SHIC
Swine Health Information Center
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Newsletter
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OUR LATEST INFORMATION ON PROTECTION OF US SWINE HERD HEALTH

SHIC Funds Nine Plan of Work Projects to Advance Emerging Disease Mission

The Swine Health Information Center recently funded nine new projects addressing research priorities and topics published in its 2024 Plan of Work. This effort helps the organization fulfill its mission to generate new intelligence for preventing, preparing for, and responding to emerging swine disease threats. Areas of funded research span across the Center's five strategic priorities: improve swine health information, monitor and mitigate risks to swine health, respond to emerging disease, surveillance and discovery of emerging disease, and swine disease matrices. The nine new projects were initiated in summer 2024 and are six to 12 months in duration. Research outcomes from the funded projects will provide critical information and resources to help pork producers as they face emerging disease challenges in their swine herds.

Newly funded projects addressing SHIC's research priorities include: disease spillover risks from wean-to-market pigs to sow herds, whole genome sequencing as a forensic diagnostic tool, pathogenesis and interpretation of test results for porcine circoviruses, early disease outbreak warning signals, population based sample types for emerging disease testing, domestic disease monitoring for bacterial pathogens, clinical relevance of newly identified agents or syndromes from veterinary diagnostic lab submissions, and informing the swine disease matrices to prioritize pathogens for research and diagnostics.

The SHIC 2024 Plan of Work call for research proposals was announced in January 2024 and received 43 proposals from 21 different institutions by the submission deadline of March 2024. Funding available for this RFP totaled $1.1 million. Funding timely research is an essential component of SHIC providing project outcomes that drive action for emerging disease prevention, preparedness, mitigation, and response for the US swine industry.

SHIC 2024 Plan of Work projects funded and initiated in response to the RFP include:

Improve Swine Health Information

Developing and implementing a capability for real-time monitoring of Escherichia coli genotyping and virotypes detected in porcine samples tested by PCR

- PI: Giovani Trevisan, Iowa State University
- Objective: To integrate coli genotyping and virotyping detection data from major swine-centric VDLs and organize continuous reporting of this pathogen detection through SDRS.

Monitor and Mitigate Risks to Swine Health

Implementing a real-time surveillance system utilizing diagnostics, movement, and site location for early detection of emerging/re-emerging diseases across different regional levels

- PI: Gustavo Silva, Iowa State University
- Objective: To implement a real-time surveillance system for PRRSV utilizing diagnostic, movement, and site location data across different regional levels.

Respond to Emerging Diseases

Reproductive failure induced by porcine circovirus type 3 infection in experimentally infected sows

- PI: Pablo Pineyro, Iowa State University
- Objective: To characterize the role of PCV3 infection on reproductive failure and evaluate differences in the clinical outcome associated with different times of infection; develop a sow challenge model for investigating PCV3 control strategies.

Atypical interstitial pneumonia-like disease in swine: etiologic investigation of an emergent syndrome

- PI: Marcelo Almeida, Iowa State University
- Objective: To investigate possible causes for an emergent syndrome in pigs with lesions of diffuse alveolar damage through PCR of tissues, characterization by IHC, and whole genome sequencing for endemic agents and novel pathogen discovery.

Exploratory study to evaluate the presence of PCV4 in different sample matrices and confirmation of its role in histological changes by direct detection

- PI: Pablo Pineyro, Iowa State University
- Objective: To determine detection rate of PCV4 in various clinical sample types, its role in the pathological process, and its prevalence in co-infections with other endemic pathogens.

Surveillance and Discovery of Emerging Diseases

Establishing oral fluid sampling guidelines for group-housed sows

- PI: Jeff Zimmerman, Iowa State University
- Objective: To establish best practices for oral fluid collection from group-housed sows considering gestation stage, parity, and pen size, and quantify the reliability of oral fluid sampling in group-housed sows using a surrogate.

Surveillance and pathogenicity of mammalian orthoreovirus, adenovirus and novel pathogens in pigs

- PI: Wenjun Ma, University of Missouri
- Objective: To determine the prevalence, epidemiology, pathogenicity, and transmissibility of mammalian orthoreovirus and porcine adenoviruses, the contribution to clinical disease and identify novel viral pathogens in US swine herds.

Validation of a new enrichment method for increasing sensitivity of PRRSV whole genome sequencing

- PI: Leyi Wang, University of Illinois Urbana Champaign
- Objective: To develop and validate capture probe-based enrichment to increase sensitivity of whole genome sequencing of PRRSV across different sample types such as sera, lungs, oral fluids, processing fluids, and tongue tip fluids.

Swine Disease Matrices

Generating a disease index based on confirmed tissue diagnosis data to assess the relative burden of endemic swine pathogens in the U.S.

- PI: Giovani Trevisan, Iowa State University
- Objective: Utilize diagnostic data to build a disease index and update the swine disease matrices in support of prioritizing target pathogens for swine health research.

SHIC/AASV Webinar Recap: Mitigation Strategies for Mosquitos as an Emerging Threat to Swine Health

The Swine Health Information Center, in collaboration with the American Association of Swine Veterinarians, hosted a webinar on mosquitos and their impact on swine health and

production August 26, 2024. Goals of the webinar were to understand the role of mosquitos as a vector for disease transmission and to take actions to control mosquito populations near swine farms. The webinar featured four subject matter experts sharing insights on entomology and mosquito life cycles, experience on managing mosquitos in and around swine farms, and best control practices to reduce the impact of insect bites on pork production.

Presenters offering their expertise included Dr. Dustin Swanson, USDA-ARS, Dr. Bernie Gleeson, SunPork (Australia), Dr. Natalee Judson, Pipestone, and Dr. Chris Rademacher, Iowa State University. Because of this year's widespread unusual rainfall during spring and summer, ideal conditions exist for explosive mosquito population growth. Mosquitos can transmit many pathogens and pose a risk to swine health and production.

Mosquito Biology

Dr. Swanson shared information on mosquito biology, including lifecycle stages, habitats needed for growth, and control strategies to reduce mosquito populations. Mosquitos have four stages starting with eggs laid in, on, or near stagnant water which then develop into an aquatic larval feeding stage. Next is an aquatic transitional pupal stage followed by the terrestrial adult stage.

The egg stage is the least noticeable to the naked eye. Eggs can be laid singly or in rafts of 80 to 100 several times over by an adult female. While eggs are typically in, on, or near standing water, Dr. Swanson stated some eggs can survive dry periods of several months and reemerge after rainfall. The second-stage aquatic larvae are worm-like and have a bulbous segment behind the head. Larvae can be found floating on water at the surface and are commonly referred to as wrigglers due to the characteristic swimming motion when disturbed. They filter feed small food items during this stage and can be a target for management strategies such as water-based insecticides

In the pupal stage, larvae go through a cocoon-like stage that is mobile. This is a water-based, non-feeding stage where pupae are comma shaped. Dr. Swanson notes at this stage, they are not a target for control strategies. Adult male and female mosquitoes are both equipped to fly and both feed on sugar sources such as flower nectar and honeydew. Dr. Swanson noted males use sugar as their sole source of nutrition and that both sexes are susceptible to targeted management efforts, such as attractive sugar baits. However, he cautioned that non-target species such as honeybees could be affected when using toxic sugar in the environment.

Mosquitos breed in stagnant water lacking an abundance of predators such as fish. This can include ponds and some streams; however, standing water resulting from human activity such as water pots, wheelbarrows, and drainage runoff are common breeding sites. Mosquitos mate in swarms and Dr. Swanson explained males fly near specific landmarks waiting for females to breed. The females fly into the swarm and will typically mate with one male. Females are the only sex which consume blood meals and during the blood feeding stage, females use blood proteins to develop and hatch eggs. Each clutch of eggs typically requires a blood meal.

Mosquitos can cause harm to pigs through physical bites and blood loss but also through the transmission of pathogens during blood feeding. Blood feeding can result in stress or allergic reactions in the host, anemia, loss of productivity, and reduced weight gain in livestock. For virus transmission, a mosquito must feed from a virus-infected host, then internally replicate the virus, seek a susceptible host for a blood meal, and transmit the virus through saliva to a susceptible host. Mosquitos can carry and replicate pathogens that affect multiple species including pigs. Understanding the lifecycle and biology of mosquitos assists in the targeted development of effective control strategies to reduce the negative impacts associated with mosquito bites.

2022 Australian Experience

Dr. Gleeson reviewed the Australian experience during the 2022 outbreak of JEV in humans and pigs. Management strategies in Australia were built acknowledging water habitat for mosquitos will be present and wild bird populations cannot be controlled. Consequently, control efforts focused

on mosquitos including emergency chemical use permits issued for control of mosquitos in standing water, in and around piggeries, and on pigs. Dr. Gleeson noted that pig skin damage from mosquito bites was not a feature of the JEV outbreak.

During the JEV outbreak, Australian stakeholders collaborated to publish a guide entitled Integrated Mosquito Management Practices for Piggeries as an aid to the industry. Dr. Gleeson encouraged producers and veterinarians to seek professional assistance when dealing with mosquito control needs. Australian efforts included medical entomologists as well as urban and peri-urban professional pest control experts.

Surveillance is a key element of integrated pest management. Dr. Gleeson stated Australian stakeholders reviewed existing surveillance and reporting systems to identify location and activity of mosquito populations. State government programs were in place and on-farm surveillance (trapping mosquitos) was initiated using CO2 and light traps. The resulting data helped direct management actions.

In Australia, applied and recommended management strategies include environmental controls of vegetation management and removal of standing water sources. Larval stage mosquito control was found to be very productive with S-methoprene and *Bacillus* products used in standing water. With chemical controls, Dr. Gleeson underscored the related environmental considerations including potential residues and included careful consideration of control products and application methods. In Australia, the use of direct topical application to pigs for repellant options required emergency permits and Dr. Gleeson pointed out these were a last resort, labor intensive, and had withdrawal requirements which limited their use to only breeding stock.

Current US Experience

Dr. Judson shared her experiences within their production system from late June to early July in the Upper Midwest where mosquito season typically runs from April to October annually. Challenges were created by extensive rainfall in the spring and early summer of 2024 in Iowa and Minnesota across areas with large concentrations of pigs. The excess rainfall created an ideal environment for mosquito breeding grounds including excess fresh, waste, and stagnant standing water.

Dr. Judson noted the negative impact for swine due to increased mosquito populations, including the increased threat of viral infections from bites as well as physical blemishes on animals' hides on-farm and at harvest sites. At harvest, 20% to 80% of loads delivered during this time period had blemishes. Additional impacts included carcass condemnation.

Dr. Judson stated the incorporation of multiple approaches targeting all stages of the mosquito life cycle is critical to reducing mosquito populations. Environmental management efforts to consider include proper site drainage, reducing standing water, maintaining well-kept premises mowed and free of weeds, ensuring effluent flows freely, turning off outdoor lights at night, and increasing airflow (cfms) to prevent mosquitos from settling. When considering chemical management, Dr. Judson mentioned pyrethrin and pyrethroid insecticides, larvicides, and insect growth regulators are potential interventions targeting different lifecycle stages. IGR products are available in liquid, wettable granules, and feed-through formulations. Options for adult mosquitos include spraying and fogging products.

Dr. Judson encouraged pork producers to contact their veterinarians to assess farm-specific needs related to mosquito control and management to mitigate risks of disease transmission and production losses.

On-Farm Mitigation

Dr. Rademacher noted the unusual rainfall amounts during spring/summer of 2024 in the Midwest resulted in increased mosquito-related producer concerns such as carcass blemishing. Red and raised lesions due to bites are associated with the stimulation of histamine release, Dr. Rademacher noted.

In response, Dr. Rademacher collaborated with industry stakeholders to assemble information for producer awareness and assist with mitigation and control of mosquitos. Stakeholder input was gathered from the AASV list serv, production

systems, USDA and allied industry entomologists and tech service staff. With the input received, Dr. Rademacher and colleagues developed and published Management of Site Insect Levels to Minimize Carcass Impact, a multi-faceted approach to insect management.

Key steps for an integrated pest management approach include:

- Understand the life cycle to target for mitigation and control steps.
- Engage with an entomologist to assist with pest identification and development of farm-specific control strategies.
- Trapping can include the use of CO2 traps, light traps, or vertical fly strips.
- Control standing water around the farm and use a rock barrier around barns to facilitate drainage.
- Control weeds and other vegetation around barns to prevent resting areas.
- Utilize ventilation adjustments to increase air flow to disrupt feeding including keeping stir fans on at night.
- Ensure the proper functioning of waterers and misters to avoid standing water within the barns.
- Use chemical mitigations targeted towards the appropriate lifecycle stage.
- For chemical spraying, always read and follow label instructions for the product being used. Be sure that residual products do not wind up in contact with the animals.

Dr. Rademacher emphasized that when considering mitigation and control strategies, especially for chemical spray utilization, it is important to review product specific withdrawal times and strictly follow regulations. Dr. Rademacher noted additional resources available for producers, including the Iowa-based mosquito surveillance that can be accessed here. Differences noted between the prevalence of mosquito populations surveyed during the 2023 dry season and the 2024 season was significant. Data includes mosquito species recently identified as well.

Changes in environmental conditions, specifically during high rainfall seasons, may result in increased mosquito populations that can lead to subsequent emergence of diseases and other challenges for swine health and production. Understanding the biology and lifecycle of mosquitos can aid in the development of mitigation and control strategies to reduce the risk of transmission of pathogens and improve swine health and welfare.

SHIC Delivers Swine Health Information at Leman Conference

The Allen D. Leman Swine Conference, an annual educational event for the global swine industry, will take place September 21-24, 2024, at the RiverCentre in St. Paul, Minnesota. Swine veterinarians, pork producers, and other swine professionals will convene to attend the Leman Swine Conference and learn the latest information and research outcomes in swine production, biosecurity, and animal health management. Drs. Megan Niederwerder and Lisa Becton of the Swine Health Information Center will each chair sessions and SHIC is sponsoring several sessions as well as individual presentations.

The preconference session on September 22 entitled, “New technologies and new approaches to control the spread of airborne diseases,” includes presentations and work supported by SHIC. The session chair is Dr. Montse Torremorell, University of Minnesota. Presentations include:

Basics of aerosol science and air filtration
Chris Hogan, University of Minnesota
Factors that contribute to airborne virus transmission in the field
Montse Torremorell, University of Minnesota
PRRS incidence in filtered farms: what MSHMP tells us
Cesar Corzo, University of Minnesota
New control technologies to improve aerosol biosecurity
Chris Hogan, University of Minnesota
Electrostatic precipitators decrease virus transmission in experimentally infected pigs
Lan Wang, University of Minnesota
Fan coverings to decrease risk of disease dissemination
Erin Kettelkamp, Swine Vet Center (Sponsored by SHIC)
Electrostatic precipitation for biocontainment from finishing facilities exhaust fans
Brett Ramirez, Iowa State University (Co-sponsored

by SHIC)

A main conference session on September 23, "Transport biosecurity," is sponsored by SHIC and Dr. Niederwerder will serve as chair. Presentations include:

Mitigating between-farm disease transmission through vehicle rerouting and enhanced cleaning and disinfection protocols
Gustavo Machado, North Carolina State University
Trailer tracking and sanitation methods for improved biosecurity
Edison Magalhaes, Iowa State University
Evaluation of ATP bioluminescence for improved biosecurity in the swine industry
Dustin Boler, Carthage Innovative Swine Solutions

Co-sponsored by SHIC, the main conference session on September 23, "Old viruses, new diseases," will be chaired by Dr. Fabio Vannucci, University of Minnesota. Presentations for this session include:

Detection of underrepresented viruses in grow-finish pigs: Should we be concerned?
Mariana Meneguzzi, University of Minnesota
Porcine astrovirus 4 as a cause of tracheitis and bronchitis in young pigs
Mike Rahe, North Carolina State University
Porcine Circovirus 4: Recent Detection in the U.S. and Its Potential Impact on Swine Production
Pablo Pinyero, Iowa State University

The main conference session scheduled September 24, "On-farm wean-to-finish biosecurity," is sponsored by SHIC and Dr. Becton will serve as chair. Presentations include:

Characterizing dead animal disposal practices and estimating PRRSV risk from rendering
Igor Paploski, University of Minnesota
Early findings of evaluating disease introduction and biosecurity in the wean-to-finish sector
Karyn Havas, Pipestone Research
Are caretakers motivated to comply with biosecurity – What resources are needed?
Mike Chetta, Talent Metrics Consulting

Coordinated communication and broad dissemination of swine health information is one of SHIC's main priorities. Working with the Leman Conference team offers the opportunity to expand SHIC's reach by sharing outcomes from work conducted as a result of the Center's research priorities. In addition to the sponsorships and chairing sessions, SHIC will have a display table at the Conference offering information and the opportunity to connect with participants.

Take Homes from SHIC Wean-to-Harvest Program Enhance Biosecurity

The Swine Health Information Center, along with the Foundation for Food & Agriculture Research and Pork Checkoff, joined together to fund and launch a $2.3M two-year Wean-to-Harvest Biosecurity Research Program in the fall of 2022. The goal of the research program is to investigate cost-effective, innovative technologies, protocols, and ideas to enhance biosecurity implementation during the Wean-to-Harvest phases of swine production. Results received to date provide opportunities for US pork producers to make changes to immediately enhance their biosecurity protocols.

The Wean-to-Harvest Biosecurity Research Program was developed to investigate research priorities across three areas – bioexclusion (keeping disease off the farm), biocontainment (after a break, keeping disease on the farm to lessen risk to neighbors), and transportation biosecurity (live haul, culls, markets, deadstock, and feed haul along with innovative ways to stop pathogens from moving from markets and concentration points back to the farm). To date, a total of 18 projects have received funding through this program for a comprehensive approach to advancing biosecurity of US farms and protecting swine health. Proactively enhancing wean-to-harvest biosecurity will help control the next emerging disease in the US pork industry.

Currently, six of the 18 funded projects have been completed, providing producers and veterinarians with knowledge and tools that can be applied on farms and in pork production today. This research program reflects SHIC's responsiveness to an identified swine health vulnerability and collaborative efforts to leverage producer Checkoff

funds to safeguard the health of the US swine herd.

Transport Biosecurity Take Homes

Transportation remains a concern for disease transmission within Wean-to-Harvest and other phases of production. Several key take-aways have been noted from projects completed to date:

- An updated inventory for public truck washes in the main hog producing states is now available for producers and can be located at https://www.ipic.iastate.edu/truckwash.html.
- Tools are available for producers to automatically track trailers between the farm and the plant and record sanitation status of trailers based on truck wash visits through the use of GPS-based tracking and the CleanTrailer app.
- Livestock trailer cleanliness can be objectively measured to determine sanitation status after a commercial truck wash using ATP swabs and ATP bioluminometers (more ATP = more potential microbial contamination).
- Areas of a trailer that are least likely to be adequately cleaned after a commercial truck wash are the nose access door and the back door flush gate. These areas may be targeted for on-site testing or additional cleaning.

On Farm Biosecurity Take Homes

Investigation of factors influencing risks of disease introduction and transmission at the site level and evaluation of caretaker compliance for biosecurity have provided several key take-aways for biosecurity enhancement:

- Animal caretaker motivation and compliance for biosecurity protocols can be positively influenced by rewarding personnel when biosecurity protocols are executed and providing supervisor support and performance feedback to employees on biosecurity practices.
- Manure pumping and land application is a risk for the introduction of PRRSV into farms, with a higher risk to nurseries compared to grow-finish sites.
- Risk of PRRSV introduction through a manure pumping event increased if conducted on a site where pigs had been placed less than 16 weeks.
- Robotic power washers can reduce manual labor hours required for washing but may increase overall water usage and room cleaning time due to manual power washing touch up required to achieve adequate sanitation of sites.
- Cleaning feeders can be a limiting factor to the efficiency of robotic power washers and ensuring access to feeders is important in designing effective wash systems.
- Nylon tear-resistant fan socks are effective exhaust fan coverings that can be used to reduce virus spread through large dust particle dispersion from the exhaust fan surface.

The Wean-to-Harvest Biosecurity Research Program continues to invite research proposal submissions which address five targeted priority areas for funding consideration until program funds are expended. Ongoing priorities include: 1) personnel biocontainment and bioexclusion, 2) mortality management, 3) truck wash efficiency, 4) alternatives to fixed truck wash, and 5) packing plant biocontainment. Real-time results of all projects will be shared as quickly as they become available for producers to implement knowledge gained on the farm.

SHIC Wean-to-Harvest Biosecurity: Evaluation of Truck Cab Decontamination Technologies (Final Report)

A study funded through the Swine Health Information Center's Wean-to-Harvest Biosecurity Research Program, in partnership with the Foundation for Food & Agriculture Research (FFAR) and the Pork Checkoff, recently evaluated the effectiveness of two different technologies for their ability to inactivate PRRSV and PEDV on non-porous surfaces in truck cabins. Led by Dr. Derald Holtkamp at Iowa State University, the study compared the use of ozone gas and purifying air-ionizing technologies. Results demonstrating the variable efficacy of ozone treatments and the lack of significant viral reduction by air-purifier treatments suggest that neither would be a reliable option for decontamination of truck cabins. Additional

research is warranted to identify a consistent, effective, and practical decontamination strategy for cabs of livestock trucks.

The Wean-to-Harvest Biosecurity Research Program is a partnership between SHIC, FFAR, a non-profit organization established in the 2014 Farm Bill, and Pork Checkoff.

Several decontamination processes for truck cabins are currently available in the market, including the use of chemical disinfectants, heat treatment, and ultraviolet light (Thomas et al., 2015). However, these methods have some drawbacks, such as the potential for chemical residues, the time required for heat treatment, and the limited penetration of ultraviolet light (Gosling et al., 2017). As a result, there is a need for alternative decontamination methods that can effectively inactivate viruses while minimizing these drawbacks.

Ozone technology and air-purifier technologies have emerged as promising alternatives for air and surface decontamination by inactivating viruses through oxidation and the generation of virucidal ions (Tseng & Li, 2008; Sharma & Hudson, 2008). Ozone is a powerful oxidant that can render viruses inactive by damaging the viral capsid and RNA (Tseng & Li, 2008). Similarly, air-ionizing technology works by ionizing water and oxygen molecules within a room, generating virucidal ions that can inactivate viruses, bacteria, and fungal spores on surfaces (Nikitin et al., 2014). Although the virucidal activity of ozone against PRRSV and PEDV has been studied, its effects at different concentrations and exposure times in truck cabins have yet to be characterized. Likewise, the effectiveness of air-ionizing technology for this specific application remains to be evaluated.

In the current truck cabin decontamination study, a factorial design was used to test three exposure times (30, 60, and 120 minutes) and four treatment types: three ozone rates (30, 38, and 68 mg/h) and one air-ionizing device (ActivePure®) that uses radiant catalytic ionization to purify air. Rubber coupons were contaminated with stock solutions of PRRSV and PEDV, air-dried, and exposed to treatments inside a truck cab. The rubber coupons were constructed using material similar to that used to manufacture floor mats in vehicles. Coupons were placed on the truck floor to replicate real-world setting and allow exposure during treatment.

Ozone machines or ActivePure® devices were placed inside the truck, along with an oscillating fan for continuous air circulation. Once the equipment was in place and turned on, the truck doors were closed and the doors remained closed until exposure time was complete. After exposure, the viruses were collected from the coupons and titrated in cell culture to determine the reduction of infectious virus titers. In total, there were 31 treatments with four replicates each, including negative and positive controls. Data loggers recorded humidity and temperature for all treatments, and ozone meters monitored ozone concentrations.

Results of the study indicated that none of the air-ionizing treatments significantly reduced titers for either PRRSV or PEDV compared to the positive controls. Ozone treatments demonstrated variable efficacy: the 30 mg/h ozone treatment significantly reduced PEDV titers at 60 and 120 minutes, and the 38 mg/h ozone treatment significantly reduced PRRSV titers at 60 minutes and PEDV titers at 120 minutes compared to controls ($p < 0.05$). None of the ozone treatments reduced viral titers more than two logs, which is the minimum reduction to be considered effective.

Statistical analysis revealed no clear trend between exposure time or ozone concentration and virus inactivation. However, the study found that temperature and humidity influenced ozone generation efficacy, and variations in ozone concentrations were observed even with identical machine setups. Specifically, the study identified strong positive correlations between ozone concentration and temperature inside the truck cab ($r = 0.5$, $p < 0.0001$) and moderate negative correlations between ozone concentration and humidity inside the truck cab ($r = -0.56$, $p < 0.0001$).

The variable efficacy of ozone treatments and the lack of significant virus reduction by air-purifier treatments suggest that under the conditions of this study, neither would be a reliable option for decontamination of truck cabins. The results also suggest that increasing ozone levels or exposure

times alone may not be sufficient for reliable viral inactivation due to the complex interplay between ozone, environmental factors, and surface characteristics. To address the challenges and achieve more effective and consistent results with ozone-based decontamination, future research should focus on optimizing environmental controls, conducting comprehensive assessments of material compatibility and occupational health considerations, and exploring the potential for combining ozone gas with other decontamination methods. Investigating these aspects in greater depth will be crucial for developing reliable viral inactivation strategies in swine logistics settings.

Overall, producers should be aware that while ozone treatments show some promise, further refinement is needed before they can be considered a reliable solution for reducing the risk of PRRSV and PEDV transmission via truck cabins in the swine industry.

SHIC Encourages Use of Standardized Outbreak Investigation Form App

The Swine Health Information Center's Standardized Outbreak Investigation Program (SOIP), introduced in early 2023, includes both a downloadable standardized outbreak investigation Word-based form and a web-based application. Developed to meet an industry need for a standardized tool to conduct disease outbreak investigations, this expert-built application provides a mechanism for consistent data collection to identify gaps and drive sustainable progress on biosecurity. For use of the web-based version, veterinarians should contact the Iowa State University-based administrator for access, a one-time process, at soip@iastate.edu.

While both a downloadable and web-based version of the standardized outbreak investigation form is available, its developers and SHIC encourage the use of the app due to the benefits listed below:

- **Centralized Information Management:** All outbreak investigation data and related information (diagnostic reports, animal movement information, etc.) is stored in a centralized system for easy access and management.
- **Collaborative Access:** The platform allows multiple investigators and production or farm staff to access, share, and contribute to investigation forms and reports enhancing collaboration across teams.
- **Automated Mapping and Weather Data Integration:** The platform automatically generates maps of the site and surrounding area, allowing users to customize and edit the maps with Secure Pork Supply Biosecurity Plan symbols, which are saved with the site information. Additionally, daily local weather data for the investigation period is automatically incorporated into the investigation form.
- **Customizable Investigation Forms:** Users can generate investigation forms, focusing only on pathogen entry events that occurred during the investigation period for more targeted data collection.
- **Built-in Biosecurity Hazard Identification Logic:** The application features built-in logic to flag responses that may indicate potential biosecurity hazards, helping users proactively identify risks.
- **Automated Report Generation:** Completed investigation forms can be automatically compiled into comprehensive reports, streamlining the reporting process.
- **Industry-Wide Learning and Improvement:** By contributing data to an industry-wide database, the platform facilitates collective learning from the experiences of veterinarians and producers, accelerating the identification of biosecurity gaps across the US swine industry.

The SOIP application can be used for endemic disease prevention, preparation for seasonal disease challenges, and outbreak investigations. It can also be used by veterinarians and producers to identify and prioritize biosecurity hazards so that production systems can implement and enhance biosecurity control measures accordingly. For the future, the SOIP application helps to prepare the industry to better respond to emerging and transboundary diseases. Producers and veterinarians will be able to rapidly identify, control, and eliminate biosecurity challenges highlighted by the SOIP app through incorporation of enhanced biosecurity control measures.

SHIC Funded Study Utilizes Endemic Disease Data for Detecting Emerging Diseases

A Swine Health Information Center-funded study has investigated if an increase in negative test results for endemic pathogens could be utilized as an early warning signal for emerging diseases. Led by Dr. Giovani Trevisan at Iowa State University, a team of scientists from six veterinary diagnostic labs evaluated different surveillance models using endemic enteric coronavirus PCR-negative test results to predict novel enteric coronavirus emergence. As an alternative approach to detect a new animal health threat causing similar clinical signs, the researchers determined that the TGEV negative-based monitoring system functioned well for the 2013 PEDV epidemic. Specifically, results demonstrated that emerging disease alarms could be identified four weeks earlier than the first official diagnosis of PEDV in the US.

Unexpected increases in negative test results can serve as a warning system to alert veterinarians and producers of an emerging swine disease. Read the full report, published by PLOS ONE and posted on the SHIC website, here.

Routine monitoring of laboratory submissions for shifts in test results can reveal trends in pathogen activity, seasonality, and provide evidence of pathogen emergence. Pathogen monitoring and surveillance systems are routine measures for veterinary medicine and recognized as tools for efficient disease control and prevention in populations. Monitoring and surveillance systems' primary goal is the timely and accurate identification of emerging and re-emerging pathogens with few or no false alarms. Systems include general passive surveillance, routine laboratory submissions, animal movement inspections, livestock markets, and other secondary data sources.

In this SHIC-funded study, a monitoring system was proposed using negative results from enteric coronavirus PCR testing in the US, where the primary goal was the early identification of a sustained increase in negative submissions that indicated a novel pathogen had emerged. Data used in this study was retrieved from the Swine Disease Reporting System, which is an ongoing monitoring project that aggregates producer anonymized diagnostic test results from six participating US VDLs.

Real diagnostic data on TGEV PCR-negative results between 2010 and 2013 were used for a negative results-based monitoring system for enteric coronaviruses during the time of PEDV emergence in 2013. TGEV and PEDV PCR-negative results between 2009 and 2014 were used to monitor the PDCoV emergence in 2014. The same methodology was thereafter applied to monitor enteric coronavirus negative results from 2023. The observation unit in the study was a porcine diagnostic submission shared with the SDRS database, which was searched for submissions between January 2009 and October 2023. The total number of negative and positive PCR submissions were calculated weekly, using the date received at the VDL as the aggregate factor. This step was repeated for TGEV, PEDV, and PDCoV PCR-negative and positive results.

Seasonal Autoregressive-Integrated Moving-Average (SARIMA) algorithms were employed to smooth the time series of negative submissions. The purpose of the smoothing process was to control for outliers, abrupt changes, trends, and seasonality to prevent false alarms from being triggered by anomalies that are not indicative of a true emerging disease. The SARIMA's fitted and residual values were subjected to four anomaly detection algorithms, EARS, CUSUM, EWMA and Farrington Flexible. These algorithms are statistical control charts that can be used to detect sustained increases and decreases for the negative results monitoring while controlling for seasonality and time trends.

In the study, all three best-performing algorithms (CUSUM, EWMA, Farrington flexible) resulted in alarms four weeks earlier than the first disease diagnosis of PEDV in the US. These alarms were considered true early alarms of PEDV emergence given that epidemiological investigations reported the first PCR-confirmed PEDV infection on April 15, 2013, but that the virus had likely been circulating in the US for a few weeks prior. These results showed that the use of negative monitoring accurately identified the sustained increase in TGEV negative submissions aligned

with the emergence of PEDV in 2013. Although PDCoV emergence was lower in magnitude than PEDV, alarms were identified due to increases in TGEV and PEDV PCR-negative test results. The monitoring system revealed no alarms for 2023 negative PCR enteric data.

Ongoing monitoring of animal health parameters and routine monitoring of laboratory submissions provides value in revealing trends and providing early warnings. Early detection of novel pathogen emergence, even without immediate identification of the specific pathogen, will provide stakeholders with opportunities for proactive responses, biocontainment, resource allocation, diagnostics, and awareness.

SWINE DISEASE MONITORING REPORTS

The Swine Health Information Center, launched in 2015 with Pork Checkoff funding, protects and enhances the health of the US swine herd by minimizing the impact of emerging disease threats through preparedness, coordinated communications, global disease monitoring, analysis of swine health data, and targeted research investments. For more information, visit http://www.swinehealth.org or contact Dr. Sundberg at psundberg@swinehealth.org.

DOMESTIC

This month's Domestic Swine Disease Monitoring Report includes educational material about the new PRRSV ORF5 sequence page, providing stakeholders with an explanation of how to interpret the four new charts. Also, SDRS reports increased PRRSV activity in Iowa, Indiana, Oklahoma, and South Dakota. PEDV and PDCoV positivity remains relatively low with overall 3.25% and 0.7% positive submissions, respectively. For the second consecutive month, *Mycoplasma hyopneumoniae* percentage of positive submissions from wean-to-finish sites increased and lungs represented 35% of samples testing positive, which may indicate increased clinical issues in the field. There was increased positivity of PCV2 and PCV3, with a drop in the average Ct values for oral fluids and processing fluids. The podcast features a talk with Dr. Hemant Naikare, University of Minnesota, about collaborative projects for the swine industry, strategies to recruit folks from rural communities to work on food animal health, how to engage students in the laboratory/diagnostic career, and the importance of veterinary diagnostic laboratories for public health.

VIEW REPORT

GLOBAL

In the Global Swine Disease Monitoring Report, read about ASF affecting Germany's first farm in Rhineland-Palatinate, highlighting the ongoing risk in the region. In the UK, a government report revealed a high risk of ASF reaching the nation due to illegal pork imports. The Internal Security Agency in Poland has warned farmers of possible sabotage following mysterious ASF outbreaks in the Kujawsko-Pomorskie province. And in the Philippines, ASF-infected hogs were intercepted at checkpoints in Metro Manila. Two trucks, with over 100 hogs in total, were flagged on Mindanao Avenue. Similarly, 30 ASF-infected pigs were intercepted in Quezon City.

VIEW REPORT