrenogest versus Control), weaning date, breeding dates, farrowing date, total number of piglets, number of piglets born alive, and number of piglets weaned. If the sow was culled, date and reason were recorded. Statistical analysis used a chi-square test for discrete data (farrowing rates, culling rates, rebreed data, percentages of sows returning to estrus within 7 days after weaning or cessation of treatment); analysis of variance for continuous variables (pigs born alive, litter size at weaning); and Tukey test to compare means (Statistix 9; Tallahassee, Florida). A *P* value of < .05 was considered significant.

Table 1: Mean (± standard error) reproductive performance parameters in sows either treated with altrenogest to synchronize estrus or untreated (controls)*

Parameter	Control	Altrenogest
No. of sows	1541	1522
Farrowing rate of sows inseminated at first estrus (%)	87.2	85.0
No. of piglets born alive P1	10.33 ± 0.06	10.31 ± 0.06
No. of piglets weaned P1	10.31 ± 0.03	10.30 ± 0.03
No. of piglets born alive P2	10.06 ± 0.08†	10.72 ± 0.08†
No. of piglets weaned P2	9.78 ± 0.08	9.98 ± 0.07
P2-P1 average piglets born alive	-0.27†	0.41†
P2-P1 average weaned piglets	-0.53	-0.32
WSI < 7 days (%)	77†	91†

* Starting at weaning, and each morning for 7 consecutive days, treated sows received 15 mg of altrenogest (Matrix; Intervet/Schering-Plough Animal Health) within a small part of their ration. Control sows were not given a placebo. Estrus was detected with boar exposure twice a day starting on the second day after weaning for the control group and the second day after the cessation of altrenogest for the treated group. Sows were artificially inseminated twice at 16- to 24-hour intervals with 3×10^9 sperm cells/dose.

† Differences between Control and Altrenogest groups were significant (chi-square; *P* < .05).

P1 = parity 1; P2 = parity 2; WSI = weaning-to-service interval.

Results

Farrowing rates at first estrus

Overall farrowing rates from July to December (weaning from March to August) did not differ (*P* > .05; Table 1). The influence of month and treatment was not significant (*P* > .05) and no trend was found between months.

Sows rebred and reasons for cull

There were 264 and 242 sows culled in the Control and Altrenogest groups, respectively. The main reason to eliminate a sow from the herd was failure to come into heat (Figure 1). In that subgroup, the number of sows treated with altrenogest was significantly less than the number of control sows (*P* < .01). No difference was found between groups when sows were culled for negative pregnancy check, abortion, or lameness, or because they did not conceive. However, twice the number of sows in the Altrenogest group were culled for vaginal discharge as in the Control group (*P* < .05).

Total piglets born, piglets born alive, and piglets weaned

Total piglets born, piglets born alive, and piglets weaned from the first-parity litters did not differ between Altrenogest and Control sows, and thus, the two groups were equivalent and comparable prior to initiation of the study (Table 1). Taking parity-two results into account, sows in the Altrenogest group gave birth to approximately half a piglet more (*P* < .05) than sows in the Control group (Table 1). However, the number of piglets weaned did not differ between the two groups. An outbreak of porcine reproductive and respiratory syndrome (PRRS) virus infection during our study may have influenced those results. This outbreak occurred in the farrowing facilities, which housed sows in both groups.

Second-parity decrease in litter size

The farm had an historical problem with a second-parity decrease in litter size. In the present study, sows from the Control group on average gave birth to 0.27 piglet less at parity two than at the first parity. In contrast, sows treated with altrenogest had a greater litter size as parity-two sows (10.72 piglets born alive) than as parity-one sows (10.31 piglets born alive; Table 1). However, this extra 0.41 piglet was not weaned by the sows. The PRRS outbreak that occurred during the study presumably contributed to the diminished survivability of piglets in most farrowing rooms in two of the farrowing buildings.

Weaning-to-service interval (WSI)

The percentages of treated and control sows returning to estrus within the 6 days after weaning (WSI < 7 days) and after the cessation of the altrenogest treatment were compared. As altrenogest stops the reproductive cycle during the time of administration, a WSI < 7 days in a sow from the control group would be comparable to a WSI < 14 days in a sow treated with altrenogest. In the Control group, 77% of the sows returned to estrus and were serviced within the 6 days after weaning, whereas 91% of the sows treated with altrenogest were mated within the 14 days after weaning (Table 1).

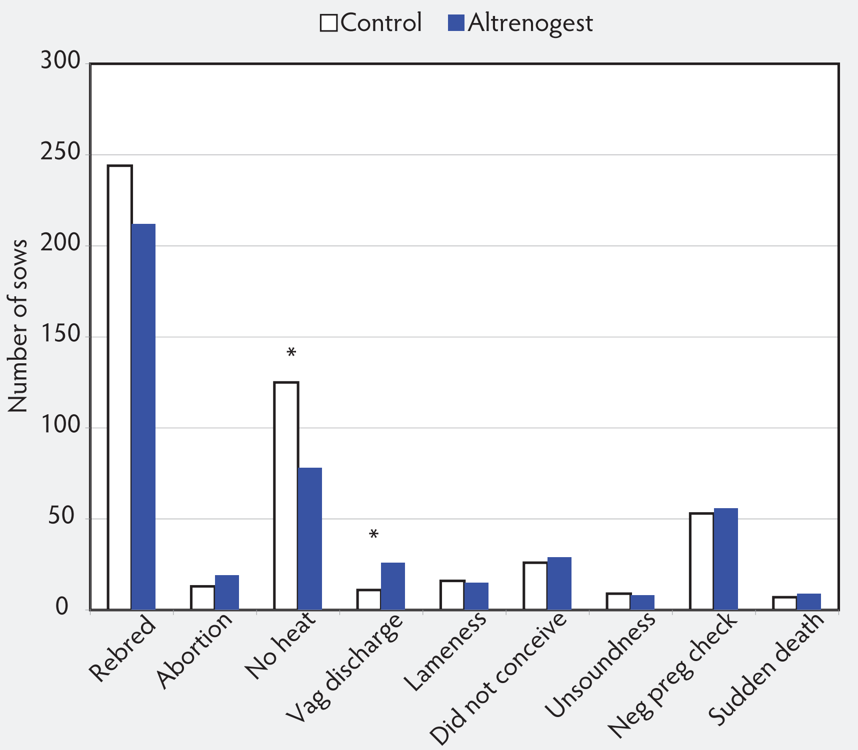
Discussion

As demonstrated in a previous study,[6] farrowing rates of the sows successfully inseminated at the first detected estrus did not differ between the Control group and Altrenogest group, and variations between months did not disclose any trend during the hot months of the year. Thus, it is evident that altrenogest treatment did not influence farrowing rates.

The increased number of sows culled for vaginal discharge may be due to a change in estrus behavior in sows that would be more challenging to detect by personnel on the farm. Most vaginal discharges are a consequence of wrong insemination timing.[7] Altrenogest, acting in a fashion very similar to progesterone, may have local immunosuppressive actions in utero, predisposing a sow to endometritis and therefore to vaginal discharge.[7]

One study[8] found a tendency for the number of piglets born alive to be higher in sows treated with altrenogest for 3 days at weaning, compared to sows returning

Figure 1: In the study described in Table 1, reasons for sow culling during the study and sows bred more than once in order to conceive were compared between Altrenogest and Control groups. The rebred sows were not included in the overall farrowing rates in Table 1 and were not culled. Sows were culled for all other categories. The "no heat" sows failed to exhibit estrus following weaning or cessation of altrenogest treatment. "Failure to conceive" included sows that failed to conceive after mating. "Neg preg check" refers to sows that tested negative with real-time ultrasound at days 35 and 50 of a presumed pregnancy. Sows with a purulent vaginal discharge at 15-19 days after mating and returned to estrus were included in "vag discharge" category. An asterisk (*) over the bars indicates a significant difference between the Control group and the Altrenogest group (chi-square; $P < .05$).



to estrus without altrenogest treatment. In contrast, Werlang et al[9] demonstrated fewer piglets born alive in the sows treated with altrenogest for 5 days. In this current study, duration of treatment was longer (7 days) than in the previous studies, and more live piglets were farrowed in the Altrenogest group than in the Control group. These divergent findings were explained, at least in part, by an insufficient duration of treatment in the previous studies. Indeed, a treatment of less than 10 to 12 days does not produce consistent results because the first dose of altrenogest given at weaning inhibits luteinizing hormone pulses for 4 hours, thereby resulting in recruitment of follicles that will enlarge and may still be present at the end of treatment, producing low-quality embryos.[10] The fact that the higher number of pigs born alive did not transfer to the number of piglets weaned can be explained, as this experiment took place on a commercial site and circumstances in the farrowing house, such as the PRRS outbreak, were unpredictable. Therefore, the number of piglets weaned does not necessarily represent the performance of the group. In addition, the PRRS virus infections contributed to preweaning mortality. Since the Control and Altrenogest sows were housed in the same farrowing rooms and farrowing buildings, piglets from both groups likely were affected by the virus. Unfortunately, the precise number of piglets affected was not documented.

It is important to emphasize that the extra 7 days given to primiparous females in the Altrenogest group facilitates their recovery and return to estrus (91% versus 77% in the Control group), as the main cause of reproductive problems in primiparous sows is diminished body condition in the preceding lactation.[11] It previously was demonstrated that extra recovery time after weaning improves subsequent reproductive performance.[6,12] This was supported by the present observation that fewer sows were culled for not returning to estrus after weaning in the Altrenogest group than in the Control group. Increasing the number of sows that return to estrus after weaning decreases the number of nonproductive days of primiparous females, with a positive economic impact on production.

Implications

- Under the conditions of this study, extending the weaning-to-estrus interval by treating with altrenogest for 7 days enhances the return to estrus in primiparous sows and increases the number of piglets born alive at the following farrowing.
- Under the conditions of this study, extending the weaning-to-estrus interval by using altrenogest does not influence farrowing rates.

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Conflict of interest

None reported.

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Conversion tables

Weights and measures conversions

Weights and measures			
Common (US)	**Metric**	**To convert**	**Multiply by**
1 oz	28.35 g	oz to g	28.4
1 lb (16 oz)	453.59 g	lb to kg	0.45
2.2 lb	1 kg	kg to lb	2.2
1 in	2.54 cm	in to cm	2.54
0.39 in	1 cm	cm to in	0.39
1 ft (12 in)	0.31 m	ft to m	0.3
3.28 ft	1 m	m to ft	3.28
1 mi	1.6 km	mi to km	1.6
0.62 mi	1 km	km to mi	0.62
1 in^2	6.45 cm^2	in^2 to cm^2	6.45
0.16 in^2	1 cm^2	cm^2 to in^2	0.16
1 ft^2	0.09 m^2	ft^2 to m^2	0.09
10.76 ft^2	1 m^2	m^2 to ft^2	10.8
1 ft^3	0.03 m^3	ft^3 to m^3	0.03
35.3 ft^3	1 m^3	m^3 to ft^3	35
1 gal (128 fl oz)	3.8 L	gal to L	3.8
0.264 gal	1 L	L to gal	0.26
1 qt (32 fl oz)	946.36 mL	qt to L	0.95
33.815 fl oz	1 L	L to qt	1.1

Temperature equivalents (approx)

°C	°F
0	32
10	50
15.5	60
16	61
18.3	65
21.1	70
23.8	75
26.6	80
28	82
29.4	85
32.2	90
38.8	102
39.4	103
40.0	104
40.5	105
41.1	106
100	212

°F = (°C × 9/5) + 32

°C = (°F - 32) × 5/9

Conversion chart, kg to lb (approx)

Pig size	Kg	Lb
Birth	1.5-2.0	3.3-4.4
Weaning	3.5	7.7
	5	11
	10	22
Nursery	15	33
	20	44
	25	55
	30	66
Grower	45	99
	50	110
	60	132
Finisher	90	198
	100	220
	105	231
	110	242
	115	253
Sow	135	300
	300	661
Boar	360	794
	363	800

1 tonne = 1000 kg

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

1 ppm = 1 mg/L

Recommendations for pen-based oral-fluid collection in growing pigs

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Summary

Sampling guidelines were developed by observing pigs during oral-fluid sample collection in commercial herds. Pigs with previous oral-fluid collection experience ("trained") should be allowed 20 minutes access to the rope. Pigs with no prior experience ("untrained") should be allowed 60 minutes. One collection is enough to train pigs.

Keywords: swine, pig behavior, oral fluid, sampling, surveillance

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Resumen - Recomendaciones para la recolección de fluidos orales en corrales de cerdos en crecimiento

Se desarrolló una guía de muestreo al observar a cerdos durante la recolección de muestras de fluidos orales en hatos comerciales. A los cerdos con experiencia previa ("entrenados") en la recolección de fluidos orales se les debe permitir 20 minutos de acceso a la cuerda. A los cerdos sin experiencia previa ("no entrenados") se les debe permitir 60 minutos. Una recolección es suficiente para entrenar a los cerdos.

Résumé - Recommandations pour le prélèvement dans les enclos de fluides oraux provenant de porcs en croissance

Des directives pour l'échantillonnage furent développées suite à l'observation de porcs durant le prélèvement d'échantillons de fluides oraux dans des troupeaux commerciaux. Pour des porcs ayant déjà vécu l'expérience de prélèvement de fluides oraux ("entrainés") ont devrait allouer un accès de 20 minutes à la corde. Pour des porcs sans expérience antérieure ("non-entrainé") ont devrait allouer 60 minutes. Une session de prélèvement est suffisante pour entrainer des porcs.

Although oral-fluid-based testing was introduced to swine medicine relatively recently, it has been widely accepted by the pork industry. In 2010, the Iowa State University Veterinary Diagnostic Laboratory (ISU-VDL) performed 10,329 tests on porcine oral-fluid samples. This number increased to 32,544 in 2011, 60,172 in 2012, and 94,011 in 2013 (written communication, Dr Rodger Main, 2014). Although currently an area of development and research, assays described for oral-fluid specimens include antibody- and PCR-based assays for a variety of pathogens, eg, porcine reproductive and respiratory syndrome virus,[1,2] influenza A virus,[3] porcine circovirus type 2,[4] African swine fever virus,[5] and others. In the field, detection of an analyte in a pen-based oral-fluid specimen depends on the prevalence of the infection in the pen,[6] stage of the infection and kinetics of the immune response,[1-4,7] the diagnostic performance of the PCR-based or antibody-based assay used to test the sample,[6,8,9] and pig behavior associated with sample collection, eg, the number of pigs that contribute oral fluid to the sample. Although the published research has begun to address many of these issues, research on pig behavior relevant to oral-fluid sampling is scarce. The primary objective of this study was to answer the question "How long should a sampling rope be left in place to achieve the best representation of the pigs in the pen?"

Materials and methods

All animal handling, housing, and veterinary care was approved and supervised by Murphy Brown LLC and conformed to Pork Quality Assurance Plus guidelines (www.pork.org). In addition, the Iowa State University Institutional Animal Care and Use Committee reviewed and approved the research study.

Animals, housing, and oral-fluid collection

Observations were made in five commercial barns located on four sites. All barns were naturally ventilated and each housed approximately 1100 animals in 40 pens, ie, 25 to 28 animals per pen. All pens were equipped with nipple waterers, and adjoining pens shared feeders. Pens in barns 1 and 4 were equipped with completely slatted floors and metal gates, whereas pens in barns 2, 3, and 5 had partially slatted floors and concrete pen dividers.

To collect oral fluids, cotton rope (0.5-inch three-strand twisted 100% cotton rope; Web Ringing Supply, Lake Barrington, Illinois) was suspended in each pen for 30 minutes. In barns 1 and 4, rope was suspended from the arm of a bracket (2-inch boxed steel) bolted to the bars of the metal gates. In barns 2, 3, and 5, the rope was suspended from a short chain attached to a bracket hooked to the rafters. In all cases, the rope was placed at least 0.6 m from the sides of the pen and suspended with the end of the rope at the pigs' shoulder level. In this arrangement, the rope could be placed and recovered

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from the aisle without entering the pen or disturbing the pigs.

Oral-fluid samples were collected from barns 1, 2, 3, and 4 each day for 5 days prior to behavioral observations (training period), whereas no oral-fluid samples were collected from Barn 5 prior to behavioral observations. Hereafter, the pigs in barns 1 to 4 will be referred to as "trained" and pigs in Barn 5 as "untrained."

Collection of behavioral data related to oral-fluid sampling

Behavior data were collected by direct observation of 233 six- to 12-week-old pigs housed in 163 pens with approximately 4100 pen mates. Observed pigs consisted of convenience-sampled, age-matched pigs from within the system. These pigs were clearly marked on the dorsal aspect of the body from the neck to the rump (Prima Spray On; Prima Tech, Kenansville, North Carolina) to differentiate them from pen mates. One trained pig (barns 1, 2, 3, 4) was added to each pen (n = 143) of 25 to 28 pigs and then observed the following day during one 30-minute collection. Observations on untrained pigs (Barn 5) were made on variable numbers of marked pigs in pens (n = 20) holding 25 pigs: one pig was observed in each of five pens, three pigs in five pens, five pigs in five pens, and nine pigs in five pens for a total of 90 pigs. In untrained pigs, observational data were collected for five successive 30-minute collections to allow for documentation of learning behavior.

Behavioral data were collected by pen-side observers, each equipped with a timer and data recording sheet during 30-minute sampling periods. To quantify pig interactions with the rope, the observation period was divided into 30 one-minute intervals, and each minute was classified as "yes" or "no" for positive contact. "A positive contact" was defined as observing the marked pig take the rope into its mouth, regardless of the length of time the rope was in the pig's mouth. The trained pigs in barns 1, 2, 3, and 4 were observed for one observation period, whereas the untrained pigs in barn 5 were observed for five consecutive 30-minute observation periods. Thereafter, the data were used to describe the observed pig behaviors, eg, the percent of pigs that contacted the rope over the 30-minute observation period, cumulative rope contacts, and other behavioral patterns related to interacting with the rope.

Statistical analysis comparing behavioral data for barns 1 through 5 was performed using an ANOVA in SAS version 9.2 (SAS Institute, Inc, Cary, North Carolina). Behavioral outcomes included cumulative interaction with the rope over time, pig total contact time, and patterns of pig contact over time. Descriptive statistics of other data are presented.

Results

No significant differences in pig behavior were noted between barns 1, 2, 3, and 4 (trained pigs), but observations in Barn 5 (untrained pigs) differed significantly (ANOVA; $P < .01$) from those in the other barns. On the basis of this analysis, the data from barns 1 through 4 were combined for subsequent analyses.

Among trained pigs, 16.1% to 31.4% (mean 22.9%) of the observed pigs (n = 143) contacted the rope during each 1-minute interval of the observation period (Figure 1). Cumulatively, 86 (60.1%) of the referents contacted the rope in the first 10 minutes of the observation period, 101 (70.6%) in the first 20 minutes, and 108 (75.5%) in 30 minutes; 35 (24.4%) never contacted the rope (Figure 1). Among the pigs that interacted with the rope, 49 (34.2%) interacted for ≤ 5 minutes, 21 (14.6%) for 6 to 10 minutes, 20 (13.8%) for 11 to 15 minutes, 13 (9.1%) for 16 to 21 minutes, and 5 (3.5%) for 21 minutes or more (Figure 2). The mean total contact time among the 108 pigs contacting the rope was 6.9 minutes. Twenty-two (15.4%) of the pigs that contacted the rope did so in a single contact event, but most cycled away from and back to the rope (Figure 3). Thus, two contact events were observed in 36 (25.2%) of the pigs, three events in 20 (14.0%), four events in 18 (12.6%), and ≥ 5 in 12 (8.4%).

Untrained pigs (n = 90) were monitored in five sequential 30-minute observation periods. In the first observation period (Observation 1), 6.7% to 28.8% of the pigs (mean 21.1%) contacted the rope during each 1-minute interval (Figure 4). Cumulatively, 30 (33.3%) contacted the rope in the first 10 minutes, 40 (44.4%) in the first 20 minutes, and 49 (54.4%) in 30 minutes; 41 (45.6%) never contacted the rope (Figure 4). Pig adaptive behavior was apparent in observations 2 through 5 (Figure 5). These observations differed from Observation 1, but not from each other. Thus, in observations 2 through 5, a mean of 48 (53.3%)

Figure 1: Percent of "trained pigs" (n = 143) interacting with an oral-fluid collection rope over the observation period. A total of 233 six- to 12-week-old pigs in a commercial finisher were observed. Trained pigs were defined as having previous experience with oral-fluid collection. Behavioral data were collected by pen-side observers each equipped with a timer and data recording sheet during 30-minute sampling periods. To quantify pig interactions with the rope, the observation period was divided into 30 one-minute intervals, with each minute classified as "yes" or "no" for positive contact. A "positive contact" was defined as observing the pig taking the rope into its mouth, regardless of the length of time the rope was in the pig's mouth.

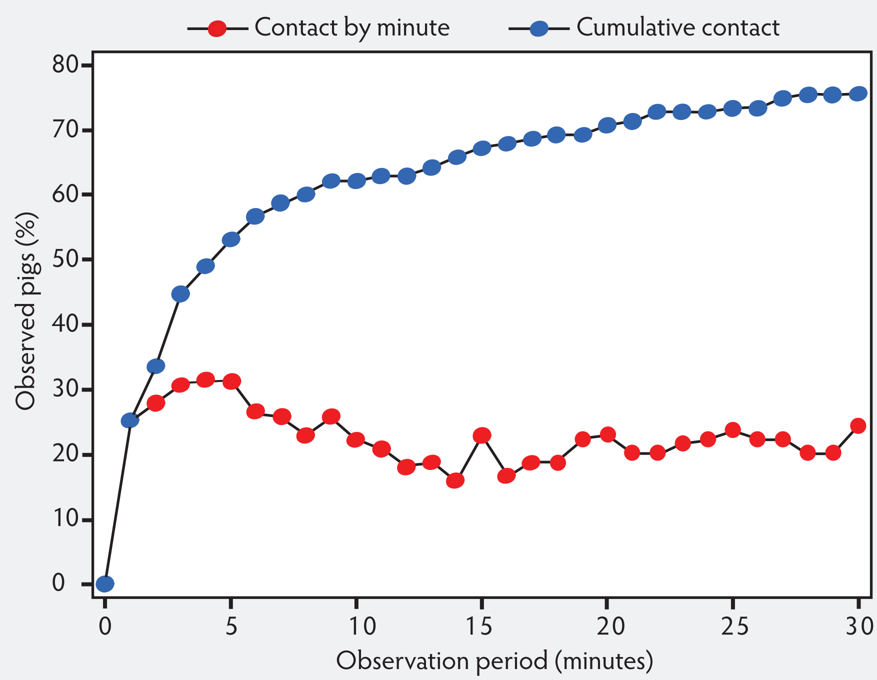


Figure 2: Distribution of total contact time with the rope among trained pigs as described in Figure 1 (n = 143).

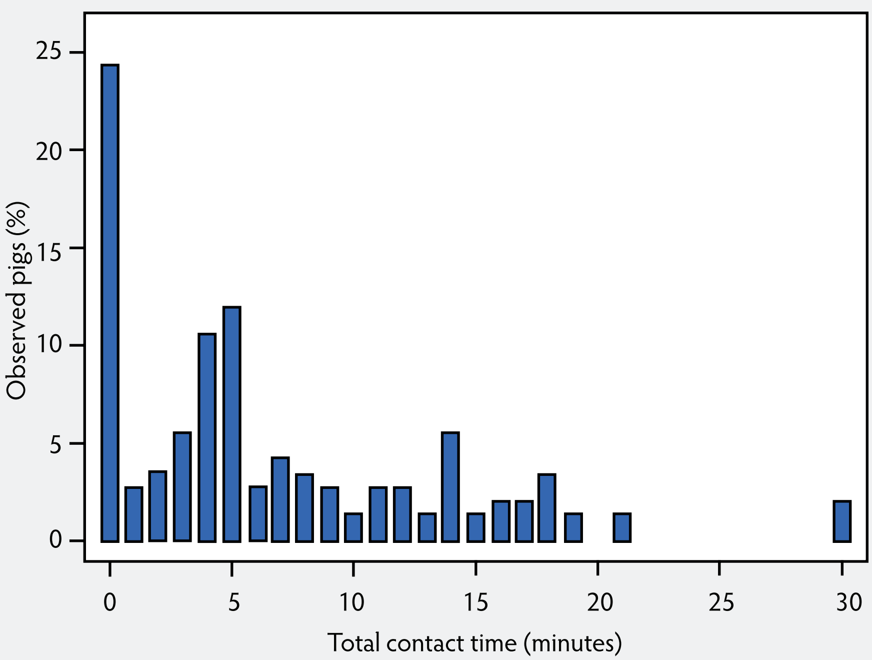
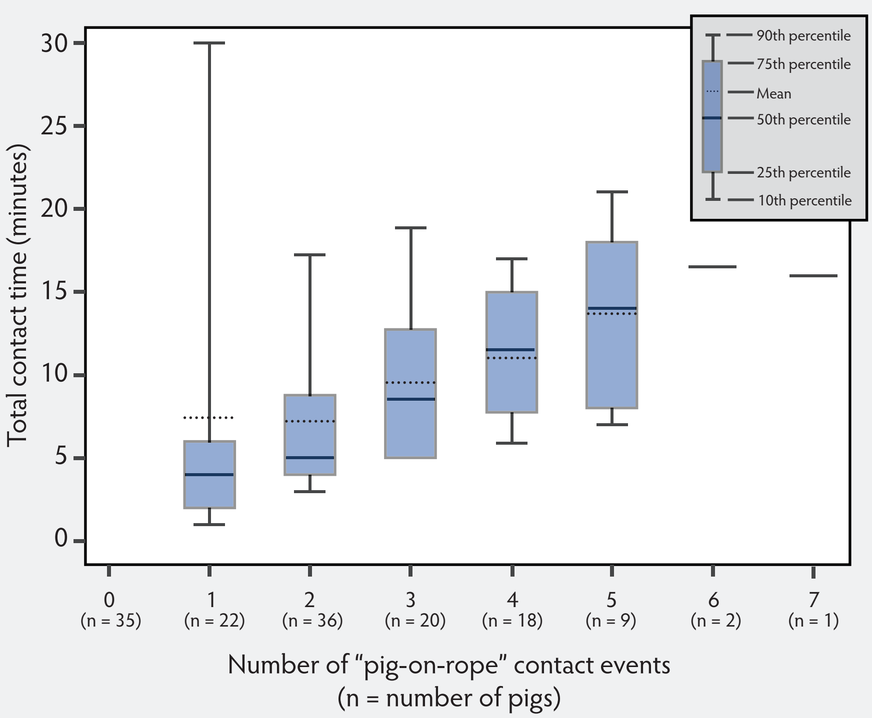


Figure 3: Number of positive-contact events among trained pigs (n =143) as described in Figure 1. While a few pigs contacted the rope in a single contact event, the majority cycled away and back to the rope over the observation period.



observed pigs contacted the rope in the first 10 minutes, 59 pigs (65.6%) in 20 minutes, and 63 pigs (70.0%) in 30 minutes; 27 pigs (30.0%) never contacted the rope. Cumulatively, it took 64 minutes for the untrained pigs to reach a 70% participation level.

Discussion

The use of oral-fluid-based surveillance facilitates health monitoring while providing a positive image for pork producers. That is, the use of oral fluids shows that we are dedicated to improving animal welfare by providing a stress-free procedure to monitor populations of pigs for a variety of infectious agents. Rope-based oral-fluid collection from pigs is possible because it is compatible with normal behavior. That is, pigs are naturally curious and explore their environment by biting, chewing, and tasting.[10,11] Age, but not gender, has been shown to affect the level of interaction, with 13-week-old pigs exhibiting more activity than 5-week-old pigs, which in turn were more active than 3-week-old pigs.[12] Pigs have a particular preference for objects that are chewable, flexible, and destructible,[12-15] eg, rope.

In this study, analysis of the data led to the formulation of two sampling recommendations: one for pigs with prior exposure to oral-fluid sampling (trained pigs) and one for those with no prior experience (untrained pigs). In trained pigs, a ≥ 20-minute oral-fluid sampling period is recommended in order to assure the participation of approximately 70% of the pigs in pens of 25 to 30 pigs. In untrained pigs, a 60-minute oral-fluid sampling is recommended to achieve a similar level of participation. The data in this study suggest that one collection experience is sufficient to train pigs. Future research is required to develop data-driven sampling recommendations for pens of different design and size.

Implications

- Oral-fluid collection can easily be added to a normal walk-through or integrated into a routine surveillance program.
- Collect samples using 100% cotton rope; hang the end of the rope at pig shoulder level.
- Allow a minimum of 20 minutes for trained pigs to interact with the rope, 60 minutes if pigs have not had prior experience with oral-fluid collection.

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Figure 4: Percent of "untrained pigs" (n = 90) interacting with the rope over the first observation period. Observation periods described in Figure 1. Untrained pigs had no previous experience with oral-fluid collection, in contrast to the trained pigs (described in Figure 1).

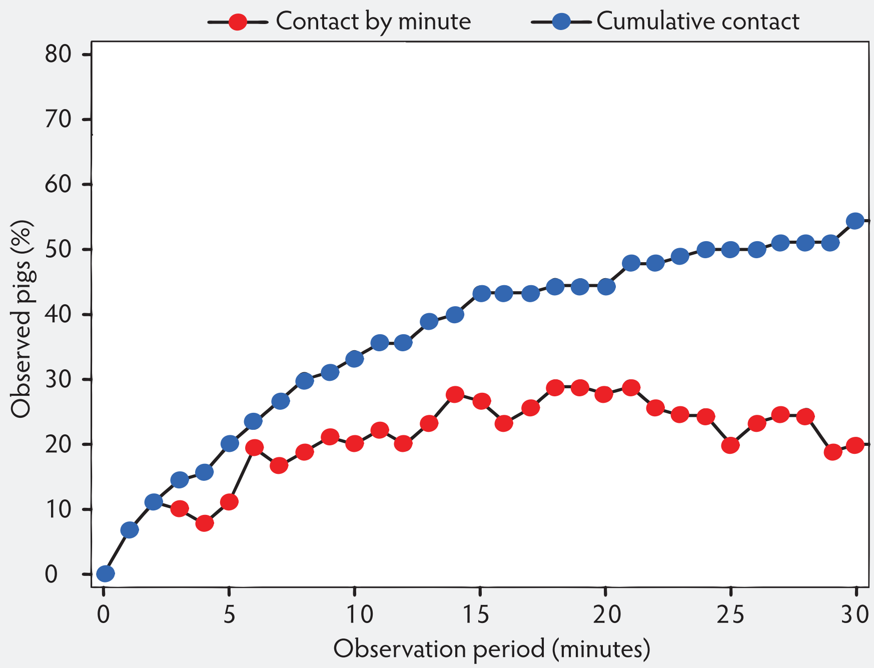
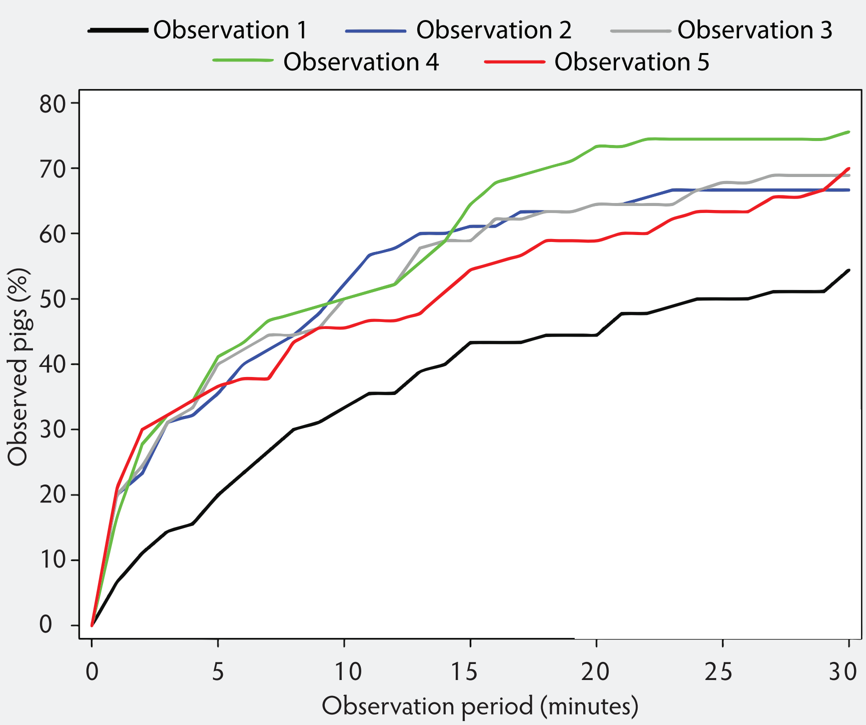


Figure 5. Percent of untrained pigs (n = 90; described in Figure 4) interacting with the rope (cumulative contact) over five sequential observation periods (described in Figure 1).



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Pork industry launches three-prong strategy to stem PEDV spread

The National Pork Board has announced additional funds earmarked for research in the fight against the further spread of porcine epidemic diarrhea virus (PEDV), which was first identified in the United States last May. The funds, US$650,000 through supplemental funding approved by the Pork Checkoff at last week's board meeting and US$500,000 through a new agreement with Genome Alberta, will provide new opportunities for research.

"This has become one of the most serious and devastating diseases our pig farmers have faced in decades," said Karen Richter, a Minnesota producer and president of the National Pork Board. "While it has absolutely no impact on food safety, it has clear implications for the pork industry in terms of supplying pork to consumers. Our number 1 priority is to address PEDV."

Additionally, the Pork Checkoff announced a new collaboration with a number of industry players, including the National Pork Producers Council, the American Association of Swine Veterinarians, the American Feed Industry Association, the National Grain and Feed Association, the National Renderers Association, and the North American Spray Dried Blood and Plasma Protein Producers, which is made up of five member companies throughout the United States and Canada.

For more information, contact Paul Sundberg at `PSundberg@pork.org` or 515-223-2764.

Industry honors Dr Maynard Hogberg with Distinguished Service Award

The National Pork Board honored Maynard Hogberg, PhD, as the recipient of its Distinguished Service Award on March 8. Hogberg is professor and chair of the Department of Animal Science at Iowa State University. The award was presented during the National Pork Industry Forum, the industry's annual business meeting. The award is given annually to recognize the lifelong contribution to the pork industry by an outstanding leader.

"Dr Hogberg has provided extraordinary leadership to the pork industry," said Sam Hines, Michigan Pork Producers Association executive vice president. "He has brought segments of the industry together to find sustainable solutions that have benefited pork producers nationwide."

Hogberg began his career at Michigan State University, where he was a professor and led the development of swine extension activities. He eventually went on to serve as the chair of the Department of Animal Science. While at Michigan State, he helped grow the state's pork industry by working with the Michigan Department of Agriculture to create Generally Accepted Management Practices for manure nutrient management. Following his time at Michigan State University, Dr Hogberg became professor and chair of the Department of Animal Science at Iowa State University.

For more information, contact Chris Hostetler at `CHostetler@pork.org` or 515-223-2606.

Dr Maynard Hogberg

Checkoff stresses "line of separation" for PEDV mitigation

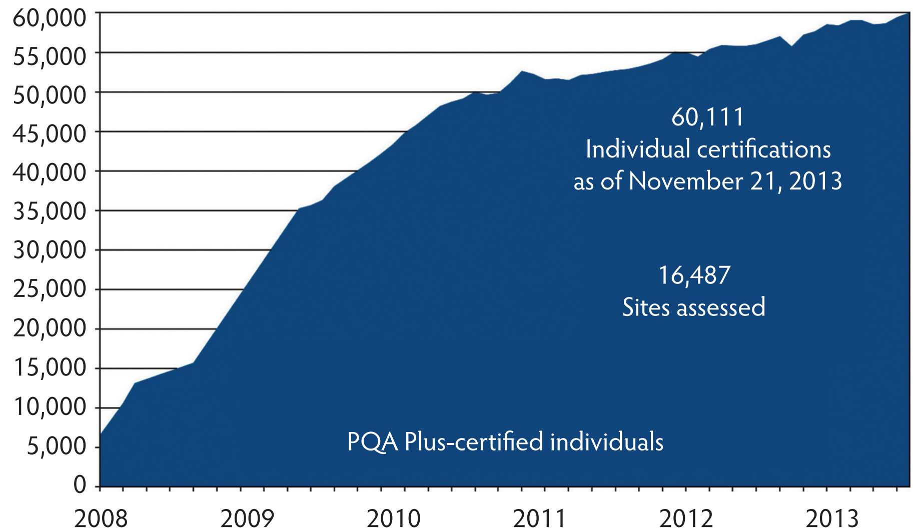
Biosecurity measures protect your herd day in and day out, but the porcine epidemic diarrhea virus (PEDV) has upped the ante. Among the steps that need renewed attention is implementing a strict line of separation within swine production sites. "That is drawing a line for non-farm personnel to remain on one side and farm personnel to remain on the other side," says Lisa Becton, DVM, Director of Swine Health and Information for the Pork Checkoff. "The line must apply to any and all service providers." Becton provides examples of how to establish various lines of separation within a hog farm, as well as updates on research projects and resources available to help producers develop management strategies to address PEDV.

For more information, go to `www.pork.org/pedv` or contact Lisa Becton at `LBecton@pork.org` or 515-223-2791.

PQA Plus certifications grow

In 2013, the Pork Quality Assurance Plus program hit an all-time high in number of certifications. The National Pork Board thanks the veterinary community for its role in helping the industry achieve this level of success.

For more information, contact Dinah Peebles at DPeebles@pork.org or 515-223-2795.



Checkoff helps prepare for PEDV ahead of show season

As swine show season starts to get underway, it's time to think about how to deal with the many questions and challenges associated with porcine epidemic diarrhea virus (PEDV). Although the virus has less impact on the older, growing pigs headed for a show ring, the potential to spread PEDV and other pathogens rises as the pigs are commingled at weigh-in and the exhibitions themselves. Regardless of PEDV's presence, though, certain measures should always be a priority for anyone involved in swine shows.

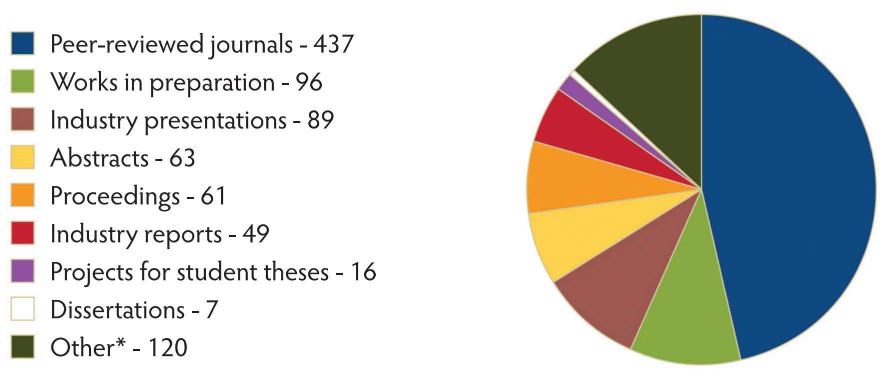
For more information on PEDV-related fact sheets, including those about exhibitions, go to www.pork.org/pedv for the entire catalog of items.

Checkoff research drives science-based knowledge

To better determine the return on investment made by America's pork producers, the Checkoff reviewed the research projects funded from 2006 to 2010. As part of this effort, Checkoff contacted 267 researchers who worked on 389 Checkoff-funded projects during these years. They reported that Checkoff helped them to increase the industry's research value by 97%. In addition, the study found that Checkoff research was cited 3808 times in 938 publications during those years.

For more information, contact Mike King at MKing@pork.org or 515-223-3532.

Pork Checkoff cited research (2006 - 2010)



When a Checkoff-funded research report is cited, it builds the overall impact of the study. Researchers responding to the survey reported that they cited Checkoff research 3808 times in 938 publications.

* "Other" includes magazines, Web sites, fact sheets, white papers, software, books, book chapters, and National Pork Board final reports.

2014 TQA Advisor Training Workshop dates and locations

If you need to get certified in the revised Transport Quality Assurance program, choose from one of these times and locations: April 17, St Louis, Missouri; April 22, Columbus, Ohio; May 14, Des Moines, Iowa; July 10, Des Moines, Iowa; October 21, Des Moines, Iowa.

If you do not see a training that fits your needs, please call the National Pork Board server center at 800-456-7675, Monday to Friday, 8 AM to 5 PM Central Time, to obtain assistance in finding a training to fit your needs.

For a brochure on 2014 TQA Advisor Training Workshops, go to www.pork.org/filelibrary/TQAAdvisorsTrn15.pdf.

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AASV NEWS

AASV announces 2014 officers

Dr Michelle Sprague was installed as president of the American Association of Swine Veterinarians at the association's 45th annual meeting in Dallas, Texas. She succeeds Dr Matt Anderson, who is now Immediate Past President. Dr Ron Brodersen has ascended to President-elect. The newly elected Vice President is Dr George Charbonneau.

AASV officers (left to right) Dr Michelle Sprague, Dr Ron Broderson, Dr George Charbonneau, Dr Matt Anderson

AASV President Dr Michelle Sprague (ISU '05) grew up on a small farrow-to-finish and row-crop farm in Glenwood, Iowa. Following graduation from the Iowa State University College of Veterinary Medicine in 2005, she joined the Audubon-Manning Veterinary Clinic (AMVC) in Audubon, Iowa. She is currently a partner and director of sow health at AMVC. Her responsibilities include overseeing animal health, biosecurity, food safety, and animal welfare on all the clinic's managed sow farms.

Dr Sprague has been an active member of the AASV, currently serving as the chair of the Pig Welfare Committee and as a member of the PADRAP Advisory Committee. She was awarded the AASV Young Swine Veterinarian of the Year Award in 2010 and is a frequent speaker at various professional and industry meetings, including AASV. She also represents AASV on AVMA's Animal Welfare Committee and is a member of the Iowa Veterinary Medical Association.

When asked to comment on her thoughts about the future of AASV and her tenure as president, Dr Sprague said, "I am honored and humbled to serve as president of the AASV this year. As is often the case, the swine industry is currently facing many challenges, including emerging disease threats, shifting public perception, and changing antimicrobial regulations. With the introduction of PEDV to our country last year, we continue to have new opportunities to provide guidance not only to our clients but also to each other. I am so proud to be part of an organization whose members have pulled together and openly shared all they can to help one another through these most recent challenges. When we collaborate with our colleagues and abide by the pillars of our oath, "the pig always wins." I look forward to representing the AASV, its members, and our patients in the coming year."

AASV President-elect Dr Ron Brodersen (ISU '79) grew up on a livestock farm near Coleridge, Nebraska. He attended the University of Nebraska-Lincoln and received a DVM degree from Iowa State University. He also attended the University of Illinois Executive Veterinary Program. Dr Brodersen is the owner of Whole Hog Health Center at Hartington, Nebraska, where he has been providing swine veterinary services since 1990. He was active on the Nebraska Pseudorabies Eradication Task Force in the 1990's. Dr Brodersen has been active in the AASV, serving on the board of directors, as well as the Pharmaceutical Issues and Boar Stud Biosecurity committees. He has also served as chairman of the AASV Foundation. The AASV recognized him as the Swine Practitioner of the Year in 2003.

AASV Vice President Dr George Charbonneau (OVC '81) grew up in Arnprior, Ontario. He obtained his Doctor of Veterinary Medicine from the Ontario Veterinary College and established a veterinary practice serving southwestern Ontario. George is currently a partner in South West Ontario Veterinary Services and is based in Stratford, Ontario.

Dr Charbonneau has been very active in the Canadian swine industry. He has served as the president of the Canadian Association of Swine Veterinarians, Ontario Association of Swine Veterinarians, and the Ontario Pork Congress. He was involved in the formation of the Ontario Pork Industry Council and served as its initial chairman. He has served as a district representative on the AASV Board of Directors and currently serves in the Canadian Association of Swine Veterinarians. Dr Charbonneau has received

AASV news continued on page 147

WINNING THE FIGHT AGAINST SWINE INFLUENZA

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Swine Influenza Vaccine, RNA utilizes neither a killed nor modified live virus, only a gene from a virus in an infected animal. This vaccine delivers a specific immune response without shedding, spreading, or reverting to virulence following vaccination.

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Cellular Immunity	–	+	–	+
May Cause Disease	–	+	–	–
Must Grow Agent	+	+	+	–
Rapid Response	–	–	–	+

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AASV news continued from page 145

numerous awards from the Ontario swine industry, as well as the Ontario Veterinary Medical Association Outstanding Veterinarian Award in 2008. He was also the 2012 recipient of the AASV Swine Practitioner of the Year award. "I am truly honored to have been elected and will do my best to serve the AASV," he noted following his election.

AASV Past President Dr Matt Anderson (ISU '99) is a Minnesota native who grew up around hogs, cattle, and crop farming near Stuart, Iowa. After graduating from Iowa State University College of Veterinary Medicine (1999), Dr Anderson started his veterinary practice career in Morris, Minnesota. He has been a partner-owner in Suidae Health and Production in Algona, Iowa, since 2001. Suidae is a seven-veterinarian, swine-only practice focused on providing full-service swine veterinary care as well as swine health and business consulting. The practice also has business initiatives in production management and research.

Call for abstracts – AASV 2015 Student Seminar

Veterinary Student Scholarships

The American Association of Swine Veterinarians announces an opportunity for veterinary students to make a scientific presentation at the AASV Annual Meeting in Orlando, Florida, on Sunday, March 1, 2015. Interested students are invited to submit a 1-page abstract of a research paper, clinical case study, or literature review for consideration. The submitting student must be a current (2014-2015) student member of the AASV at the time of submission, and must not have graduated from veterinary school prior to March 1, 2015. Submissions are limited to one (1) abstract per student.

Abstracts and supplementary materials must be *received* by Dr Alex Ramirez (**alex@aasv.org**) by **11:59 PM Central Daylight Time** on **Monday, September 22, 2014** (firm deadline). All material must be submitted electronically. Late abstracts will not be considered. You should receive an e-mail confirming the receipt of your submission. If you do not receive this confirmation e-mail, you must contact Dr Alex Ramirez (**alex@aasv.org**) by Wednesday September 24, 2014, with supporting evidence that the submission was made in time; otherwise your submission will not be considered for judging. The abstracts will be reviewed by an unbiased professional panel consisting of a private practitioner, an academician, and an industry veterinarian. Fifteen abstracts will be selected for oral presentation in the Student Seminar at the AASV Annual Meeting. Students whose papers are selected will be notified by October 15, 2014, and will be expected to provide the complete paper or abstract, reformatted for publication, by November 17, 2014.

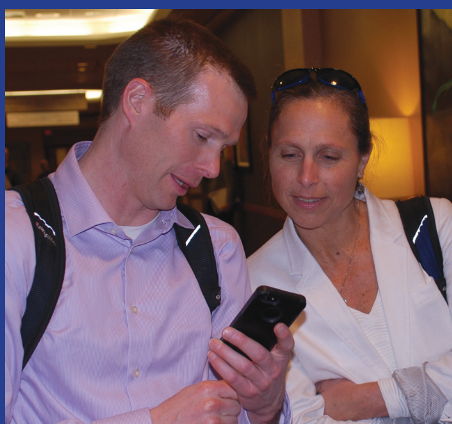
To help defray the costs of attending the AASV meeting, Zoetis provides a $750 honorarium to the student presenter of each paper selected for oral presentation during the Student Seminar.

Each veterinary student whose paper is selected for oral presentation also competes for one of several veterinary student scholarships awarded through the AASV Foundation. The oral presentations will be judged to determine the amount of the scholarship awarded. Zoetis funds a $5000 scholarship for the student whose paper, oral presentation, and supporting information are judged best overall. Elanco Animal Health provides $20,000 in additional funding, enabling the AASV Foundation to award $2500 each for 2nd through 5th place, $1500 each for 6th through 10th place, and $500 each for 11th through 15th place.

Abstracts that are not selected for oral presentation in the Student Seminar will be considered for participation in a poster session at the annual meeting. Zoetis and the AASV fund a stipend of $250 for each student who is selected and participates in the poster presentation. In addition, Boehringer Ingelheim Vetmedica, Inc provides financial support for the Veterinary Student Poster Competition. The presenters of the top 15 poster abstracts compete for awards ranging from $200 to $500.

Complete information for preparing and submitting abstracts is available on the AASV Web site at **http://www.aasv.org/annmtg/2015/studentseminar.htm**. Please note: the rules for submission should be followed carefully. For more information, contact the AASV office (Tel: 515-465-5255; Fax: 515-465-3832; E-mail: **aasv@aasv.org**).

Building and enhancing skills & knowledge



Fellowship and networking

2014 AASV Annual Meeting highly successful

The American Association of Swine Veterinarians (AASV) held its 45th annual meeting in Dallas, Texas, March 1-4, 2014. The meeting, held at the Sheraton Dallas Hotel, drew 1046 total attendees including 612 paid registrants and 133 students. The participants represented 25 countries, with 22% of attendees from outside the United States. Total attendance included 235 allied industry representatives from 81 exhibitors manning a record 82 technical tables. The students in attendance represented 21 veterinary schools!

The theme of this year's meeting was "Our oath in practice." The participants were presented with numerous educational sessions including 10 pre-conference workshops, two general sessions, three break-out sessions, research topics, industrial partner sessions, 15 Student Seminar presentations, and 95 posters.

Dr Daryl Olsen opened the Monday General Session with the Howard Dunne Memorial Lecture. His presentation, entitled "The pig always wins," reminds us that we as veterinarians took an oath to speak for the pig. He concluded by saying, "If we practice scientific, ethical veterinary medicine, based on our Veterinarian's Oath, then the pig will always win." Dr Mark Engle followed up with the Alex Hogg Memorial Lecture entitled "The PED challenge: Application of our veterinary oath to represent the interest of the pig." Dr Engle reminded us that the fulfillment of our oath requires a commitment to lifelong learning, and the introduction of PED virus continues to teach us lessons about disease response and management.

The Monday afternoon session included presentations on PRRS, swine influenza, *Mycoplasma*, enteric disease, and animal welfare. Trent Loos started off the Tuesday morning session challenging us to become "agvocates" for our profession and the swine industry. The remainder of the Tuesday session focused on the impact of the introduction of porcine epidemic diarrhea virus into the North American swine herd. All of the General Session presentations on Monday and Tuesday were video recorded and will be posted in the video library of the AASV Web site in the near future.

In addition, 15 AASV committees met during the annual meeting, and the board of directors convened at the close of the meeting on Tuesday afternoon, recognizing the new slate of officers: Drs Michelle Sprague, President; Ron Brodersen, President-elect; George Charbonneau, Vice President; and Matt Anderson, Past President. The board also welcomed incoming representatives: District 2, Dr Gene Nemechek; District 5, Dr Bill Hollis; District 9, Dr Jeff Kurt; and District 11, Dr Blaine Tully. The 2015 annual meeting will be held February 28-March 3 in Orlando, Florida. If you would like to provide feedback on this year's meeting or suggestions for future meetings, please complete the short online survey at `http://fluidsurveys.com/s/AASV2014/`.

AASV annual awards

The AASV honored five members for their contributions to the association and the swine industry. Dr Paul Ruen, 2010 AASV President, presented the awards at Monday night's reception.

Swine Practitioner of the Year

Dr Matthew Turner was named 2014 Swine Practitioner of the Year by the American Association of Swine Veterinarians. The award is given to the swine practitioner who has demonstrated an unusual degree of proficiency and effectiveness in the delivery of veterinary service to clients.

Dr Turner obtained his doctor of veterinary medicine degree from the North Carolina State University College of Veterinary Medicine (NCSU-CVM) in 2000. Following graduation, he accepted the position of staff veterinarian at Prestage Farms in Clinton, North Carolina. He completed the Executive Veterinary Program at the University of Illinois College of Veterinary Medicine in 2009.

Dr Turner has represented District 2 on the AASV Board of Directors and is a member of the AVMA and the North Carolina Veterinary Medical Association (NCVMA). He was selected as the NCVMA's "Young Veterinarian of the Year" in 2004 and was named to Pfizer Animal Health's "10 Under 40" list of young veterinarians making contributions in swine medicine. He was also the focus of a "Veterinarians on Call" video on swine health and food safety produced by Zoetis. In addition to practice, he also serves as an adjunct faculty at NCSU-CVM and has been recognized for his dedication to mentoring students. According to students he has mentored, he tries to focus on what the student needs and stresses key issues such as food safety, animal welfare, and communication.

Dr Matthew Turner, recipient of the AASV Practitioner of the Year Award

Asked to comment about receiving this award, Dr Turner replied, "I have been extremely fortunate to be surrounded by wonderful people in my life. This award is a tremendous honor and a reflection of the quality of individuals that have helped mentor me, including co-workers and students."

Dr Turner and his wife, Dr Beth Turner, currently reside in Faison, North Carolina, with their son, Christopher.

Howard Dunne Memorial Award

Dr Locke Karriker received the American Association of Swine Veterinarians' 2014 Howard Dunne Memorial Award. The award recognizes an AASV member who has made important contributions and provided outstanding service to the association and the swine industry.

Dr Locke Karriker, recipient of the Howard Dunne Memorial Award

Dr Karriker received his DVM (1999) and MS in Veterinary Science (2000) from Mississippi State University. He completed board certification and became a Diplomate in the College of Veterinary Preventive Medicine in 2006 and completed the Executive Veterinary Program in Swine Health Management at the University of Illinois College of Veterinary Medicine in 2009. He is currently Associate Professor with Tenure in the Department of Veterinary Diagnostic and Production Animal Medicine and serves as the director of the Swine Medicine Education Center at the Iowa State University College of Veterinary Medicine (ISU-CVM).

In addition to being a prolific researcher, Dr Karriker is dedicated to mentoring students. He is currently instructor-in-charge of multiple swine-oriented classes at the ISU-CVM. In addition, he teaches courses at Kansas State University and the University of Wisconsin. The student-team-driven, case-based problem solving format that he pioneered and now uses in the Advanced Swine Production Medicine course is highly effective, and now this approach is being adopted in the dairy and beef courses as well. Dr Karriker has authored numerous refereed publications in addition to serving as an editor for the 10th edition of *Diseases of Swine*.

He is highly respected by students and colleagues alike. He is the recipient of the 2011 Dr William O. Reece Award for Outstanding Academic Advising from the ISU-CVM. In one of the many letters of nomination we received, Dr Pat Halbur described Karriker as "a franchise player in academia...a triple threat... a world-class clinical instructor, a highly valued resource on evidence-based medicine for practitioners and swine producers, and a highly regarded applied researcher."

Says Karriker, "I sincerely appreciate the many teachers, mentors, and colleagues that have provided guidance and opportunities to me throughout my career. I'm very proud of our students and the high standards they achieve and would like to thank them for making my role very rewarding. The accomplishments of the previous awardees create an intense respect for the award, and I am thankful for the opportunity to work hard and be an adequate custodian of the standards they have demonstrated. I am proud to be a swine veterinarian, a teacher, and a member of this organization."

Dr Karriker lives with his wife, Rachael, in Ames, Iowa. They are expecting their first child in September.

Meritorious Service Award

Dr Harry Snelson was named the 2014 recipient of the American Association of Swine Veterinarians' Meritorious Service Award. The award recognizes individuals who have provided outstanding service to the AASV.

Dr Snelson received his DVM from the North Carolina State University College of Veterinary Medicine (NCSU-CVM) in 1990. Following completion of the inaugural Swine Medicine Internship at NCSU-CVM, he accepted a position as the swine veterinarian for Carroll's Foods in Warsaw, North Carolina. He left Carroll's in 2000 to join the swine technical services team at Schering-Plough Animal Health as Manager of Swine Tech Services. In 2003, he accepted a unique opportunity as the Director of Science and Technology with the National Pork Producers Council in Washington, DC. Then, in 2005, what he calls "the opportunity of a lifetime" presented itself with the formation of his current position as AASV Director of Communications. He completed the Executive Veterinary Program at the University of Illinois in 2009.

Dr Snelson has been a member of AASV since 1988, joining while still a student. He was trained as a foreign animal disease diagnostician at Plum Island in 2000 and participated in foreign-animal disease-eradication programs in Mexico and the United Kingdom. He has been active in AASV committees and chaired the Foreign Animal Disease committee. He also represented District 2 on the board of directors 1999-2004.

Dr Harry Snelson, recipient of the Meritorious Service Award

He was very honored, and quite surprised, to receive the award, noting "it's very special to be recognized for doing something you really enjoy. Having the opportunity to work with Tom and Sue has been a great learning experience for me. Although I'm 'on staff,' I still consider myself a member of AASV and appreciate the camaraderie and family-like feel that permeates our association. It's an honor to be able to work with our members, leadership, and staff, and to advocate for issues of importance to our profession."

Harry and Jan reside in Burgaw, North Carolina.

Young Swine Veterinarian of the Year Award

The American Association of Swine Veterinarians' Young Swine Veterinarian of the Year Award was presented to **Dr Aaron Lower.** It is given annually to an AASV member 5 or fewer years post graduation who has demonstrated the ideals of exemplary service and proficiency early in his or her career.

Dr Lower is a 2009 graduate of the University of Illinois College of Veterinary Medicine. Raised in Lanark, Illinois, on a livestock farm, this background heavily influenced his desire to work with livestock producers. Following graduation, Lower joined Carthage Veterinary Service, Ltd in Carthage, Illinois. This swine practice allows him to provide health, diagnostic, production, and research support to his clients throughout Illinois, Indiana, and Missouri.

He is a member of AASV, the American Veterinary Medical Association, and the Illinois State Veterinary Medical Association. He has been active within the AASV association, as he won the Best Student Presentation Award at the 2007 AASV Annual Meeting in Orlando, Florida, and served as the first student delegate to the AASV Board of Directors that same year. He has also served on the AASV Student Recruitment and Influenza Committees.

He has given a number of presentations at national meetings including AASV, the Iowa State University Swine Disease Conference, and the Leman Swine Conference. He is in partnership with his family in livestock production at home, while also maintaining his role as a partner in Carthage Veterinary Service, Ltd. He is noted for his emphasis on client communications and expanding his international consulting opportunities with clients in Asia.

At acceptance of the award, Dr Lower noted, "the swine industry and specifically AASV have provided abundant opportunities and mentors to develop the key skills needed in swine veterinary medicine. I am extremely grateful and appreciative of these influences on my life and career."

Dr Aaron Lower, recipient of the Young Swine Veterinarian of the Year Award

Dr Lower resides in White Heath, Illinois, with his wife Roberta.

Technical Services/Allied Industry Veterinarian of the Year Award

Dr Darrell Neuberger received the American Association of Swine Veterinarians' Technical Services/Allied Industry Veterinarian of the Year Award. Established in 2008, the award recognizes swine-industry veterinarians who have demonstrated an unusual degree of proficiency and effectiveness in delivery of veterinary service to their companies and their clients, as well as given tirelessly in service to the AASV and the swine industry.

Dr Neuberger was recognized for his years in technical service first as a swine health management veterinarian for Fort Dodge Animal Health and his current role with Zoetis. In his position, Dr Neuberger's responsibilities include providing technical product expertise and supporting the company's sales force. Swine producers he works with commented on his skill at mentoring recent veterinary graduates, and he currently mentors a select group of veterinary students who have a swine focus.

Dr Neuberger received his DVM (1977) from the Iowa State University (ISU) College of Veterinary Medicine. He later completed the Executive Veterinary Program in Swine Health Management at the University of Illinois in 2000. Following graduation, he joined the Garner-Ventura Vet Clinic in Garner, Iowa, a mixed-animal practice, before joining Fort Dodge Animal Health in 1997.

Elected by his peers, Dr Neuberger served as president of the Iowa Veterinary Medical Association from 2005 to 2006. In 2013, he was recognized into the President's Circle by his current employer, Zoetis. Along with teaching and mentoring, Darrell always enjoys grilling pork loins for the students. Darrell is also currently involved in Operation Main Street, where he talks with pre-veterinary students at ISU.

When asked to comment on what the award meant to him, Dr Neuberger said, "I am very fortunate to be able to work with veterinarians and people in the swine industry on a daily basis. I have been able to interact with high quality veterinary students who have a swine interest. I am part of a great group of technical services veterinarians at Zoetis.

Dr Darrell Neuberger, recipient of the Technical/Allied Industry Veterinarian of the Year Award

They are all fantastic people. To be recognized by them and receive this award is a truly great honor."

Dr Neuberger and his wife, Diane, reside in Garner, Iowa. They have three daughters: Melissa and her husband William and their three children, who live in Manassas, Virginia; Kristin, who lives in Plymouth, Minnesota; and Erin and her husband Nick and their son, who live in Davie, Florida.

Student Seminar scholarships

The American Association of Swine Veterinarians Foundation awarded scholarships totaling $25,000 to 15 veterinary students during the 45th AASV Annual Meeting in Dallas, Texas.

Deanne Day, Iowa State University, received the $5000 scholarship for top student presentation. Her presentation was titled "Infection with porcine reproductive and respiratory syndrome virus and *Streptococcus suis* changes the pharmacokinetics of ceftiofur hydrochloride in nursery pigs." Zoetis provided the financial support for the Best Student Presenter award.

Additional scholarships totaling $20,000 were provided by Eli Lilly and Company Foundation on behalf of Elanco Animal Health.

Four veterinary student presenters received $2500 scholarships: **Laura Carroll,** North Carolina State University; **Alexander Hintz,**

Recipient of the $5000 scholarship for Best Student Presenter during AASV's Student Seminar: Deanne Day (right), Iowa State University. Pictured with Deanne is Dr Shelley Stanford of Zoetis.

Dr Pete Sherlock (far left) on behalf of Elanco Animal Health presented scholarships provided by Eli Lilly and Company Foundation. Recipients of the $2500 AASV Foundation scholarships were (from left) Alexander Hintz, University of Wisconsin; Laura Carroll, North Carolina State University; Andrew Kryzer, University of Minnesota; Jake Schwartz, University of Minnesota.

University of Wisconsin; **Andrew Kryzer,** University of Minnesota; and **Jake Schwartz,** University of Minnesota.

Five veterinary student presenters received $1500 scholarships: **Daniel Boykin,** North Carolina State University; **Alexandra Buckley,** Michigan State University; **Brigitte Mason,** University of Illinois; **Brianna Peters,** University of Tennessee; and **Katherine Wedel,** University of Minnesota.

Student presenters receiving $500 scholarships were **Levi Johnson,** Iowa State University; **Anna Samson,** Colorado State University; **Ethan Spronk,** University of Minnesota; **Elizabeth Stiles,** University of Pennsylvania; and **Ryan Strobel,** University of Minnesota.

Fifty-nine veterinary students from 17 universities submitted abstracts for consideration. From those submissions, 15 students were selected to present during the annual meeting. Zoetis, sponsor of the Student Seminar, provided a $750 travel stipend to each student selected to participate.

A panel of judges selected the recipients on the basis of communications skills in the writing of the abstract and the presentation of the report and on applicability of the research to swine medicine.

Dr Pete Sherlock (far left) on behalf of Elanco Animal Health presented scholarships provided by Eli Lilly and Company Foundation. Recipients of the $1500 AASV Foundation scholarships were (from left) Katherine Wedel, University of Minnesota; Alexandra Buckley, Michigan State University; Brigitte Mason, University of Illinois; Brianna Peters, University of Tennessee; Daniel Boykin, North Carolina State University.

Student Poster Competition

The AASV provided an opportunity for 15 veterinary students to compete for awards in the Veterinary Student Poster Competition. Boehringer Ingelheim Vetmedica, Inc sponsored the competition, offering awards totaling $4000.

On the basis of scores received in the original judging of abstracts submitted for the AASV Student Seminar, the top 15 abstracts not selected for oral presentation at the annual meeting were eligible to compete in the poster competition.

Boehringer Ingelheim Vetmedica, Inc announced the following awards during the AASV Luncheon on March 3.

$500 Award: Tyler Te Grotenhuis, Iowa State University – Top student poster entitled "Using placental umbilical cord serum to determine porcine circovirus type 2 (PCV2) status of breeding herd."

$400 awards: Amy Daniels, University of Illinois, and **Christine Mainquist,** Iowa State University.

Dr Pete Sherlock (far left) on behalf of Elanco Animal Health presented scholarships provided by Eli Lilly and Company Foundation. Recipients of the $500 AASV Foundation scholarships were (from left): Anna Samson, Colorado State University; Elizabeth Stiles, University of Pennsylvania; Levi Johnson, Iowa State University; Ethan Spronk, University of Minnesota; Ryan Strobel, University of Minnesota.

Boehringer Ingelheim Vetmedica, Inc announced the recipients of the $400 poster-competion winners (from left): Christine Mainquist, Iowa State University; Amy Daniels, University of Illinois

$300 awards: Brent Pepin, Iowa State University; **Christopher Sievers,** Iowa State University; and **Lisa Yeske-Livermore,** Iowa State University.

$200 awards: Matthew Cook, University of Pennsylvania; **Lauren Glowzenski,** University of Pennsylvania; **Jessica Johnson,** University of Minnesota; **Justin Kuecker,** Iowa State University; **Carrie Lee,** University of Minnesota; **Chad O'Connor,** University of Illinois; **Lauren Scruggs,** Auburn University; **Shannon Walsh,** University of Guelph; and **Christina Yamazaki,** University of Prince Edward Island.

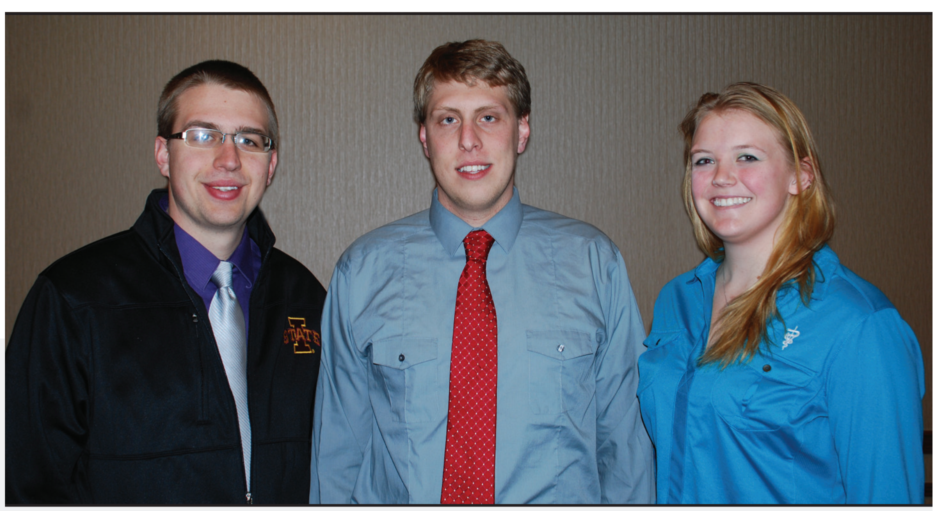
In addition to the poster competition awards, each student poster participant received a $250 travel stipend from Zoetis and the AASV.

Annual Business Breakfast

AASV president Dr Matt Anderson reported on the association's membership and activities during the annual breakfast on Tuesday, March 4. He stated that there are 1724 members, including 335 student members. Dr Anderson thanked outgoing directors Drs Matthew Turner (District 2), Doug Groth (District 5), Scott Dee (District 9), and George Charbonneau (District 11), and Joshua Duff, Student Delegate to the board, for their service. He congratulated incoming Alternate Student Delegate Chris Sievers.

Honored guests at the Business Breakfast included Dr Clark Fobian (AVMA President), Dr Ron DeHaven (AVMA Executive Vice President), Dr Gary Brown (AVMA Executive Board Liaison), Dr Paul Sundberg (NPB Senior VP of Science and Technology), Dr Liz Wagstrom (National Pork Producers Council Chief Veterinarian) and Dr Dan Grooms (AABP President). The audience heard updates from each respective organization. Approximately 200 people attended the breakfast.

Sponsor of the Boehringer Ingelheim Vetmedica, Inc poster competition announced Tyler Te Grotenhuis, Iowa State University, as the winner of the top prize of $500 for best poster



Boehringer Ingelheim Vetmedica, Inc announced the recipients of the $300 poster-competition winners (from left): Christopher Sievers, Iowa State University; Brent Pepin, Iowa State University; Lisa Yeske-Livermore, Iowa State University

New officers

Dr Michelle Sprague was installed as president, succeeding Dr Matt Anderson, who is now immediate past president. Dr Ron Brodersen has ascended to president-elect. The newly elected vice president is Dr George Charbonneau.

Save the date

The 2015 annual meeting is scheduled for February 28-March 3, 2015, in Orlando, Florida.

Photo courtesy statement

Photos are courtesy of Tina Smith.

Boehringer Ingelheim Vetmedica, Inc announced the recipients of the $200 poster-competion winners (from left): Justin Kuecker, Iowa State University; Chad O'Connor, University of Illinois; Jessica Johnson, University of Minnesota; Carrie Lee, University of Minnesota; Lauren Glowzenski, University of Pennsylvania; and Shannon Walsh, University of Guelph. Other winners not pictured: Matthew Cook, University of Pennsylvania; Lauren Scruggs, Auburn University; Christina Yamazaki, University of Prince Edward Island

2014 AASV ANNUAL MEETING

A time to learn, discuss challenges, and consider solutions while reconnecting with friends and colleagues

AASV FOUNDATION NEWS

AASV Foundation holds successful 2014 auction

The lively foundation auction raised approximately $100,715! This tremendous effort eclipsed the $100,000 goal set by the auction committee, resulting in the foundation receiving an additional $25,000 through the incredible generosity of Mary Lou Hogg and MVP Laboratories. The money raised supports foundation programs, including student travel stipends, research projects, scholarships, student externships, summer internships, awards, and other opportunities to enhance the personal and professional aspects of swine veterinary medicine.

Auctioneer and AASV Executive Director Dr Tom Burkgren called the auction with the assistance of Dr Shamus Brown and Dr Jess Waddell. The foundation thanks all those who participated in the auction by bidding on or donating items, as well as those who served on the auction committee chaired by Dr Daryl Olsen. This year's auction also included a raffle in which participants purchased tickets for a chance to win one of four fabulous prizes. The raffle netted $17,800 for the foundation. Dr Tony Scheiber was winner of the 1st prize, a Dean & Deluca Wine subscription donated by Zoetis. 2nd prize, $1000, was won by Mark Hayden (Automated Production Systems) and donated back to the foundation. The 3rd and 4th prizes were 2015 AASV Annual Meeting registrations, won by Dr Megan Inskeep and Joel Schmidt.

A special thanks goes to the ring men: Shamus Brown, Tom Burkgren, Terry Metcalf, Darrell Neuberger, David Reeves, Craig Rowles, Jess Waddell, and John Waddell, who kept the bids coming, and the following, whose behind-the-scenes and front-end help were invaluable: Wes Johnson, Kay Kimpston-Burkgren, Sue Kimpston, Karen Menz, Karen Richardson, Lee Schulteis, Sue Schulteis, Tina Smith, and Harry Snelson.

An extra-special thanks goes out to Lee and Sue Schulteis for driving the truck and trailer containing all the auction items and meeting materials from Perry, Iowa, to Dallas and back again.

Mary Lou Hogg presents $25,000 check to Daryl Olsen, Auction Chair

AASV Foundation news continued on page 157

The AASV Foundation is grateful to everyone who purchased a raffle ticket or bid on items in the live and silent auctions, enabling us to surpass our goal of raising $100,000! We are pleased to recognize and thank the following bidders who purchased one or more items at the auction:

Matt Anderson
Randall Anderson
Paul Armbrecht
Audubon-Manning Veterinary Clinic
Butch Baker
John Baker
Gloria Basse
Bob Blomme
Randy Bush
Richard Collins
Marie Culhane
Scanlon Daniels
Jeff DeMint
Mark Engesser
Fast Genetics
Wayne Freese
Tom Gillespie
GlobalVetLINK
Daryl Hammer
Hank Harris
Joel Harris
Peggy Anne Hawkins
Bill Hollis
Clark Huinker
Micah Jansen
Ruth Loula
Rodger Main
Bill Marks
Charles Martin
Chelcee McCulley
Michelle Michalak
Bill Minton
Jana Morgan
Daryl Olsen
Nancy Olsen
Jodie Pettit
Tom Petznick
PharmGate Animal Health
Doug Powers
Max Rodibaugh
Paul Ruen
Pete Sherlock
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AASV Foundation news continued from page 155

Meeting attendees participate in the AASV Foundation silent auction

Foundation awards $60,000 to researchers

During the AASV Foundation's annual luncheon in Dallas, Texas, foundation president Dr Daryl Olsen announced the selection of research proposals for funding in 2014. The selections were the inaugural awards made under the foundation's new submission, review, and reporting guidelines, which were implemented in conjunction with a substantial increase in funding designated for research. Olsen reported that $60,000 was awarded to three projects to be conducted over the coming year.

A grant of $30,000 was awarded to support a proposal submitted by Dr James Lowe at the University of Illinois. Lowe and fellow investigators will be studying the effects of cross-fostering strategy on the immune system, microbiome, and lifetime growth in pigs with minimal disease loads. By examining the impact of the periparturient acquisition of non-inherited factors on piglet health and performance, their goal is to help shape management practices that improve host robustness in the face of disease challenge.

Dr Darwin Reicks at the Swine Vet Center in St Peter, Minnesota, was awarded a grant of $25,000 to study porcine epidemic diarrhea virus (PEDV) shedding and contamination potential from infected boars. The project goal is to determine if PEDV can be transmitted in boar semen and if the virus is a fecal contaminant or the result of systemic infection or cellular trafficking from an intestinal infection.

A grant of $5000 was awarded to Dr Cate Dewey at the University of Guelph to fund a proposal targeted at reducing pathogen spread during farm feed delivery. One-page briefs will be prepared for major swine pathogens as well as a quick-reference chart summarizing the information. The materials will be peer-reviewed and ultimately shared with AASV members for distribution to producers, feed company personnel, and others.

In addition to coordinating the revision of the foundation's proposal submission and review guidelines, Dr Peggy Anne Hawkins chaired the scientific subcommittee responsible for reviewing and scoring the record number of proposals received for consideration. Hawkins joins the foundation in thanking Drs Todd Distad, Bill DuBois, Gene Erickson, Eva Jablonski, and Bob Morrison for their service on the subcommittee.

When compared to past years, the $60,000 awarded represents a dramatic increase in the amount disbursed for research and is a direct result of the $100,000 matching-funds gift designated for research that was provided by MVP Laboratories and MJ Biologics at the 2013 fundraising auction.

An overview of past and current projects funded by the foundation is available at `https://www.aasv.org/foundation/research.htm`. The foundation will issue its next call for research proposals in the fall of 2014.

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PED – plenty of blame to go around

Even as bad as it is, porcine epidemic diarrhea (PED) could have been so much worse. If this had been a foreign animal disease, the economic and production impacts would have been devastating. The PED virus (PEDV) gives us an opportunity to evaluate our surveillance, mitigations, vulnerabilities, and response structure. This outbreak has clearly shown our weaknesses in all those areas. The safeguards designed to prevent introduction of foreign pathogens into the United States failed. Biosecurity interventions at the farm failed. Ability to rapidly diagnose emerging pathogens failed. Capability to transfer information efficiently and seamlessly between diagnostic laboratories and within the laboratory network failed. Producers and veterinarians failed to contain the disease. The US Department of Agriculture (USDA) and the industry failed to prepare for this scenario. Obviously, there is enough blame to go around and we all have some soul-searching to do. So let's get started.

We need a better strategy to address disease threats globally. We knew PEDV was a significant disease of swine in Asia. People working and consulting in China experienced the disease and heard about its significance. Dr Robert Desrosiers even included it in his report to the 2012 AASV Swine Health Committee. We chose to ignore the warnings. More than 30 viruses affect swine worldwide today. Let's make sure we're monitoring these diseases, identifying and addressing knowledge gaps, and promoting research to ensure we can detect these pathogens.

We need the resources to pursue emerging disease diagnosis in the United States. Today, once it has been determined that an emerging disease is not a foreign animal disease, it's up to the producer and the practitioner to pursue a definitive diagnosis. The earliest known PED case was not diagnosed for at least a month. Rapidly identifying the index case greatly increases our options for minimizing a disease's potential impact on animal health.

Once PEDV was identified, the veterinary diagnostic laboratories developed, validated, and implemented diagnostic and differential tests and ramped up capacity to handle more samples. However, collation and communication of epidemiological information, even within the National Animal Health Laboratory Network (NAHLN), was less than seamless and efficient. This communication failure is widely recognized: 12 years after NAHLN's inception, its laboratories still cannot electronically share data in an efficient, seamless manner. The NAHLN recently received authorization for $15 million in the 2014 Farm Bill. Most agriculture and veterinary groups, including AASV, strongly supported this request because we see the value of a unified, integrated network of laboratories that can support animal agriculture and respond to disease outbreaks. We've got to begin functioning as a true national network for the betterment of animal agriculture. If this outbreak had been foot-and-mouth disease, with dozens of laboratories involved, information transfer would have been unmanageable using current practices.

The government agencies responsible for preventing incursion of pathogens into the United States need to conduct a thorough analysis of the potential routes of pathogen transmission and implement effective surveillance and mitigation protocols to prevent and detect introduction of foreign pathogens. That's their job. No one else can do that. The USDA needs the resources to monitor disease activities internationally and to work with other countries to better understand the threat foreign animal diseases pose to US agriculture. The USDA also needs to be able to monitor internal disease movements. Emerging diseases should be reportable at the state and federal level. The USDA should be able to help producers and veterinarians monitor disease transmission and disease status at the herd, state, and national levels.

Producers and veterinarians are the first line of defense. Early in the PEDV outbreak, practitioners stepped up to the plate and reported something was wrong. They worked with the laboratories to obtain an accurate diagnosis and reported results to their clients, neighbors, and animal-health officials. I commend these veterinarians and their clients for their actions. We need to ensure that we provide complete and thorough information when submitting samples to the diagnostic laboratories, including Premises Identification Numbers (PINs) and proper designations of animal age or stage of production. The accuracy of this information is critical to conduct meaningful epidemiological and disease monitoring. PINs are included on < 20% of diagnostic submission forms. Most swine farms have a PIN: use it on all official forms and diagnostic submissions. Go to **pork.org** to print barcodes for swine premises, and affix the barcode to the submission form.

On a positive note, many things worked well. The laboratories quickly developed diagnostic tests, pork producers appropriated funds for research, researchers responded quickly, and USDA's Center for Epidemiology and Animal Health collaborated on epidemiological efforts. Veterinarians are discussing their observations and participating in efforts to better understand the movement of this disease. State animal-health officials have been engaged and cooperative, and AASV has worked collaboratively to conduct epidemiological surveys, produce educational materials, and provide expertise. The real failure would be not learning from this experience and failing to work together to identify and correct our shortcomings.

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Classified advertising

Faculty position in diagnostic pathology

The Iowa State University (ISU) College of Veterinary Medicine's Department of Veterinary Diagnostic and Production Animal Medicine invites applications for a full-time clinical-track or full-time tenure-track faculty position in diagnostic pathology in the Iowa State University Veterinary Diagnostic Laboratory (ISU VDL). Applications for clinical-track positions will be accepted at the levels of clinician or senior clinician. Applications for tenure-track positions will be accepted at the levels of assistant, associate, or full professor. The ISU VDL is an American Association of Veterinary Laboratory Diagnosticians-accredited, full-service laboratory. The caseload is diverse, with food-animal species representing the majority of submissions. The primary responsibility of this position will be to provide diagnostic pathology support and deliver comprehensive diagnostic case information to practicing veterinarians and other animal-health professionals. The ability to interact, communicate, and collaborate with progressive practicing veterinarians and other stakeholders in animal agriculture is essential. The person in this position will be expected to engage in discovery by continuing the ISU VDL's long history of applied research that directly benefits animal agriculture. The successful applicant will also be expected to aid in the development and implementation of new diagnostic procedures and assist in maintaining quality assurance programs. The position includes instruction of veterinary students, guidance and training of graduate students and residents, and the creative use of case material for teaching and/or research.

Requirements for all positions include a DVM or equivalent degree and experience in veterinary production-animal medicine. In addition, appointment as a senior clinician will require a minimum of 6 years' experience in diagnostic medicine. Appointment as an assistant professor requires evidence of experience conducting research or other scholarly activity. Appointment as an associate or full professor requires an established record of scholarship appropriate to each rank at Iowa State University. Preferred qualifications include advanced degree (MS or PhD) in pathology or microbiology or a related field, working knowledge and experience with food-animal agriculture, experience communicating and collaborating with stakeholders in the food-animal industry, experience in applied food-animal infectious-disease research, experience in the instruction of veterinary students, board eligible or board certified by the American College of Veterinary Pathologists, and national or international distinction and reputation for outstanding contributions in the field of diagnostic medicine. For more details and to submit an application, candidates are directed to the "Faculty" portion of the ISU jobs Web site at `https://www.iastatejobs.com/applicants/jsp/shared/Welcome_css.jsp` and specifically **Vacancy ID# 140097**. Review of applications will begin on May 15, 2014. If you have specific questions regarding this vacancy, please contact Dr Rodger Main, ISU VDL Director at 515-231-4571 or via e-mail at `rmain@iastate.edu`.

2014 AASV Foundation

Midwest Golf Outing

Fox Ridge Golf Course – Dike, Iowa

Thursday, August 21, 2014 • 11:00 AM – 6:00 PM

The popular AASV Foundation Golf Outing is set for Thursday, August 21, at Fox Ridge Golf Club in Dike, Iowa. Golfers can expect a warm welcome at this location, as the club is owned by AASV member Dr Steve Menke, who practices in Ottumwa, Iowa. Dr Menke's son, Michael, serves as the club's general manager. Fox Ridge was recently recognized as winner of the golf club category in the Waterloo/Cedar Falls Courier's 2013 "Best of the Best" publication.

AASV members, industry stakeholders, and guests are invited to register a four-person team to enjoy this friendly 18-hole best-ball tournament. Individuals and couples are also welcome to register and will be assigned to a team. Golfers will test their combined skills against the challenges of the course and compete in individual contests along the way.

Golfer check-in begins at 11:00 AM the day of the event, with the driving range available for warming up with a few practice balls. The four-person team, best-ball competition gets underway at 12:00 noon with a shotgun start. Box lunches and beverages will be supplied on-course. Following the golfing, team and individual contest winners will be recognized during a pork chop dinner.

The registration fee includes 18 holes of "best-ball" golf, cart rental, lunch, beverages, awards dinner, and prizes. Proceeds from the outing provide support for the AASV Foundation as it seeks to "ensure our future…create a legacy" for swine veterinarians. Income generated by the event helps fund foundation programs such as swine externship grants for veterinary students, travel stipends for students attending the AASV Annual Meeting, research funding, student intern support, and heritage member videos.

For a sneak peek at the golf course, visit the Fox Ridge Web site: **www.golffoxridge.com**.

For more information about the outing, contact AASV:
Tel: 515-465-5255
Fax: 515-465-3832
E-mail: aasv@aasv.org

REGISTRATION FORM

Please complete, detach, and return this form with payment to the AASV Foundation by August 7, 2014

❑ Single registration $125.00

(per person – includes 18 holes of golf, golf-cart rental, refreshments, box lunch, and closing dinner)

❑ Team registration $500.00

(group of four – list names below)

1. ______________________________
2. ______________________________
3. ______________________________
4. ______________________________

❑ I cannot attend, but will contribute to the AASV Foundation.

My tax-deductible donation is enclosed: $ ____________

Name ______________________________

Address ______________________________

Phone ______________________________

Fax ______________________________

Make your check payable to the AASV Foundation
Mail to: AASV Foundation, 830 26th Street, Perry, IA 50220-2328

Upcoming meetings

6th European Symposium on Porcine Health Management (ESPHM) 2014
May 7-9, 2014 (Wed-Fri)
Hotel Hilton Sorrento Palace, Sorrento, Italy

For more information:
MV Congressi S.p.A.
Via Marchesi, 26D, 43126 Parma, Italy
Tel: +39 0521 290191; Fax: +39 0521 291314
E-mail: esphm2014@mvcongressi.it
Web: http://www.esphm2014.org

World Pork Expo
June 4-6, 2014 (Wed-Fri)
Iowa State Fairgrounds, Des Moines, Iowa

For more information:
Alicia Irlbeck
National Pork Producers Council
10664 Justin Drive, Urbandale, IA 50322
Tel: 515-278-8012
E-mail: irlbecka@nppc.org
Web: http://www.worldpork.org

23rd International Pig Veterinary Society Congress
June 8-11, 2014 (Sun-Wed)
Cancun, Mexico
"Science and Excellence in Swine Production"

For more information:
E-mail: ipvs@congressmexico.com
Web: http://www.ipvs2014.org/

24th Annual Swine Health and Production Conference
September 9, 2014 (Tue)
Western Illinois University Union, Macomb, Illinois

Hosted by Carthage Veterinary Service, Ltd

For more information:
Karen Jacquot, Training and Education Coordinator
PO Box 220, Carthage, IL 62321
Tel: 217-357-2811; Fax: 217-357-6665
E-mail: kjacquot@hogvet.com
Web: http://www.hogvet.com/conf-overview.htm

Allen D. Leman Swine Conference
September 13-16, 2014 (Sat-Tue)
St Paul RiverCentre, St Paul, Minnesota

For more information:
Veterinary Continuing Education
1365 Gortner Ave, 462 Veterinary Medical Center
St Paul, MN 55108
Tel: 800-380-8636 or 612-624-3434; Fax: 612-625-5755
E-mail: vetmedce@umn.edu
Web: http://www.LemanSwineConference.org

2014 USAHA and AAVLD Joint Annual Meeting
October 16-22, 2014 (Thu-Wed)
Sheraton Kansas City at Crown Center, Kansas City, Missouri

Hosted by United States Animal Health Association (USAHA) and American Association of Veterinary Laboratory Diagnosticians (AAVLD)

For more information:
Web: http://www.usaha.org/Home.aspx

2014 Leman China Swine Conference
October 20-22, 2014 (Mon-Wed)
Qujiang International Conference Center, Xi'an, China

Organized by the University of Minnesota

For more information (China):
Shixin and Lamp International Exhibition (Beijing) Co, Ltd
Room 919, Qinghe Qiangyou Building
Haidian District, Beijing, China 100085
Tel: +86 10 62928860; Fax: +86 10 62957691
E-mail: cisile@126.com
Web: http://www.shixinlamp.com

For more information (United States):
Dr Bob Morrison
Tel: 612-625-9276
E-mail: bobm@umn.edu
Web: http://www.cvm.umn.edu/lemanchina/

American Association of Swine Veterinarians 46th Annual Meeting
February 28-March 3, 2015 (Sat-Tue)
Buena Vista Palace Hotel and Spa, Orlando, Florida

For more information:
American Association of Swine Veterinarians
830 26th Street, Perry, IA 50220
Tel: 515-465-5255; Fax: 515-465-3832
E-mail: aasv@aasv.org
Web: http://www.aasv.org/annmtg

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

American Association of Swine Veterinarians
830 26th Street
Perry, IA 50220-2328

Photo Corner

Patchwork pig

Photo courtesy of Dr John Waddell

AASV Industry Support Council

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