Swine Health Information Center
2024 Annual Progress Report
To the National Pork Board

December 31, 2024

Table of Contents

Executive Summary of SHIC and 2024 Activities

Mission and Scope of Work

The mission of the Swine Health Information Center (SHIC), launched in 2015 with Pork Checkoff funding, is to protect and enhance 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. SHIC began operation as a 501(c)(3) corporation on July 4, 2015.

When SHIC was formed in 2015 by a grant of Checkoff funds from the National Pork Board (NPB), it was with the understanding that it was a five-year project. The proposal language surrounding the Center's formation stated, "Funding of the Center past its five-year life will depend on it being able to demonstrate a sufficient return on the investment to justify keeping it running." During 2021, the NPB Board of Directors voted to provide $15M to continue to fund SHIC's work through the end of 2027.

As outlined in the NPB grant, the scope of work to be performed by SHIC includes global swine health and issues identification, targeted swine disease research, and swine health data analysis and monitoring for trends. To fulfill SHIC's mission and scope of work, the annual plan of work and progress report are developed around five strategic priorities:

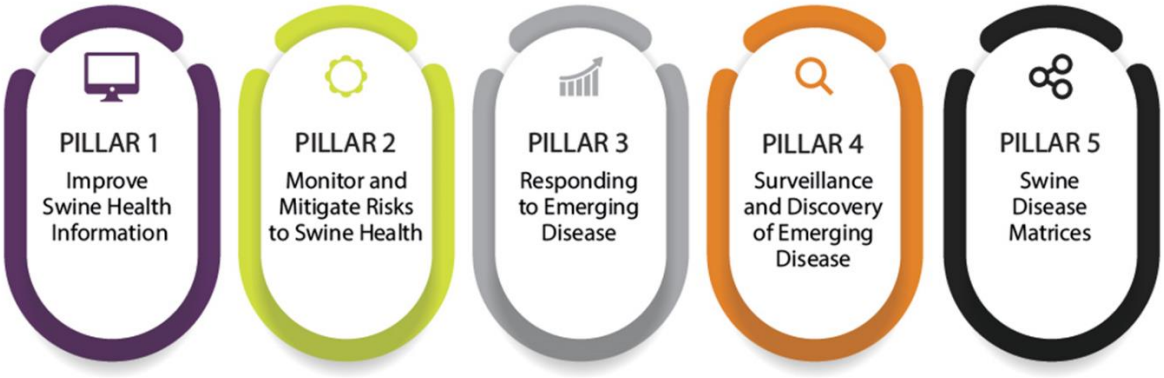

Figure 1. Strategic priorities of SHIC.

Board of Directors, Working Groups and Staff

SHIC is governed by a Board of Directors consisting of nine members, of which six directors are appointed, and three directors are elected. The NPB, National Pork Producers Council (NPPC) and the American Association of Swine Veterinarians (AASV) have each appointed two members to the SHIC Board of Directors. Three directors are elected by the appointed directors and must be active pork producers or representatives of producing companies that have an interest in the mission of SHIC. The Board approved a 2024 operating budget, a 2024 Plan of Work and a plan for FDIC insured investments, that is modeled after that of the NPB.

Two directors initiated their terms on the SHIC Board of Directors during the summer of 2024, including Dr. Jay Miller (AASV appointed) and Dr. Seth Krantz (NPB appointed) while two

directors concluded their terms, including founding board member Dr. Daryl Olsen (AASV appointed) and Dr. Russ Nugent (NPB appointed). In July 2024, the new SHIC Board of Directors held an election of officers with Mark Schwartz, Schwartz Farms, chosen to lead the SHIC Board as its chair, Paul Ruen, DVM, EHF Consulting elected to be the vice chair for the organization, and Kent Bang selected to again serve as secretary/treasurer.

Current members of the SHIC Board of Directors:

A. NPB Appointed
    1. Dr. Seth Krantz, Veterinarian, Tosh Pork, Tennessee
    2. Gene Noem, Pork Producer, Genus PLC Director – retired, Iowa
B. NPPC Appointed
    3. Joseph Dykhuis, Pork Producer, President of Dykhuis Farms, Inc., Michigan
    4. Dr. Jeremy Pittman, Senior Director, US Vet Services, Smithfield, Virginia
C. AASV Appointed
    5. Dr. Jay Miller, President and CEO, The Maschhoffs, LLC, Illinois
    6. Dr. Paul Ruen, EHF Consulting and AASV past-president, Minnesota
D. Elected Directors
    7. Kent Bang, Bang Ag Consulting/Compeer Financial – retired, Nebraska
    8. Dr. Pete Thomas, Director of Health Services, Iowa Select Farms, Iowa
    9. Mark Schwartz, Director of Production Systems, Schwartz Farms, Minnesota

Two Working Groups are active in providing program oversight and assisting in decision-making to fulfill the SHIC mission, including a Monitoring and Analysis Working Group and a Preparedness and Response Working Group. Working Groups are comprised of practitioners, allied industry partners, pork producers, academic researchers, diagnosticians, federal and state animal health officials, packer/processors, and industry association veterinarians from AASV, NPPC and NPB. Each Working Group meets regularly through virtual calls to fulfill their respective objectives by reviewing and selecting research projects and engaging in SHIC programming activities to carry out the Plan of Work.

The Monitoring and Analysis Working Group is responsible for assessing domestic and foreign or transboundary production disease risk using information from a variety of sources. The outcome of this assessment is the on-going prioritization of the Swine Viral Disease Matrix and the Swine Bacterial Disease Matrix. It is also responsible for monitoring and advising the use of diagnostic technologies to improve the health of the nation's swine herd, development and oversight of on-going projects to monitor diseases affecting swine health, and analysis of swine health data to support on-farm, prospective producer decision making.

The Preparedness and Response Working Group is responsible for oversight of research to assist in US prevention, preparedness, mitigation and response to priority swine diseases outlined in the swine viral and bacterial disease matrices. It helps advise on research investment needs and SHIC's role in the response to an emerging swine disease. That includes identifying the appropriate SHIC response to help provide the information and analysis necessary to support the proportional pork producer and pork industry response to these emerging swine diseases.

Three Task Forces convened for meetings in 2024 with specific objectives to review, prioritize and recommend proposals for funding in the Wean-to-Harvest Biosecurity Research Program, 2024 Plan of Work Research Program, and the Japanese Encephalitis Virus Research Program. Task Forces are comprised of SHIC Working Group Members, SHIC Board of Directors Members, funding partner representatives from FFAR and NPB, and other subject matter experts.

The transition of staff leadership occurred on January 1, 2024, with Megan Niederwerder, DVM, PhD being selected by the SHIC Board of Directors to serve as Executive Director after serving as the SHIC Associate Director since April 1, 2022. Lisa Becton, DVM, MS, DACVPM was selected by the SHIC Board of Directors to serve as the new SHIC Associate Director effective January 1, 2024, after previously serving as the NPB's Director of Swine Health.

Plan of Work and Operating Budget Projection

The 2024 Plan of Work process was initiated in early fall 2023 to identify research priorities and topic areas in line with the SHIC mission for 2024. Milestones of the process included reviewing the budget ranges across the five strategic priorities, conducting a series of stakeholder meetings to solicit input on proposed topic areas, creating a budget projection for each proposed topic, soliciting working group feedback to prioritize project ideas, and SHIC Board of Director review, revision and approval of the 2024 Plan of Work. Publication of the 2024 Plan of Work was completed in December 2023 for stakeholder awareness of upcoming activities. Although the 2024 Plan of Work guides SHIC's activities throughout the year, SHIC was adaptive to continuous input and strived to be nimble and responsive to emerging priorities as they arose.

The SHIC Board of Directors approved a projected budget for 2024 and has reviewed and modified the projection during the year to best meet the SHIC mission. The approved projected budget addressing the 2024 Plan of Work was $3,643,400. An evaluation of funds needed for the operating budget was conducted monthly to guide investments in securities with Wells Fargo and modeled after NPB's investment plan. The investments are a series of FDIC insured Certificates of Deposit, laddered to provide on-going operating funds as the certificates reach maturity.

Targeted Research Investments

Across all SHIC research program areas in 2024, there were 93 proposals submitted to SHIC that underwent a competitive review process with a total request for funding of $11,677,163. Overall in 2024, 32 research projects were awarded funding for a total of $3,990,689 contracted. Since 2015, this is the greatest number of proposals received by SHIC and the highest dollar amount contracted by SHIC for research projects in a single year. By leveraging Pork Checkoff dollars received by SHIC with matching funds and external grants, the expanded scientific network of research breadth and funding capacity has increased the return on investment for stakeholders.

In the fall of 2022, SHIC formed the "Wean-to-Harvest Biosecurity Research Program" in collaboration with the Foundation for Food & Agriculture Research (FFAR) and the Pork Checkoff. The total dollar allocation of $2.3M was comprised of $1M contribution from SHIC, $150K contribution from NPB, and $1.15M contribution from FFAR. The Research Program was ongoing through 2023 and 2024 with a rolling deadline for proposal submission. In 2024, 7 Wean-to-Harvest Biosecurity Research projects were funded for a total of $791,870.

In January 2024, SHIC announced the "Plan of Work Research Program" request for proposals to address the research priorities and topics that had been identified through stakeholder engagement and published as the SHIC BOD approved 2024 Plan of Work. In 2024, a total of 19 SHIC Plan of Work Research Projects were funded for a total of $1,894,887.

In February 2024, SHIC announced the "Japanese Encephalitis Virus Research Program" in partnership with FFAR. The total budget allocation for the research program was $1.3M with $650K from SHIC and $650K from FFAR. Proposals were due April 15, 2024. A total of 6 research projects were funded through this program for a total of $1,303,932.

In November 2024, SHIC announced the "H5N1 Risk to Swine Research Program" in partnership with FFAR and the Pork Checkoff. The Request for Proposals has a total budget allocation of $4M, with $1.8M being contributed by SHIC, $200K being contributed by NPB, and $2M being contributed by FFAR. Since SHIC's inception in 2015, this is the highest dollar amount committed to a SHIC-led research program. Proposals were due December 31, 2024.

Coordinated Outreach and Communications

There has been personal outreach to pork producers, veterinarians, academics and researchers, allied industry and state and federal animal health officials to foster collaboration, develop projects, increase understanding of SHIC and its mission and inform them about the research and programs. Their feedback has helped focus and refine SHIC responsibilities, research, and programs. Presence and participation in national and international meetings as well as international organizations have helped to monitor swine diseases and issues around the world.

Sharing swine health information with a diverse body of stakeholders requires a variety of communications tools and processes. SHIC communications employed to disseminate information to stakeholders include the SHIC website, monthly e-newsletter, timely e-blasts, article development and distribution, news releases, media interviews with Drs. Megan Niederwerder and Lisa Becton, social media, SHIC Talk podcast, coordinating SHIC sessions at industry meetings, and SHIC/AASV webinar series. SHIC also participates in industry events to provide access to information essential to the protection of US swine herd health. Google Analytics data on SHIC website traffic are used to measure impact of media efforts.

SHIC Activities and Communication Channels	Number in 2024
Individual swinehealth.org Website Visitors	25,314 Visitors
Total Website Page Views	153,156 Views
Articles Prepared for Partners	72 Articles
SHIC Monthly E-Newsletters	12 Newsletters
Number of Individuals Receiving SHIC E-Newsletter	3,280 Individuals
SHIC Talk Podcasts	4 Podcasts
SHIC Sponsored Webinars	4 Webinars
Domestic Swine Disease Monitoring Reports	12 Domestic Reports
Global Swine Disease Monitoring Reports	12 Global Reports
Media Interviews	110 Interviews
Media Press Releases	6 Releases
SHIC Presentations at Industry Meetings	17 Presentations

Details of 2024 Activities and Accomplishments

Board of Directors and Staff Transitions

Krantz and Miller Join SHIC Board of Directors; Schwartz, Ruen, and Bang elected officers

SHIC welcomed two new board members during their meeting held on July 29-30, 2024. Seth Krantz, DVM, Tosh Farms, and Jay Miller, DVM, The Maschhoffs, began their terms. Founding board member Daryl Olsen, DVM, AMVC, and Russ Nugent, PhD, concluded their service. Nugent joined the SHIC Board of Directors in 2021 and served as president for the year just completed. He was honored for his service with a plaque during SHIC's June board meeting.

The new SHIC Board of Directors held an election of officers as well. Mark Schwartz, Schwartz Farms, was chosen to lead the SHIC Board as its chair. Paul Ruen, DVM, EHF Consulting will be the vice chair for the organization and Kent Bang will again serve as secretary/treasurer. Other board members are Joseph Dykhuis, Gene Noem, Jeremy Pittman, DVM, and Pete Thomas, DVM. Megan Niederwerder, DVM, PhD, is SHIC's executive director and Lisa Becton, DVM, MS, DACVPM, serves as associate director.

New Board Members
Seth Krantz discovered his passion for pigs and the swine industry while in college at the University of Tennessee – Martin. Summer jobs, including at Tosh Farms, and other work experience gave him an appreciation of not only pigs but the people who raise and care for them, leading to veterinary school at the University of Tennessee – Knoxville. After spending two years in practice with Carthage Veterinary Service, Krantz took the opportunity to return home to Tennessee as veterinarian at Tosh Pork. During his career, Krantz has appreciated SHIC's mission and deliverables to the industry.

"SHIC has been a tremendous resource over the last several years," he explained. "Certainly, SHIC has been the key resource for veterinarians and producers alike for keeping us abreast of emerging diseases and best practices for emerging diseases."

Krantz has a lot of appreciation for what the organization does and the service it provides producers. "New and emerging swine diseases are tricky. If we don't have them in the back of our mind, it could be a problem," he stated. "SHIC is a key source of resources we will need if we do have to respond to emerging diseases."

Appointed to the SHIC Board of Directors by the National Pork Board, Krantz was excited to become a part of the organization. "Even in my limited experience so far, I have seen some of the new projects that are being initiated are really fantastic, specifically the work surrounding Japanese encephalitis virus. And really, the quality of the projects and the questions they are answering, and the information delivered out is really exciting, too," he said.

Serving with industry organizations is important though Krantz says he really likes being a pig farmer more than anything. "I came for the pigs, but I stayed for the people. That's where I found

the most passion for the industry is the people I get to work with and folks raising pigs. It has become the driving force for what I do, the driving force for a robust industry that provides for people and that's what I'm in it for," he concluded.

Jay Miller grew up on a central Illinois farm and was very active in 4-H and FFA including a focus on raising and showing cattle. While at vet school at Kansas State University, he discovered an interest in pigs and the swine industry. Miller returned to Illinois where he worked at a traditional mixed animal practice then shifted to become a swine consultant. When it was time to move back closer to home, Miller established his own mixed animal practice which grew to have multiple locations and include five veterinarians.

While serving as a swine consultant, Miller met the team at The Maschhoffs, LLC, which launched a 16-year span of serving them as an advisor before joining them full-time as the director of health. This led to Miller becoming their vice president of health and operations then, in October 2023, president and CEO of the organization.

"While practicing, my passion was really for the success of my clientele," he remembered. "I felt like I became everything from veterinarian to financial advisor, doing everything to help my clientele be successful." Miller said he gravitates as much to the business part of an operation as the medicine.

Miller was asked to represent the American Association of Swine Veterinarians on the SHIC Board of Directors. "When Harry Snelson (AASV executive director) asked me to be part of the SHIC Board for AASV, I was absolutely excited to be part of it," Miller stated. "Paul Sundberg was instrumental along with Daryl Olsen and the original board in establishing SHIC. And SHIC interacted with The Maschhoffs several times as they were working on the issues of biosecurity, emerging disease, and the PED outbreak. We were fortunate to have direct exposure to SHIC in those ways."

One of SHIC's strengths, per Miller, is connecting academic research to the producer. "I'm a big believer that you need to make decisions based on accurate information and facts. In this industry, the biological protein industry, it can be difficult to get to the bottom of issues and find the cause of problems. And I see The Maschhoffs as being a science-based biological protein company. SHIC has supported the industry in the same manner, using science to help solve problems and inform decisions for producers while understanding the economic impact of these issues to producers and the industry," he observed.

Founding Board Member Daryl Olsen

Olsen saw the need and potential for SHIC when established in 2015. A member of its board of directors from day one, Olsen also served as the organization's president for eight years. "In the very short time we've been in existence, we have come to play such a vital role in helping defend the health of our industry. I recommend people evaluate our performance. You're going to understand that since receiving initial funding from the National Pork Board, we have filled a void and been very successful. We're committed to protecting the US pig population," he observed.

During his tenure with SHIC, Olsen credits his fellow board members, working group members, and staff for helping reach the goals set out when it was created. “I have been able to work with great people,” he remarked. “Paul and Megan are outstanding. And the board members I’ve served with have been great.”

While honored to be part of SHIC’s growth and contributions to the swine industry, Olsen believes having new board members adding their perspective and expertise is appropriate. Plus, he says, he will be able to be involved in the industry in new places.

To recognize his service to SHIC and the swine industry, Olsen was honored at the recent SHIC board meeting by current board president Mark Schwartz with a presentation and plaque.

Niederwerder and Becton Assume Staff Leadership Roles at SHIC

With the beginning of 2024 comes the anticipated change in leadership for SHIC. Dr. Megan Niederwerder now serves as executive director while Dr. Lisa Becton begins her tenure with SHIC as associate director. Both are eager to carry forward the mission of the Center to protect and enhance 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.

Dr. Niederwerder joined SHIC in April 2022 as associate director. During her time with SHIC, she has been engaged in all facets of the Center’s operations, projects, and priorities. This experience, in concert with her previous swine industry roles, prepared her for assuming the executive director position. “SHIC strives to provide a unique and valuable service to the US pork industry by focusing efforts on emerging diseases,” Dr. Niederwerder observed. “We will continue to work diligently on initiatives to serve pork producers and their practitioners with emerging disease information efficiently and effectively.”

Under new leadership, SHIC will continue to deliver domestic and global swine disease monitoring information, research to address emerging disease threats, and review of swine health data. SHIC’s nimble structure allows it to address threats to US swine herd health as they arise. The Wean-to-Harvest Biosecurity Program and efforts to prevent and prepare for potential emerging diseases, such as Japanese encephalitis virus, are key SHIC priorities.

“We’re going to have challenges. How quickly we can identify those challenges and turn those concerns into solutions shapes our effort,” remarked Dr. Becton. “A lot of the industry’s focus is on how rapidly we can diagnose new, emerging swine disease threats, and how quickly we can tell if an existing pathogen has changed to create new problems. This is at the core of SHIC’s mission.” In her new role, Dr. Becton brings her previous experience in the industry and devotion to US pork producers to enable solutions.

SHIC’s work in 2024 will be guided by the Plan of Work approved by the board of directors. On-going and new efforts also build on previous work detailed in the 2023 Progress Report. Drs. Niederwerder and Becton welcome swine industry stakeholders to provide ongoing input and ideas to fulfill the SHIC mission and provide return on investment to US pork producers.

Plan of Work Priorities and Projects

2024 Plan of Work Continues SHIC Focus on Protection of US Swine Herd Health

Activities of SHIC are guided by its annual Plan of Work detailing projects to address its five strategic priorities, including 1) improving swine health information, 2) monitoring and mitigating risks to swine health, 3) responding to emerging disease, 4) surveillance and discovery of emerging disease, and 5) swine disease matrices. Developed through stakeholder feedback and approved by the SHIC Board of Directors, the 2024 Plan of Work will be implemented by Executive Director Dr. Megan Niederwerder and Associate Director Dr. Lisa Becton with input from the board and SHIC Working Groups.

Proposals to address the priorities detailed in the 2024 Plan of Work are accepted on a rolling basis for review and funding recommendation. SHIC's activities are guided by the Plan of Work while remaining nimble and responsive to industry needs. Stakeholder input and ideas are welcomed year-round to inform newly identified needs which may necessitate adapting the Plan of Work to fulfill SHIC's mission. Input may include topic areas, research priorities, and identified industry needs in which SHIC should focus efforts, such as an emerging swine disease or an emerging swine health issue.

2024 Plan of Work Highlights

Improve Swine Health Information

- Domestic disease monitoring through veterinary diagnostic laboratory data collation via the Swine Disease Reporting System
- Domestic disease monitoring through voluntary reporting to the Morrison Swine Health Monitoring Project provides a foundation for industry capacity to report system level disease, respond rapidly, and maintain business continuity
- Japanese encephalitis virus information sharing website for US stakeholders will be monitored and updated as needed to ensure the latest information remains available
- A strategic summary of SHIC swine health and disease work-to-date will be explored as a resource to organize information for stakeholders
- Webinars to inform veterinarians and producers about emerging swine health issues will be offered
- Maintaining up-to-date swine disease fact sheets
- Ensure timely and valuable communications across all stakeholder audiences

Monitor and Mitigate Risks to Swine Health

- Customs and Border Protection and identifying high-risk product importation and traveler entry at borders
- Global disease monitoring to identify and inform international swine disease risks
- Foster information sharing with government and allied industry through international animal health organizations
- Adoption and measuring implementation of wean-to-harvest biosecurity research outcomes
- Enhancing biosecurity of mortality management practices to reduce disease transmission back to farm ‡

- Transportation biosecurity of live pig and market haul ‡
- Novel air filtration technologies for cost-effective bioexclusion on grow/finish sites ‡
- Packing plant biocontainment for reducing pathogen spread back to the farm ‡
- Cull sow and secondary market biosecurity and disease surveillance
- Engineering biosecurity controls through site construction design or strategic renovation
- Defining spillover risks of emerging diseases from wean-to-market pigs to sow herds

Respond to Emerging Disease

- Emergency disease preparedness and response planning in coordination with state, federal and industry stakeholders
- Validating feed mill decontamination protocols to reduce feed transmission risk
- Investigating production and swine health impacts of porcine astrovirus, kobuvirus and sapovirus as emerging pathogens
- Improving diagnostic tools, understanding of pathogenesis, and interpretation of test results for porcine circovirus types 2, 3 and 4
- Utilizing the web-based Standardized Outbreak Investigation Program to identify high risk events for pathogen entry
- Identification of early disease outbreak warning signals from industry data
- Rapid deployment of research funds for a newly emerging disease
- Diagnostic assay development for confirming efficacy of cleaning and disinfection protocols

Surveillance and Discovery of Emerging Disease

- Population based sample types (oral fluids, processing fluids) for emerging disease testing
- Pan-diagnostic assay development for co-infections or identifying unknown emerging diseases
- Environmental sample types for emerging disease surveillance and efficacy of cleaning and disinfection protocols
- Whole genome sequencing as a forensic diagnostic tool and epidemiological resource
- Expanding use of diagnostic fee support to assist in early detection of emerging disease
- Increasing utility of VDL submissions as an effective surveillance stream for detection of emerging disease
- Investigation of the clinical relevance and epidemiology of newly identified agents in VDL submissions associated with swine disease

Swine Disease Matrices

- Updating bacterial and viral swine disease matrices to prioritize swine pathogens
- Using the swine bacterial and viral disease matrices as guidelines for research to enhance swine disease diagnostic capabilities

‡ FFAR/SHIC/NPB Wean-to-Harvest Biosecurity Research Program priorities.

SHIC Requests Research Proposals to Address Emerging Swine Disease Challenges

Research provides critical information and resources to help pork producers as they face emerging disease challenges in their swine herds. Research priorities and topics identified in the SHIC 2024 Plan of Work help SHIC fulfill its mission to generate new intelligence for preventing, preparing, and responding to emerging swine disease threats. SHIC has now issued a

formal request for proposals inviting submissions to specifically address 11 of the 36 research priorities and topics published in the 2024 Plan of Work, across three of the Center's five strategic emphases. Proposals are due March 1, 2024, and will undergo a competitive review process for value to the pork industry by a SHIC working group which will provide funding recommendations.

The specific research priorities included in this RFP focus on monitoring and mitigating risks to swine health, responding to emerging disease, and surveillance and discovery of emerging disease. The intent of the RFP is to encourage researchers to develop and submit proposals that specifically address these identified priorities, broaden awareness of funding opportunities to advance SHIC's 2024 Plan of Work, and to expand the scientific network of researchers and institutions conducting critical research on emerging swine diseases. Funding timely research is an essential component of SHIC providing project outcomes that drive action for emerging disease prevention, preparedness, and mitigation.

Proposals should clearly state the targeted priority that will be addressed through the project. Collaborative projects that include the pork industry, allied industry, academic institutions, and/or public/private partnerships are highly encouraged. Projects that demonstrate the most urgent and timely completion, provide the greatest value to pork producers, and show efficient use of funds will be prioritized for funding. Projects are requested to be completed within a 12-month period with justification being required if the project duration extends beyond 12 months.

Funding available for the SHIC 2024 Plan of Work Research Program priorities included in this RFP is $1.1 million. Individual awards are anticipated to be between $50,000 and $150,000. Budgets exceeding this range require sufficient justification. Projects should strive to be unique, have a high impact, and have industry-wide benefit. The deadline for proposal submission is 5:00 pm CST on March 1, 2024. The proposal template and instructions for completion and submission can be found at www.swinehealth.org/call-for-research/.

SHIC 2024 Plan of Work Competitive Call Nets 43 Proposals from 21 Institutions

In January 2024, SHIC issued a formal request for proposals inviting submissions to specifically address 11 of the 36 research priorities and topics published in its 2024 Plan of Work. Areas of research spanned across three of the Center's five strategic priorities, including monitoring and mitigating risks to swine health, responding to emerging disease, and surveillance and discovery of emerging disease. Proposals were due March 1, 2024, and a competitive review process for value to the pork industry by a SHIC working group will provide funding recommendations. A total of 43 proposals from 21 institutions were received by the deadline.

"Through targeted research investments, SHIC is striving to drive innovation in the pork industry for the protection and enhancement of US swine herd health," remarked SHIC Executive Director Dr. Megan Niederwerder. "The formal RFP received an outstanding response, providing an opportunity to recruit a broad net of research ideas to generate new knowledge in the field of emerging swine diseases."

Research outcomes from the projects to be funded from this request for proposals will provide critical information and resources to help pork producers as they face emerging disease challenges in their swine herds. Research priorities and topics identified in the SHIC 2024 Plan of Work help the organization fulfill its mission to generate new intelligence for preventing, preparing, and responding to emerging swine disease threats. Funding available for the SHIC 2024 Plan of Work Research Program priorities included in this RFP is $1.1 million. Individual awards are anticipated to be between $50,000 and $150,000.

The specific research priorities included in the January RFP were high-risk product importation and traveler entry at US borders, cull sow and secondary market biosecurity, engineering biosecurity through site construction or renovation, disease spillover risks from wean-to-market pigs to sow herds, understanding the impact of porcine circoviruses, identifying early disease outbreak warning signals, diagnostic assays for confirming cleaning/disinfection protocols, expansion of population based sample types for emerging disease testing, pan-diagnostic assay development, environmental sample types for emerging disease surveillance, and investigating the clinical relevance of newly identified agents from veterinary diagnostic lab submissions.

Through the RFP process, SHIC's goals were to encourage researchers to develop and submit proposals that specifically addressed the identified priorities, broaden awareness of funding opportunities to advance its 2024 Plan of Work, and expand the scientific network of researchers and institutions conducting critical research on emerging swine diseases. Funding timely research is an essential component of SHIC providing project outcomes that drive action for emerging disease prevention, preparedness, and mitigation.

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

SHIC 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

1. 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

2. 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

3. 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.

4. 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.

5. 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

6. 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.

7. 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.

8. 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

9. 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 Invites Stakeholder Input for 2025 Plan of Work

SHIC annually solicits input for its Plan of Work which guides its activities. Now being developed, SHIC is requesting ideas for its 2025 Plan. SHIC's five strategic priorities include 1) improving swine health information, 2) monitoring and mitigating risks to swine health, 3) responding to emerging disease, 4) surveillance and discovery of emerging disease, and 5) swine disease matrices. These priorities guide the Center's Plan of Work along with stakeholder input. Once developed, the 2025 Plan of Work will be implemented by Executive Director Dr. Megan Niederwerder and Associate Director Dr. Lisa Becton with input from the SHIC Board of Directors and SHIC Working Groups.

Stakeholder input for SHIC's 2025 Plan of work can be submitted here and is requested by November 8, 2024. All swine industry stakeholders are encouraged and welcomed to provide feedback. Input may include topic areas, research priorities, and/or identified industry needs that will focus SHIC's programmatic and research efforts in 2025, such as an emerging swine disease or an emerging swine health issue.

SHIC's activities are guided by the Plan of Work while the organization remains nimble and responsive to industry needs as they arise throughout the year. Stakeholder input and ideas are welcomed year-round to address newly identified needs which may necessitate adapting the Plan of Work to fulfill SHIC's mission on emerging diseases.

SHIC has recently funded nine new projects addressing research priorities and topics that were published in its 2024 Plan of Work. These nine projects were initiated in summer 2024 and are six to 12 months in duration. Research outcomes from SHIC's 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
- informing the swine disease matrices to prioritize pathogens for research and diagnostics

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.

List of Research Projects Funded Through 2024 SHIC Plan of Work

1. Principal Investigator: Dustin Boler, Carthage Innovative Swine Solutions
    - Title: Ensuring farrowing room cleanliness and biosecurity using ATP bioluminescence
    - Start Date: February 1, 2024; Project Duration: 6 months
2. Principal Investigator: Maria Sol Perez Aguirreburualde, University of Minnesota
    - Title: A near-real time global surveillance system for swine diseases
    - Start Date: February 15, 2024; Project Duration: 12 months
3. Principal Investigator: Pablo Pineyro, Iowa State University
    - Title: Reproductive failure induced by Porcine Circovirus Type 3 infection in experimentally infected sows
    - Start Date: June 1, 2024; Project Duration: 12 months
4. Principal Investigator: Leonardo Cardia Caserta, Cornell University
    - Title: Improving next-generation sequencing for detection of emerging swine viruses
    - Start Date: June 1, 2024; Project Duration: 12 months
5. Principal Investigator: Giovani Trevisan, Iowa State University
    - Title: Generating a disease index based on confirmed tissue diagnosis data to assess the relative burden of endemic swine pathogens in the U.S.
    - Start Date: June 1, 2024; Project Duration: 12 months
6. Principal Investigator: Rebecca P. Wilkes, Purdue University
    - Title: Development of a targeted next-generation sequencing panel for common and emerging swine pathogens
    - Start Date: June 1, 2024; Project Duration: 12 months
7. Principal Investigator: Marcelo Almeida, Iowa State University

- Atypical Interstitial Pneumonia-like disease in swine: etiologic investigation of an emergent syndrome
- Start Date: June 1, 2024; Project Duration: 8 months

8. Principal Investigator: Aruna Ambagala, Canadian Food Inspection Agency
   - Title: Pen-based oral fluid samples and slaughter house tissue samples for detection of emerging strains of African swine fever virus
   - Start Date: June 1, 2024; Project Duration: 12 months
9. Principal Investigator: Pablo Pineyro, Iowa State University
   - Title: Exploratory study to evaluate the presence of PCV4 in different sample matrices and confirmation of its role in histological changes by direct detection
   - Start Date: June 1, 2024; Project Duration: 6 months
10. Principal Investigator: Wenjun Ma, University of Missouri
    - Title: Surveillance and pathogenicity of mammalian orthoreovirus, adenovirus and novel pathogens in pigs
    - Start Date: June 1, 2024; Project Duration: 12 months
11. Principal Investigator: Leyi Wang, University of Illinois Urbana-Champaign
    - Title: Validation of a new enrichment method for increasing sensitivity of PRRSV whole genome sequencing
    - Start Date: June 1, 2024; Project Duration: 12 months
12. Principal Investigator: Gustavo Silva, Iowa State University
    - Title: Implementing a Real-Time Surveillance System Utilizing Diagnostic, Movement, and Site Location to Early Detect Emerging/Re-emerging Diseases Across Different Regional Levels
    - Start Date: June 1, 2024; Project Duration: 12 months
13. Principal Investigator: Giovani Trevisan, Iowa State University
    - Title: Developing and implementing a capability for real-time monitoring of Escherichia coli genotyping and virotypes detected in porcine samples tested by PCR.
    - Start Date: August 1, 2024; Project Duration: 12 months
14. Principal Investigator: Jeff Zimmerman, Iowa State University
    - Title: Establishing oral fluid sampling guidelines for group-housed sows
    - Start Date: August 1, 2024; Project Duration: 12 months
15. Principal Investigator: Giovani Trevisan, Iowa State University
    - Title: Domestic Swine Disease Surveillance monthly report updates until September 2025
    - Start Date: October 1, 2024; Project Duration: 12 months
16. Principal Investigator: Anastasia Vlasova, Ohio State University
    - Title: An underappreciated respiratory pathogen or shifting tropism of porcine rotaviruses
    - Start Date: October 15, 2024; Project Duration: 12 months
17. Principal Investigator: Igor Paprotny, University of Illinois
    - Title: Development and validation of a ‘Smoke Detector’ technology for onsite monitoring of emerging viruses in swine farms
    - Start Date: October 15, 2024; Project Duration: 12 months
18. Principal Investigator: Federico Zuckermann, University of Illinois

- Title: Validation Of Prognostic Biomarkers of Porcine Reproductive and Respiratory Syndrome Virus Virulence
- Start Date: December 1, 2024; Project Duration: 12 months

19. Principal Investigator: Marcelo Almeida, Iowa State University
    - Title: Infection dynamics of porcine sapovirus in commercial pig populations
    - Start Date: January 1, 2025; Project Duration: 12 months

Monthly Global Swine Disease Monitoring Reports

The SHIC Global Swine Disease Monitoring Reports have provided near real-time information on swine diseases regularly since November 2017. This reporting system has been successful in identifying, scoring and reporting hazards using a step-wise procedure for screening diseases that represent a potential risk for the US swine industry. A combination of unofficial and official data is actively and passively collected and organized. Following successive screening steps in which data and information are modified, edited, corrected, and expanded in collaboration with stakeholders, a report describing the outputs is communicated to the US pork industry through SHIC's monthly e-newsletter and posting online on the SHIC website. The project has been successful in finding and communicating multiple potential threats to the US pork industry.

Summaries of the Global Swine Disease Monitoring Reports published in 2024:

January 2024. In the January Global Disease Monitoring Report, find a 2023 summary including highlights of events across six continents (Asia, Africa, Europe, Oceania, North America, and South America). Events saw over 780,000 pigs directly affected by the outbreaks of seven diseases (ASF, PRV, JEV, FMD, CSF, PED, Nipah). The report also features an in-depth analysis of FMD with an overview of the disease dynamic throughout the year. FMD outbreaks were reported in 30 countries in 2023. Read about Russia resuming pork exports to China after a 15-year break, following the lifting of a ban imposed by Beijing due to an African swine fever outbreak in 2008. Surveillance at points of entry resulted in a new type of ASF being detected at the Taiwanese border for the first time. This new strain – recombinants of genotype I and II ASFVs – was first confirmed in 2022 and has been found in various regions of China, including Jiangsu, Henan, and Inner Mongolia.

February 2024. African swine fever keeps spreading in Europe where Montenegro has become the 27th European country to report the disease for the first time in wild boars. In Italy, the European Commission has officially declared the resolved status of the outbreak genotype II in Sardinia and characterized it as *"occasional" and "imported.*" Remaining Italian outbreaks are confined to the province of Nuoro. The first report of ASF in domestic pigs in Gyeonggi-do province, South Korea, since April 2021 has occurred. There were 2,448 pigs culled on site in response. Foot-and-mouth disease outbreaks have been reported in six countries in Africa. There is limited information available regarding the responsible viral strains; for only two of those, serotype O has been confirmed. Unprecedented volumes of illegally imported meat have been detected by Pork of Dover, UK, authorities, raising concerns about the risk of ASF. In Naples, Italy, traces of ASFV detected in Chinese salamis falsely labeled as vegetarian were discovered.

March 2024. In this month's Global Swine Disease Monitoring Report, read about Albania which has become the 28th European country to confirm the presence of African swine fever,

genotype 2, since the virus was introduced to the continent in 2007. Details on wild boar population control measures in Europe are included. Authorities in Italy, Poland, Estonia, and Norway have issued statements outlining measures to control the wild boar population as a strategy to combat ASF. Learn about nearly 10% of Chinese meat products testing positive for ASF during Taiwan's border inspection. Strict border inspections have been effective in preventing high-risk products from entering, as evidenced by a decrease in fines from 3.61 cases per 10,000 passengers to 2.85 from 2019 to 2023, respectively. The report includes information on WOAH's thematic study on zoning. WOAH has launched its first thematic study through the Observatory program, focusing on the international standard of zoning. The study assesses the implementation of zoning for avian influenza, ASF, and foot-and-mouth disease, highlighting its use, challenges, and impacts.

April 2024. In this month's Global Swine Disease Monitoring Report, read about African swine fever in the Dominican Republic as a report on results of surveillance efforts in 2023 and the first quarter of this year are shared. Learn more about China lifting its ban on Russian pork. Russia has delivered 27 tonnes of pork following lifting of ASF restrictions in September 2023. A fatal outbreak of Streptococcus suis was linked to raw pork consumption in Thailand. Authorities in France have reported a resurgence of Aujeszky's disease, with the latest update indicating seven outbreaks since September 2023. Instances of surveillance at points of entry in Padua, Italy, and Muang district, Thailand, are included in this month's report as well.

May 2024. In the May report, read about new African swine fever outbreaks in Italy triggering the expansion of restriction zones I and II in Parma province and raising concern regarding the international markets' response. The first report of ASF in domestic pigs in Bulgaria since early 2022 is detailed. Learn about Crimean-Congo Hemorrhagic Fever; a recent report presents evidence of seropositivity in wild boar and Iberian pigs. Classical swine fever has been confirmed in Eastern Russia, the first report of the disease since August 2020. Physical border checks are implemented in the United Kingdom for EU-imported, medium-risk animal products. Days before new biosecurity checks on EU imports were set to begin, over 3.4 tonnes of illegal meat were seized at the Port of Dover.

June 2024. In the June Global Swine Disease Monitoring Report, read about government action in Brazil self-declaring the country Foot-and-Mouth Disease-Free Status Without Vaccination. More than 244 million cattle and buffaloes on around 3.2 million properties will no longer be vaccinated against the disease. A new outbreak of classical swine fever in domestic pigs in Japan affected a commercial farm with over 17,500 pigs. Learn about a study initiated in 2022 that investigated survival of ASFV in 14 plant derived feed and bedding materials. And learn about an incident in Taiwan where an Indonesian passenger was deported after bringing a meal containing pork into the country. A quarantine dog detected the pork, leading to a NT$200,000 ($6,205) fine. Unable to pay, the traveler was deported.

July 2024. Information on a new African swine fever outbreak in Germany is included in the July Global Swine Disease Monitoring Report. The outbreak was reported in domestic pigs at a farm in Mecklenburg-Western Pomerania, affecting 3,000 fattening pigs. In South Korea, about 25,000 domestic swine were culled due to ASF. And in Latvia, the first ASF outbreak in domestic pigs was reported this year with about 500 pigs culled in response. Porcine reproductive and

respiratory syndrome virus was confirmed for the first time in Trinidad and Tobago on a swine farm in south Trinidad. In the United Kingdom, approximately 882 pounds of illegal meat products, including 172 sheep heads, smokies cutlets, a sheep leg joint, and offal, were seized from two businesses in Reading as part of surveillance at ports of entry.

August 2024. The August Global Swine Disease Monitoring Report captures significant African swine fever activity in Germany and Italy. In Germany, ASF made another long-distance jump. The affected region is about 250 miles from the nearest ASF-infected area in Germany and approximately 310 miles from the closest infected area in Italy. Genome sequencing suggests a new introduction event. In Italy, six farms were affected across four northern provinces. A surveillance program in Canada is designed for ASF early detection and was expanded to wild pigs. In Vietnam, recombinant genotype I/II ASF virus strains were detected. In The Philippines, authorities will roll out ASF vaccination by late 2024.

September 2024. 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.

October 2024. Read about African swine fever in Italy in the October Global Swine Disease Monitoring Report. Since ASF was first introduced there in 2022, the pig population in the most affected areas has dropped significantly, causing estimated losses of over USD $130 million. In September, the European Commission officially recognized Sardinia as free from ASF genotype I, which is different from genotype II currently circulating in continental Italy and across many European and Asian countries. The European Commission also officially recognized Sweden as free from ASF a year after the disease was first detected in wild boar. The first 10,000 ASF vaccine doses were administered on backyard farms in The Philippines. AVAC, a Vietnam-based company, is the vaccine provider. Detection of the first recombinant ASF virus (genotypes I and II) in domestic pigs in Russia is also highlighted in the report.

November 2024. In the November Global Swine Disease Monitoring Report, learn about The Philippines rolling out an ASF vaccine. Their focus is support for backyard pig farms who supply 70-80% of the country's pork. Legislators and industry groups propose free vaccines to assist these farmers. Elsewhere, the Ukrainian Meat Association urges swift approval of the AVAC ASF live vaccine, while the Ukrainian Pig Breeders Association advises caution until it gains international validation. In Lombardy, Italy, wild boar culling has been intensified along with biosecurity measures against ASF. Over 13,000 wild boars have been culled to date. In India**,** Mizoram state declared the ASF outbreak a state disaster and submitted a proposal to increase the central government's cost-share of the outbreak response from 50% to 90%. The Dartford Council in the UK seized 375 lb (170 kg) of illegally imported meat due to ASF risk concerns following an earlier seizure of 3.4 tonnes at Dover – farmers urge more robust post-Brexit border controls. Finally, the Department of Agriculture in The Philippines imposed a

temporary import ban on FMD-susceptible animals, products, and by-products from Türkiye due to an FMD outbreak in Kirsehir.

December 2024. Following the report from Guatemala in October, the first case of New World screwworm has now been reported in Chiapas, Mexico. Read about the USDA intensifying control efforts to protect US livestock in the December Global Swine Disease Monitoring Report. African swine fever outbreak information from Europe and Southeast Asia is also included in the report. In Italy, the spread of ASF to a new province in the Piedmont region is detailed while Alessandria province reported its first case in domestic pigs. In the Czech Republic, authorities aim to replicate the successful ASFV eradication achieved in 2017, bolstered by the added support of professional snipers targeting wild boar. In Vietnam, nearly 1,500 ASF outbreaks have been reported across over 48 provinces, leading to the culling of 81,030 pigs – 2.6 times more than during the same period in 2023. And in The Philippines, the second phase of the ASF vaccination campaign is set to begin, with 150,000 doses of Vietnam's AVAC live vaccine, following the successful deployment of 10,000 doses in Batangas last August. Concerns over ASF have resurfaced in Sardinia just a month after its eradication was declared, following the arrival of a shipment of ASF-infected pork from northern Italy in October.

Monthly Domestic Swine Disease Monitoring Reports

The SHIC Domestic Swine Disease Monitoring Reports have provided the only publicly available source of swine health information from US VDLs on pathogen activity in all production phases and sample types submitted for 8 endemic porcine pathogens. Continued to be positioned as one of the largest global databases for veterinary diagnostic information, the Reports include robust diagnostic data with statistical analyses on PRRSV, PEDV, PDCoV, TGEV, MHP, IAV, PCV2 and PCV3. Reports provide science-based spatiotemporal information on endemic pathogen activity accounting for >96% of all swine samples submitted to US VDLs, offering broad representativeness and assisting US pork producers and swine veterinarians in making informed decisions on disease prevention, detection and management.

Summaries of the Domestic Swine Disease Monitoring Reports published in 2024:

January 2024. This month's Domestic Swine Disease Monitoring Report brings the 2023 highlights, including the major findings regarding the swine pathogens monitored in the project. Also, the report brings information about the spike in the PRRSV positivity in the wean-to-market category, completing the fourth month of increased positivity. At a regional level, PRRSV overall positivity continues above expected in Iowa, Illinois, and Ohio. For enteric coronaviruses, PEDV positivity increased in all age categories, raising the alarm for upcoming months. At a regional level, PEDV's overall percentage of positive submissions is above the expected in Missouri and North Carolina. For influenza A virus and PCV2, overall positivity remains similar as in November, with over 33% and 40% of positive submissions, respectively. Even though there were only a small number of cases, there were signals for an increased number of *Trueperella pyogenes*, *Mycoplasma hyorhinis*, and PEDV confirmed tissue diagnoses at Iowa State University Veterinary Diagnostic Lab. In the podcast, the SDRS hosts discussed the highlights of 2023, going through the major findings of each pathogen monitored by the project.

February 2024. This month's Domestic Swine Disease Monitoring Report brings the new chart for weekly monitoring of Influenza A virus PCR detection. The newly implemented monitoring capability provides the industry with information about IAV detection and enables comparison to the historical expected for a specific period. Also, the report brings information about the decreased PRRSV positivity in all age categories, breaking the four consecutive months of increase in the wean-to-market positivity category. However, the average PCR Ct values of the submissions remain low. For the PRRSV ORF 5 sequence, the L1C lineages (L1C.2, L1C.3, L1C.5, L1C-others) remain predominantly detected in the field, and in 2023 accounted for 53% of all wild-type ORF5 sequence detections. For enteric coronaviruses, PEDV positivity had a sharp increase during January in all age categories, raising an alert for the activity of this pathogen. Also, PDCoV had a moderate increase in wean-to-market positivity. *Actinobacillus suis* entered the top 10 confirmed tissue diagnoses for the first time in the monthly report at ISU-VDL. In the podcast, the SDRS hosts talk with Dr. Brigitte Mason (Country View Family Farms) about the movement of PRRSV L1C.5 (variant) to the eastern corn belt states and disease management in the winter months.

March 2024. This month's Domestic Swine Disease Monitoring Report includes the new SDRS Blast for PRRSV ORF5 sequence tool. The newly implemented tool aids veterinarians and producers in identifying their own PRRSV ORF5 sequences' similarity with previous PRRSV sequences in the SDRS database. Also, the report brings information about the first PRRSV L1C.5 detection in South Carolina. The detection was in a sample identified as having been collected from a finishing site, with 100% nucleotide identity with another PRRSV ORF5 sequence recovered in another state and identified as L1C.5 RFLP 1-4-3. For enteric coronaviruses, PEDV positivity had a substantial increase during February in the wean-to-market category. PDCoV positivity remains high in the wean-to-market category, similar to the increased positivity of January 2024. *Mycoplasma hyopneumoniae* substantially increased positivity for the adult/sow farm category. However, according to the SDRS advisory board, this activity is due to few farms and does not represent abnormal activity in sow farms. In the podcast, the SDRS hosts talk with Dr. Lauren Glowzenski (JBS) about solutions for decreasing PEDV activity in farms and PRRSV ORF5 sequence regional diversity.

April 2024. This month's Domestic Swine Disease Monitoring Report brings the new influenza A virus state-level monitoring dashboard. The newly implemented tool aids veterinarians and producers in identifying if the percentage of influenza A positive cases is above expected in their region on a monthly basis. Also, the report brings information about the wean-to-market positivity remaining high for PRRSV, with some regions such as Iowa and Indiana having a percentage of positive submissions above the expected. For enteric coronaviruses, PEDV and PDCoV positivity decreased during March, mainly in the wean-to-market category. However, in the state-level monitoring, the overall positivity is above the expected for PEDV in Kansas and PDCoV in Minnesota and Missouri. Influenza A virus substantially increased positivity for the wean-to-market farm category, with 51% of the IAV-positive cases being lung submissions. In the podcast, SDRS hosts talk with Dr. Peter Schneider (Innovative Agriculture Solutions) about managing animal health in highly swine dense areas.

May 2024. This month's Domestic Swine Disease Monitoring Report brings the new SDRS PCR dashboard. The new dashboard is a compilation of all the PCR data for the eight pathogens

monitored by the project that will be publicly available, enabling our audience to look at the trends of detection over time by specimen, category, and geographic location. Also, the report brings information about the record of PRRSV ORF5 sequences detected as L1C.5 (variant) for the month of April (355). Since its emergence, L1C.5 has never had this amount of detection in a month, except in November of 2022 (405). The majority of the sequences were from wean-to-market sites (190). Also, some specific regions such as Iowa, South Dakota, Indiana, and Illinois have a PRRSV percentage of positive submissions above the expected. For enteric coronaviruses, PEDV and PDCoV positivity continued to decrease during April, achieving low levels of positivity. However, in the state-level monitoring, the overall positivity continues above the expected for PEDV in Kansas and PDCoV in Minnesota and Missouri. PCV3 substantially increased positivity for the sow farm category, where 63% of submissions were positive. At the ISU-VDL, there were consecutive alarms of the increased number of confirmed diagnoses for PRRSV in tissue cases. Podcast hosts talked with Dr. Cameron Schmitt (Pipestone) about Influenza A virus monitoring and control strategies.

June 2024. This month's Domestic Swine Disease Monitoring Report brings information about the PRRSV positivity remaining at high levels in the wean-to-market category, with 41% of submissions being positive. Also, at a state-level monitoring, the overall PRRSV positivity was above the expected in Iowa, South Dakota, and Indiana. For enteric coronaviruses, PEDV and PDCoV positivity continued to decrease as expected for the beginning of the summer, with PEDV having 10% and PDCoV having 3% positive submissions. However, in the state-level monitoring, the overall positivity continues above the expected for PEDV in Kansas and for PDCoV in Minnesota. *Mycoplasma hyopneumoniae* was above the expected in the weekly monitoring, with the weeks of May 6 and May 13 increasing positivity, driven mainly by sow farm submissions. The advisory group highlighted the presence of more co-infections in the field with PRRS, mainly bacteria such as *Pasteurella multocida*, *Glaesserella parasuis*, and *Streptococcus suis*. At the ISU-VDL, PRRSV, *Streptococcus suis*, Influenza A virus, *Pasteurella multocida*, and *Glaesserella parasuis* are the top five pathogens diagnosed in submitted tissue cases and also show this pattern of co-diagnosis. The podcast hosts talked with Dr. Luc Dufresene (Demeter Quebec and Swine Veterinary Partners) about regional biosecurity for control & prevention of pathogen spread; tips and tricks for PEDV elimination initiatives; success stories of regional elimination of PEDV and PRRSV L1C.5; and implications of PRRSV diversity.

July 2024. This month's Domestic Swine Disease Monitoring Report brings PEDV PCR genotyping information onboard, providing stakeholders with knowledge on how many samples have been tested, detection of the non-Indel variant (historically more pathogenic), the Indel (considered a milder strain), and samples that had the detection of both. Also, the report brings information about the decrease in PRRSV positivity in June, reaching less than 40% positivity in the wean-to-market submissions. At a regional level, PRRSV's overall positivity is still above the expected in South Dakota and Indiana. For enteric coronaviruses, PEDV and PDCoV positivity decreased during June, and PDCoV positivity was as low as 1.3% of overall submissions. At the regional level, the PEDV overall positivity is above the expected in Kansas and Ohio. PCV3 and PCV2 had increased positivity in the sow farm category, whereas 65% of submissions were positive for PCV3 and 34% were positive for PCV2. The podcast hosted a talk with Dr. Deb

Murray (New Fashion Pork) about farm management and animal health tips for the summer period and strategies for E.coli control upper and downstream.

August 2024. This month's Domestic Swine Disease Monitoring Report brings a brand new PRRSV ORF5 sequence page, providing stakeholders four new charts describing the number of sequences retrieved by month, how many sequences are considered new PRRSV strains using the criteria of < 95% similarity within the SDRS database, and a dynamic table with the three most frequently detected strains by State. Also, SDRS reports the second consecutive month of decreased PRRSV positivity, reaching 19% of overall positivity. At a regional level, PRRSV's overall positivity is above the expected in South Dakota, Oklahoma, and Indiana. PRRSV lineage 1C.2 RFLP 1-2-4 is the predominant strain detected in Illinois and the second most frequently detected in Iowa, calling attention to becoming the third most frequently detected PRRSV strain in the U.S. Regarding enteric coronaviruses, PEDV and PDCoV positivity remains at relatively low levels, with 4% and 1.5% positivity, respectively. Mycoplasma hyopneumoniae percentage of positive submissions coming from sow farm and wean-to-finish sites in July increased, having an overall percentage of positive cases above the expected between June 24th and July 8th. The podcast broadcasts a talk with Dr. Jianqiang (JQ) Zhang (Iowa State University) about how to interpret differential PCRs for PEDV genotypes, the global scenario of enteric coronaviruses, and the PEDV elimination task force.

September 2024. 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.

October 2024. This month's Domestic Swine Disease Monitoring Report includes a survey which asks for your input on the SDRS Strategic Plan. SDRS reports increased PRRSV activity in Iowa, Oklahoma, and South Dakota. The overall PEDV percent case positivity remains low at 4%. However, there is an increase in finishing sites' PEDV percent case positivity in Kansas above expected levels. For the third consecutive month, an increase in the percent positive case submissions for *Mycoplasma hyopneumoniae* in wean-to-finish sites was reported. *Mycoplasma hyopneumoniae* positivity remains steady from the previous month in sow farms, with 12% positive case submissions reported. An increase in case positivity for influenza A virus, mainly in the finishing sites, was noted with the advisory group highlighting that growing animals close to market were more affected. The podcast broadcasts a talk with Dr. Janice Zanella (Embrapa Swine and Poultry, Brazil) about the global scenario of the influenza A virus, the importance of

influenza A virus in the swine industry and its public health issues, and finally, strategies for controlling IAV in the farms.

November 2024. This month's Domestic Swine Disease Monitoring Report includes a bonus page about diagnostic data supporting effective *Mycoplasma hyopneumoniae* (MHP) control in breeding herds. SDRS reported increased PRRSV positivity in both sow farms and wean-to-finish sites. PRRSV's overall positivity was above the expected in Iowa, Oklahoma, Indiana, and South Dakota, with Lineages L1C.5 and L1A being predominantly detected. PEDV positivity started to increase at a regional level, with Iowa, Oklahoma, and Missouri beginning to have more positive cases in October. MHP continues with a high percentage of positive submissions in wean-to-finish sites. However, the advisory group reported that most submissions with MHP testing were due to elimination protocols. In the confirmed tissue diagnosis, there were alarms for increased PRRSV, Influenza A virus, and *Pasteurella multocida*. The podcast broadcasts a talk with Dr. Lisa Becton (Swine Health Information Center) discussing steps to prepare for the potential increase in pathogen activity in the winter and the efforts to eliminate endemic pathogens in the swine industry.

December 2024. This month's Domestic Swine Disease Monitoring Report provides information about the highest positivity of PRRSV in the wean-to-market category (50%) since November 2018. This positivity was mainly driven by the PRRSV lineage 1C.5, which had a record number of detections (n = 403) within a single month since its emergence. Also, the detection of this lineage broke the 2023 record by 281 cases, with 2,765 detections to date. PEDV positivity increased in November for Iowa, Oklahoma, Minnesota, and Missouri. Influenza A virus positivity increased in sow farms, reaching 36% of positive submissions overall. *Mycoplasma hyopneumoniae* had a decrease in the wean-to-finish positivity (25%) but remains high compared with previous years. In the confirmed tissue diagnosis, there were alarms for increased PRRSV, influenza A virus, *Pasteurella multocida*, *Streptococcus suis*, and *Mycoplasma hyorhinis*. The podcast broadcasts a talk with Dr. Daniel Boykin (Smithfield Foods) about endemic pathogen activity in the US and biosecurity tips for PEDV and PRRSV.

Improving Swine Health Information

SHIC Renews Morrison Swine Health Monitoring Project Funding for 2023-2024

With funding from SHIC renewed for 2023-2024, the Morrison Swine Health Monitoring Project's industry-driven goals continue to focus on enhancing the health of the US swine herd by providing tools that enable implementation of expanded preparedness measures to address emerging or foreign animal disease emergencies. This includes continuously tracking and analyzing trends in the incidence, prevalence, and elimination of pathogens, sustaining ongoing surveillance of PRRSV sequences impacting the US swine population, enhancing producer engagement, broadening representation of the industry, and facilitating access to timely and relevant disease information.

In their proposal for funding, the MSHMP team wrote, "Building on our longstanding dedication to the swine industry foreign animal disease preparedness, we remain committed to the development of tools for the industry through collection, analysis, and reporting of data

pertaining to endemic disease incidence and eradication endeavors." In 2023-2024, the team will explore potential inclusion of new pathogen incidence estimations, specifically Senecavirus A, while ensuring the ongoing accuracy and reliability of MSHMP's data. MSHMP will continue to actively cultivate relationships and facilitate interactions among participants, as well as foster collaborations between participants and research institutions.

Endemic swine diseases and potential for foreign animal disease introduction pose a risk to the US pork industry. These challenges form the basis for MSHMP's sustained effort to understand, monitor, and mitigate disease risks. Launched in 2011, MSHMP has made substantial contributions to swine health management in the US by monitoring the health status of individual breeding sites, which collectively represent more than 60% of the US breeding herd. MSHMP has facilitated a more comprehensive understanding of the impact of diseases like PRRS and PED while also uncovering data insights such as spatial and temporal patterns of disease transmission, the molecular evolution of PRRSV, and risk factors associated with disease outbreaks.

MSHMP's granular data has allowed for the timely detection and detailed description of newly emerging PRRSVs variants such as the Lineage 1C 1-4-4. And new developments within the project will help shape the industry's response to ongoing disease challenges. For example, MSHMP's data increases understanding of the endemic transmission of diseases like PED, offering the industry the opportunity to engage in informed discussions about elimination strategies.

MSHMP Continues to Build Capacity with SHIC Funding per Annual Report

In the eighth annual report to SHIC, which provides the primary funding for its work, Morrison Swine Health Monitoring Project leader Dr. Cesar Corzo of the University of Minnesota detailed project outcomes for its three primary objectives. MSHMP monitors trends in pathogens incidence and prevalence, conducts prospective monitoring of PRRSV sequence evolution and impact, and expands participation of producers to increase relevance and deliverables to the swine industry.

Swine pathogens PRRSV, PEDV, PDCoV, SVA, and central nervous system associated viruses are routinely monitored and compared to historical trends. Additional investigations were undertaken to evaluate pathogen patterns, epidemiology and herd stabilization post-infection. MSHMP investigated the relationship of the PRRS RT-PCR positivity rate between breeding and growing pigs during 2015 to 2020 from MSHMP participants. A correlation was identified in the time lapse between positive submissions from nursery/finisher samples and adult/farrowing samples. The correlation found that adult/farrowing positivity follows the same trend as the nursery/finisher positivity with a one-week lag. However, the data was interpreted with caution as no account for spatial distribution or PRRS virus sequence information was included. Consequently, MSHMP was unable to conclude that the increase in PRRS positive rate in breeding herds is due to an increase in positivity rate in growing pigs.

In another investigation, MSHMP assessed the frequency of PRRS outbreaks in breeding herds managing mortality either through composting, incineration, or rendering. The goal of the investigation was to identify associations between carcass disposal methods and PRRS

occurrence. Results of the study include analysis of 133 breeding sites from eight production systems to date. One finding included a higher numerical rate of ≥1 PRRS outbreaks on sites using compost (29.7%) compared to sites using rendering (21.1%). However, when accounting for variables such as production system, average inventory, air filtration status, and state, composting was not associated with a higher number of PRRS outbreaks when compared to rendering ($p = 0.67$). Further assessment of data is warranted once additional data is received from participating systems and the study is evaluated over an extended time frame.

Regarding PEDV, MSHMP quantified the time that positive herds required for stabilization across both the epidemic phase (May 1, 2013 – December 31, 2014) and the endemic phase (January 1, 2015 – June 30, 2023). Results concluded that those infected during the epidemic phase of the disease in the US took nine weeks longer to reach stability than those infected during the endemic phase, reflecting industry progress in PEDV control. Being able to estimate time to stability can assist producers and their veterinarians develop an effective herd plan for PEDV management and potential elimination.

For PRRSV outbreaks, MSHMP provided an extensive dataset to report the spatial-temporal distribution of strains similar to the outbreak strain, providing invaluable information during outbreak investigations. MSHMP characterized the epidemiological situation of an emerging PRRS virus (L1C-124) that was thought to be virulent and fast spreading. A total of 382 case sequences were identified across 16 production systems. Most sequences originated from breeding sites ($n = 223$) compared to grow/finish sites ($n = 127$), with the sequences originating from 118 unique sites (73 grow/finish, 37 breeding, and eight unknown). Even though the virus did disseminate, it did not reach the transmission speed and magnitude of spread for other recently identified PRRS variants. Clinical impact was also characterized and found to be similar to the recent L1C-144. Continuous monitoring and assessment of emerging PRRS strains is critical to manage transmission and highlights the need for focus on biosecurity practices to prevent spread.

During 2022-2023, MSHMP added four production systems to their ongoing collection of swine health data. The project's database now has 1,274 sow farms housing approximately 3.8 million sows, 3,318 growing pig farms with 12.2 million pig spaces, and 48 boar studs totaling 12,799 boars. The addition of new groups and voluntary participants allows for improved monitoring to assess the role grow-finish populations play for area/regional disease pressure.

MSHMP's first publicly available website officially launched in Q3 of 2023 and has been continuously updated. This website is designed to optimize MSHMP output dissemination within both the participant and industry communities. The website has been designed with 10 comprehensive sections, including Home, About, History, People, Reports, Outreach, Ongoing Projects, News, Resources, and Contact Us. The website has been accessed by individuals from 41 countries with the highest number of users coming from the US, China, and Spain.

PRRSV and PEDV cumulative incidence data graphs from MSHMP are also now included in SHIC's monthly e-newsletter along with a link to sign up to participate in the program and/or receive weekly reports.

SHIC/AASV Porcine Circovirus-Focused February 2024 Webinar Provides Timely Updates

On February 6, 2024, the Swine Health Information Center along with the American Association of Swine Veterinarians offered a webinar focused on emerging trends of porcine circovirus. Expert presenters provided the latest information on porcine circovirus including domestic and global distribution, new research updates, diagnostic trends, sample types submitted for surveillance, interpretation of test results, and practitioner perspectives for disease management strategies.

There were 311 people registered for the PCV webinar, conducted by the Swine Medicine Education Center at Iowa State University, which is now available online for review. The first presenter, Dr. Tanja Opriessnig, ISU, provided a general disease overview including domestic and global distribution, recent research outcomes, and an update on PCV4. She said although PCVs were first identified approximately 27 years ago, an improved understanding of circoviruses and their impact on swine health has continued to evolve over time.

PCV2 has been a significant health challenge for global pig producers for many decades. Dr. Opriessnig said PCV2-specific vaccines have worked remarkably well to prevent viral health impacts since global introduction in 2006. Modern PCV2 vaccines provide cross-protection against currently known PCV2 genotypes and are among the most widely used vaccine in growing pigs. Dr. Opriessnig shared evidence of the global distribution of PCV3 as well as the recent identification of PCV4 in Asia and Spain, saying a more field-based approach is needed for prevention, preparedness, and response to emerging PCVs. Dr. Opriessnig remarked that initial evidence shows that PCV3 vaccines are helpful for control and that monitoring for emerging strains, including porcine circovirus-like viruses, is ongoing.

Dr. Darin Madson, ISU Veterinary Diagnostic Lab, shared background information for PCV2, stating it is a globally distributed and ubiquitous virus with very few negative swine herds in the US. PCV2 is an economically important disease, ranking as one of the top three infectious agents in the swine industry. Dr. Madson remarked that infection generally occurs after waning of maternal antibodies in pigs 7- to 15-weeks of age. Transmission of PCV2 is possible both horizontally (pig to pig) and vertically (dam to offspring) through nasal-oral and fecal-oral routes. He pointed out a major route of transmission occurs through virus secreted and/or excreted in urine, ocular discharge, nasal discharge, saliva, and feces.

Fomites capable of transmission include needles, insects, and rodents. Aerosol transmission of PCV2 is possible as the virus has been detected in exhaust air and dust outside barns; however, infectivity is unknown. The virus is environmentally hardy and difficult to inactivate with disinfectants.

During his presentation, Dr. Madson shared an AASV Board-approved porcine circovirus position statement to aid in accurate diagnosis of PCV. PCVAD can be subclinical or include one or more of the following clinical manifestations concurrently:

- High mortality: Doubling of historical mortality rate
- Respiratory signs including pneumonia
- Porcine dermatitis and nephropathy syndrome (PDNS)

- Enteric signs including diarrhea and weight loss
- Reproductive disorders including abortions, stillbirths, and fetal mummification

For diagnosis, the following signs are triggers:

- Clinical signs of disease
- Lymphoid depletion +/- histiocytic replacement
- PCV2 antigen or nucleic acid associated with lesions

Dr. Madson discussed the continued challenge of determining PCV2 infection vs disease. He stated the diagnosticians' dilemma is interpreting positive test results without clinical disease or lesions. His presentation also included a review of PCV2 immunity and reviewed information about possible causes of disease control lapses and immunity failures.

Dr. Pablo Pineyro, ISU VDL, provided further information regarding PCV2 vaccination and impact on reducing viral load in serum and tissues, albeit not completely stopping PCV2 antigen expression. Dr. Pineyro shared knowledge gained from VDL submissions, stating the amount of PCV2 DNA and antigen detected by PCR and IHC strongly correlates with vaccination status. Genetic changes of the virus over time can affect vaccine protection and vaccination challenges should be evaluated in association with genetic changes and biological relevance on the farm. While PCV2 vaccine has reduced PCVAD clinical prevalence, it has not changed the challenges associated with PCVAD diagnosis. For PCVAD diagnosis, a correct interpretation of the result depends on the clinical question and the diagnostic tool.

When considering PCV3, the challenge is to determine clinical relevance, including causation vs detection. Currently, there is a lack of specific lesions and direct detection tools for PCV3. Clinical cases associated with infection and multi-systemic inflammation (grower-finishers) are all being considered, Dr. Pineyro noted.

Dr. Mark Ladd, Smithfield, shared his experience with PCV detection, treatment, and management from 2014-2023. During this time, he oversaw 65,000 sows and all related downstream nurseries and grow/finish units. In 2014, he started using sequencing to identify PCV2 genotype and evaluate vaccination status. If PCV2b was detected, Dr. Ladd concluded either animals were not vaccinated, if seen in multiple ages with a specific flow, or there was a vaccine failure which was usually an individual farm problem. If PCV2d was detected, Dr. Ladd would not look at vaccination status as the primary cause. Calling it the PCV2d puzzle, Dr. Ladd noted vaccinated animals can still be viremic but may or may not have clinical disease as the virus can be found in healthy pigs. These characteristics make diagnosing reproductive failure by PCV2d very difficult, per Dr. Ladd.

Sharing his experience with growing pigs, Dr. Ladd said elevated mortality and a lack of response to antibiotics were factors initiating tissue collection for a diagnostic workup. Suspect PCV cases with either lesions consistent with PCVAD or PCR Ct values less than 25 raised concern. Dr. Ladd said 6% of the PCV2 cases he saw were from nursery pigs (3- to 10-weeks of age) and 94% of the cases were from finishing pigs (11- to 31-weeks of age). Among the PCV2 cases, 88% were also PRRSV positive and 25% were IAV positive, with only 5% having neither PRRSV nor IAV. Dr. Ladd said flows returned to normal when PRRS and/or IAV were addressed. Methods to stabilize the herds included depop/repop if it was a continuous flow

growing site or stopping PRRSV circulation upstream at sow farms. IAV vaccine was used after determining strains found in the herd. His experience leads Dr. Ladd to say it appears PCV2d needs co-infection to be clinically relevant. And he asks, does co-infection with PRRS and/or IAV increase the possibility of PCV2 vaccine failure in pigs?

Dr. Chelsea Stewart, Christensen Farms, began by asking if the detection of PCV2 is clinical, subclinical or irrelevant? In her experience, PCV2 was occasionally detected in certain flows without PCVAD clinical signs. She noted significant stressors such as PRRSV, poor ventilation, weather changes, and delayed vaccination appear to be risk factors. When PCVAD was present, signs included CT values in the low teens, lymphoid depletion, wasting, and fallout.

In response to PCVAD in one commingled flow, Dr. Stewart initiated field exposure surveillance in cooperation with ISU VDL and Boehringer Ingelheim. A cross-sectional surveillance of downstream flows was to determine the timing of exposure and if the existing vaccination timing made sense. Sow farm surveillance included collecting processing fluids in one room per week for 12 weeks. Dr. Stewart said this was designed for long-term, system-wide surveillance. From the processing fluids, the VDL sequenced several positives with most being PCV2a or PCV2d, with a few PCV2e. As a result, Dr. Stewart's overall question was, can we correlate PF PCR CT values to sow immune status to gauge efficacy of the current vaccine protocol?

Another step in their process was to determine individual processing fluid correlation to sow immune status. To measure this, two sow farms with PCR positive results and a high rate of fetal mummification were chosen for further investigation. Processing fluids were collected from litters and serum from sows. Sows were equally divided with 10 at parity one, 10 in parities two through five, and 10 at parity five or more. Dr. Stewart said no cross fostering was allowed until after processing fluids were collected. Processing fluids were evaluated for PCV2 by PCR and serum was used for PCV2 antibody testing. Goals of the study were to evaluate if CT value correlated to individual sow status or parity.

Dr. Stewart concluded by saying they did not detect a parity difference but did identify a gap in gilt immunity that may have resulted in the PCVAD cases. As a result, they modified their vaccination program to include booster vaccines at the sow farms and a rescue dose to growing pigs between 5- and 9-weeks of age. Flow has continued to perform around target since discontinuing the rescue dose and sows are a full gestation past whole herd booster. Vaccination compliance is critical, per Dr. Stewart who also recommends not chasing positive CT results without a clinical diagnosis.

PCV presents a significant swine disease challenge and is included in SHIC's 2024 Plan of Work as a priority pathogen.

SHIC-Funded MSHMP Project Fills PDCoV Epidemiologic Information Gap

In February 2014, porcine deltacoronavirus emerged in the US nearly one year after the initial detection of porcine epidemic diarrhea virus, further impacting the US swine industry. Dr. Mariana Kikuti with MSHMP at the University of Minnesota, along with colleagues Drs. Catalina Picasso-Risso and Cesar Corzo, conducted a Swine Health Information Center-funded study to fill the gaps in current epidemiologic information regarding PDCoV post-introduction.

MSHMP data available between January 2015 and December 2023 were analyzed, representing approximately 60% of the US breeding herd. During the study period, 244 PDCoV outbreaks occurred across 186 sites from 22 production systems in 16 different states. Yearly cumulative PDCoV incidence ranged from 0.44% in 2017 to 4.28% in 2023. Research findings underscore the importance of continued monitoring and control measures to mitigate the impact of PDCoV in the US.

PDCoV causes atrophic enteritis in neonatal piglets, leading to acute watery diarrhea, malabsorption, dehydration, and death. In 2014, upon initial emergence, data from laboratory testing indicated PDCoV was detected in 25-30% of samples submitted from clinically affected pigs, with cases being reported across >10 states. In reporting from US veterinary diagnostic laboratories, PDCoV occurrence is described as the percentage of positive case submissions. Since laboratory submissions more frequently represent clinically affected cases, the probability of testing positive is typically greater than the general swine population.

In the current study, researchers utilized data available from producer participants who report PDCoV weekly status to MSHMP. Data from the participating breeding herds was utilized to calculate the yearly cumulative incidence of PDCoV as an estimation of disease occurrence across the general breeding population. Providing a unique dataset, MSHMP includes the weekly status of herds both clinical and nonclinical for diarrheal disease.

Since January 2015, results of the study showed a total of 244 PDCoV outbreaks have been reported to MSHMP, originating from 186 sites, belonging to 22 production systems, and located across 16 US states. During the entire nine-year period (2015-2023), 140 herds reported one PDCoV outbreak, 36 herds reported PDCoV twice, eight reported it three times, and two herds reported PDCoV outbreaks four times. For sites that experienced more than one PDCoV outbreak during the study period, the interval between outbreaks had a median interval of 2.11 years, ranging from two months to almost five years.
PDCoV case locations were divided into West, Midwest, Northeast and South. Most cases occurred in the South (69.9%) and the Midwest (24.7%), with the remaining cases located in the West (1.6%) and Northeast (0.5%). While most cases occurred in the Midwest in 2015 and 2016, a change occurred in 2017 when most cases originated in the South. The yearly cumulative PDCoV incidence ranged from 0.44% in 2017 to 4.28% in 2023.

Researchers noted that no standardized classification of PDCoV status has been proposed that would allow an estimate of disease prevalence fluctuations over time. Further, the absence of universally adopted standardized criteria for declaring a herd negative post-outbreak also hampers the ability to have a comprehensive understanding of an outbreak's duration. "Efforts to standardize monitoring and classifying a herd as negative after an outbreak should be made if the goal is to better understand the disease dynamics," investigators wrote. While PDCoV occurs at a much lower frequency than other important swine diseases such as PEDV, this study provides evidence that PDCoV is still present in US breeding herds and that incidence has increased when compared to early years immediately post-introduction. The findings from this study highlight the importance of continued monitoring of PDCoV in US breeding herds to note changes in occurrence and that focus on control measures is needed to limit the impact on US swine production.

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

SHIC, in collaboration with AASV, 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.

Swine Disease Reporting System Seeks Your Input on Survey

To be responsive to current US swine industry issues and needs related to disease pathogens, the team assembling the Domestic Disease Monitoring Report has developed a survey to gather stakeholder input. Your response to this survey will help improve reports, suggest new features, and provide guidance on additional pathogens to include. SHIC encourages your feedback via this survey. Your response is requested by November 15, 2024. SHIC funds this domestic swine disease surveillance system creating the monthly Domestic Disease Monitoring Report with the goal of sharing information on the activity of endemic and emerging diseases affecting the swine population in the US. The primary objective of the program is to assist veterinarians and producers in making informed decisions on disease prevention, detection, and management.

Initiated in 2019, the Swine Disease Reporting System is a collaborative effort among multiple VDLs to aggregate swine diagnostic data and report it in an intuitive format, describing dynamics of pathogen detection by PCR-based assays over time, specimen, age group, and geographic area. In the beginning, information for one pathogen (PRRSV) from one veterinary diagnostic laboratory was the focus. Since then, five more laboratories have joined the project with six currently participating. Data is collated from the Iowa State University VDL, South Dakota State University ADRDL, University of Minnesota VDL, Kansas State VDL, Ohio ADDL, and Purdue ADDL. Over the last five years, additional pathogens have been added based on recommendations from stakeholder feedback and the SDRS advisory group, which consists of veterinarians and producers across the US swine industry. There are currently nine domestic disease pathogens being monitored through the monthly report, including data on PRRSV (PRRSV-1 and PRRSV-2), PEDV, PDCoV, TGEV, *Mycoplasma hyopneumoniae*, PCV2, PCV3, and influenza A. Further, SHIC has recently funded the addition of Escherichia coli PCR genotyping to the Domestic Disease Monitoring Reports, allowing for continuous reporting of genotype, virotype, and detection data.

Your input is greatly valued and helps keep the SDRS relevant to current swine industry disease issues. The survey provides opportunities to recommend additional pathogens, laboratories, and

features which help increase the value of the report. Thank you for taking the time to complete the SDRS survey!

Updated SHIC Fact Sheets for Pseudorabies, Japanese Encephalitis, Ebola, and Reston Viruses Available

As one of SHIC's most accessed resources, swine disease fact sheets provide specific information on emerging or re-emerging pathogens. Recently updated, these facts sheets for pseudorabies virus, Japanese encephalitis virus as well as Ebola and Reston virus are now published. Newly included information encompasses disease outbreak demographics and impacts, virology and surveillance strategies, and incorporates peer-reviewed research results addressing multiple components for disease management. A key component of SHIC's mission is to generate and communicate information for prevention, preparedness, mitigation, and response efforts for emerging swine disease threats. Providing current and up-to-date information through the curation of the swine disease fact sheets supports this mission.

The fact sheet informational framework is supported by an in-depth literature review for each respective pathogen. Each section presents pathogen-specific information such as the importance of the pathogen to the industry, public health impacts, epidemiology, pathogenesis, diagnostic detection, clinical presentation and treatment for swine, as well as steps for prevention and control. Each fact sheet covers a single disease-causing agent with pathogen-specific information.

Although US commercial swine herds have been officially free of pseudorabies virus since 2004 after a national eradication program, PRV is present in US feral swine that serve as a constant reservoir and source of the virus. The PRV fact sheet provides new details describing the differences between a recently identified variant strain in China and the classic PRV strain, including clinical presentation and risk to swine. Implications for surveillance, control measures, and potential vaccine strategies to mitigate disease are also included.

Japanese encephalitis virus is a mosquito-borne, zoonotic disease that has been recently identified as a potential emerging swine pathogen. In 2022, Australia experienced a novel outbreak of JEV genotype IV in their national swine herd populations that affected new geographic regions. The Australian outbreak spread quickly, causing significant reproductive losses in their breeding herds across areas of the country in which the virus had not previously been identified. The JEV fact sheet highlights key demographic and clinical impacts of the recent Australian outbreak in swine, public health impacts, and identifies gaps in preparedness based on recent research funded by SHIC.

Ebola virus causes a zoonotic disease that has significant human health impacts while the related Reston virus does not cause disease in humans. The new fact sheet includes updates to the terminology and taxonomy used to name the different viruses. While Reston virus has been identified in pigs, clinical signs or death due to natural Ebola virus infection has not been reported in pigs. Updated information is provided on experimental infection, transmission and detection prevalence, as well as immunity and post-exposure data for Ebola and Reston virus. The fact sheet reiterates that Reston virus should be considered a livestock pathogen with zoonotic potential and that transboundary routes of transmission could pose a risk to US swine.

Providing publicly available, science-based fact sheets supports SHIC's mission of minimizing the impact of emerging disease threats through coordinated communication of key resources and improving swine health information. The SHIC swine disease fact sheets can be found online.

SHIC Renews Domestic Swine Disease Monitoring Reports and Approves *E. coli* Addition

The Swine Health Information Center has renewed funding for the Domestic Swine Disease Monitoring Report including the addition of *Escherichia coli* monitoring, through September 2025. Leading the project are Drs. Giovani Trevisan and Daniel Linhares, Iowa State University. The SDRS program was initially funded by SHIC in 2017 and continues to focus on the analysis and reporting of collated veterinary diagnostic laboratory data to identify emerging endemic disease trends. Reports provide producers with an early warning system to prompt preventative actions such as increasing monitoring and heightening biosecurity measures. As a recently approved addition, *Escherichia coli* monitoring data is anticipated for inclusion in the report starting in spring 2025.

SDRS aggregates and reports veterinary diagnostic lab data collected across the US representing more than 96% of all swine samples submitted for testing. The SDRS database is the largest publicly available source of swine health information reporting diagnostic data across all phases of swine production from boar studs to grow finish pigs and includes feed and environmental sample submissions. SDRS reporting maintains a database of PCR-based detection results from participating laboratories while providing monthly Domestic Swine Disease Monitoring Reports (PDF, audio) to SHIC, published in its monthly enewsletter and posted on its website. SDRS continuously updates its live interactive dashboards found online.

Initial success of the SDRS program led to expansion of both participating laboratories and monitored pathogens over the eight years of funding by SHIC. Currently, data is incorporated from six VDLs, including Iowa State University VDL, University of Minnesota VDL, South Dakota State University Animal Disease and Research Diagnostic Laboratory, Kansas StateVDL, Ohio Animal Disease Diagnostic Laboratory, and Purdue University Animal Disease Diagnostic Laboratory. Data on nine domestic disease pathogens are being monitored through the monthly report, including PRRSV (PRRSV-1 and PRRSV-2), PEDV, PDCoV, TGEV, *Mycoplasma hyopneumoniae,* PCV2, PCV3, and IAV.

Since inception, SDRS has provided valuable information to the US swine industry, including seasonal trends of pathogen detection, predominant PRRSV strains by location, real-time information on emerging diseases, identification of re-emerging threats like PEDV, monitoring of *Mycoplasma hyopneumoniae* control efforts, and increased biosecurity awareness in finishing phases. The addition of *E. coli* PCR genotyping to the Domestic Disease Monitoring Reports will allow for continuous reporting of genotype, virotype, and detection data.

E. coli, a frequently identified bacterium in pigs, can create significant enteric disease challenges in all ages of pigs but most commonly impacts neonatal and weaned pigs. Infection can lead to significant economic losses through increased morbidity, mortality and costs for supportive care and treatment of sick pigs. Antibiotic resistance is a growing concern, making treatment difficult.

While mitigation and management strategies are available, such as nutritional and vaccine use options, they are not always effective against the disease.

Recently, *E. coli* infections have been increasing in the US, particularly post-weaning colibacillosis. Current methods for identifying *E. coli* strains are PCR-based assays, but there is no national-level reporting system for *E. coli* genotypes and virotypes. Expanding the SHIC Domestic Swine Disease Monitoring Reports to include *E. coli* genotyping and virotyping data will provide valuable insights into the trends and geographic distribution of this pathogen. This information can be used to identify regional trends in virulence genes, inform disease control strategies and reduce the impact of *E. coli* on US swine.

The SDRS program has become a vital resource for the US swine industry by informing veterinarians and producers about disease detection trends and visualization of changes in swine health on a regional and national basis. Renewal of the program will allow SDRS to continue to enhance disease monitoring, inform pathogen elimination programs, support informed decision-making, and protect the health and productivity of the US swine herd.

Monitoring and Mitigating Risks to Swine Health

SHIC Global Disease Monitoring Report Renewed by Board

Since December 2017, more than 80 Global Swine Disease Monitoring Reports have been developed by a team at the University of Minnesota, now led by Dr. Maria Sol Perez Aguirreburualde. Funded by SHIC as part of its mission to identify emerging disease threats, the monthly reports are published in the SHIC newsletter and serve as a frequently accessed resource for the swine industry on the SHIC website. Reports are built with near real-time global surveillance of swine diseases for their content and rely on a network of global collaborators to expand and verify regional information. With renewal, the GSDMR will continue and expand in 2024 with a new online dashboard to display the global distribution of priority swine diseases in near real-time.

The GSDMR uses a continually updated procedure of screening to identify and score swine disease related events that may represent a risk for the US swine industry and reports those results on a monthly basis. Both official and unofficial information sources from primary or secondary platforms are collected, reviewed, then organized by disease and geographical region. A technical team subsequently synthesizes and frames each disease section, facilitating its interpretation by the audience reviewing the GSDMR.

After a multi-step review phase in which data and information is verified, edited, and/or expanded, in collaboration with key technical informants and a network of US and international stakeholders, a report describing the surveillance outcome is made available to SHIC. In extraordinary circumstances in which a rapid response is indicated, an immediate release of health event data is developed for rapid sharing with the pork industry (e.g., the first African swine fever outbreak in China, first ASF outbreak in Belgium, first classical swine fever outbreak in Japan in 25 years).

From November 2022 through April 2024, 17 GSDMRs were produced, highlighting the continuous expansion of ASF in Asia, Europe, and Latin America. Currently, the three USDA-classified tier 1 reportable foreign animal diseases of swine (ASF, CSF, and foot-and-mouth disease) are included in the report. Additional swine diseases listed in the SHIC disease matrices, such as influenza and pseudorabies, are also included when appropriate after considering the epidemiological context of the event.

In 2023, a new section was incorporated into the GSDMR to provide specific regional disease information for swine industry stakeholders. In this feature, entitled “Focus on,” comprehensive snapshots of current knowledge of swine infectious diseases throughout regions were delivered quarterly. This section zoomed in on countries with emergent or consolidated pig production sectors. Feature goals were to build a temporal and spatial context regarding the dynamic changes of swine infectious diseases to support the understanding of point-in-time changes captured in the monthly report. Additionally, this new feature creates awareness of the risk dynamic to the US swine herd. A credible and consistent source of robust information is a crucial element for disease prioritization and for the development of risk-based preventive strategies to protect the swine industry.

The GSDMR is consistently one of the most accessed items in the monthly SHIC newsletter. In 2023, there were 7046 GSDMR page views on the SHIC website, making it one of the most visited on www.swinehealth.org.

The US swine industry is vulnerable to the introduction of emerging pathogens and routine swine disease monitoring provides early warnings of global disease challenges that could negatively impact US swine producers. GSDMR staff strive to continuously improve the model through developing private-public-academic partnerships to support near real time identification of hazards. This contributes to the mission of identifying disease risks and adds practical insight into the tools used by different stakeholders for disease prevention and control. Ultimately, the goals of the GSDMR are to continue contributing to identification of risks and raising awareness to support decision making process around current prevention and mitigation strategies for emerging disease introduction in the US.

Pork Industry Representatives Serve as US Delegation Members at WOAH General Session

The 91st General Session of the World Assembly of Delegates for the World Organisation for Animal Health recently convened from May 26 – May 30, 2024, in Paris, France. As part of the Session, WOAH marked a 100-year milestone anniversary since being founded in 1924. Representatives of the US pork industry served as members of the US delegation, including SHIC Executive Director Dr. Megan Niederwerder, National Pork Board Chief Veterinarian Dr. Dusty Oedekoven, and consultant to the National Pork Producers Council Dr. Liz Wagstrom. As WOAH serves as the global authority on animal health, the standards discussed and implemented can affect all US producers.

The General Session of the World Assembly of 183 member countries serves as the highest authority of the WOAH. The World Assembly includes delegates of all member countries and meets at least once a year. The General Session lasts five days every May in Paris, France.

During the General Session, delegates adopt international standards in the field of animal health with a focus on international trade, elect governing bodies of WOAH, adopt resolutions on the control of major animal diseases, examine and approve annual reports, and appoint the Director General of WOAH. Delegates also explore ways WOAH can collaboratively shape a sustainable future for global animal health and welfare.

Special Sessions, in addition to the WOAH Plenary Sessions, included a Global Coordination Committee for African Swine Fever meeting to identify ASFV priorities and goals for different regions around the world and a Special Session on Compartmentalization to discuss how regionalization, zoning and compartmentalization can support international trade.

The World Organization for Animal Health (WOAH) Terrestrial and Aquatic Animal Health Codes provide standards for the improvement of animal health and welfare and veterinary public health worldwide, including through standards for safe international trade in terrestrial and aquatic animals and their products. The manuals provide a standardized approach to the diagnosis of the diseases listed in the Terrestrial and Aquatic Codes. Diseases of concern to swine producers listed within the Terrestrial Animal Health Code include African swine fever virus, classical swine fever virus, porcine reproductive and respiratory syndrome virus, foot and mouth disease virus, pseudorabies virus, and include diseases of public health concern such as Japanese encephalitis virus.

SHIC Continues Research with DHS on $650K Grant from USDA NIFA to Investigate ASFV Stability in Soybean Products

In 2024, SHIC has continued to make progress on a 4-year $650,000 grant from the USDA National Institute of Food and Agriculture – Agriculture and Food Research Initiative Competitive Grants Program for research designed to reduce the risk of imported feed ingredients, specifically soybeans, from spreading African swine fever virus in the domestic swine herd. This project will define the stability of ASFV in soybean products commonly used in complete feed diets as well as improve diagnostic capabilities and surveillance tools for the detection of ASFV in contaminated soybean products and complete feed.

The project is entitled “Stability and detection of African swine fever virus in soybean products fed to pigs” and is part of the Tactical Sciences for Agricultural Biosecurity Program Area. The two research objectives of the project are to 1) assess stability of ASFV in soybean products commonly imported into the US and 2) increase the utility of diagnostic tools to detect ASFV in contaminated soybean products. Project goals include identifying soybean products at highest risk for ASFV introduction and increasing diagnostic screening capabilities for ASFV contamination of feed. SHIC has awarded the US Department of Homeland Security Science & Technology Directorate a subcontract to complete the research objectives and is actively collaborating with DHS on the procedures, project progress, and data analysis.

SHIC-funded Vehicle Movement Study Provides Insight into Risks for Swine Disease Spread

A project funded by SHIC focusing on the role of vehicle movement in swine disease dissemination has recently been published in the Journal of Preventive Veterinary Medicine. Principal investigators Drs. Gustavo Machado and Jason Galvis, North Carolina State University,

studied a novel method to analyze the role of vehicle movement in swine disease spread by accounting for the variability around pathogen stability and vehicle cleaning effectiveness. Specifically, the study investigated the moving vehicle's role in disease spread from farm to farm by considering 1) the factors that may affect the pathogen stability on the contaminated vehicle and 2) the efficacy of the procedure to clean and disinfect the contaminated vehicle.

Knowing there are many methods for swine disease spread, the objective of this study was to increase understanding around the risk of vehicles traveling to and from swine farms for disease transmission across the US pork industry. A goal was to define the contribution of moving vehicles in disseminating disease from farm to farm. The investigators collected vehicle movement data and vehicle cleaning efficacy data for the project. Using the African swine fever virus as the pathogen of interest in the model, they reconstructed a vehicle movement network to evaluate the possible dissemination of the ASFV between farms.

Investigators collected a year's GPS data on 823 vehicles moving between 6363 production sites across two US regions. Region one consisted of 1974 commercial swine farms managed by six production companies, and region two consisted of 4389 commercial swine farms managed by 13 production companies. Farms were classified into 24 types based on swine production phase and simplified into categories such as a sow farm, which contained breeding age animals. Five vehicle types were named by the type of use to include feed vehicle, pig-farm vehicle, pig-market vehicle, crew vehicle, and undefined vehicle. For each vehicle, 12 months of daily GPS tracker records were collected. Additional information was also collected, including company-owned cleaning stations for transportation biosecurity analysis and incorporation of vehicle cleaning and disinfection.

This study extended and updated a previously developed method for evaluating disease transmission across vehicle contact networks. For the current study, Drs. Galvis and Machado considered both vehicle cleaning and disinfection efficacy uncertainty along with ASFV stability decay in the environment.

"Our study revealed that although efficient cleaning and disinfection measures affected the number of farms connected through vehicle movements, simulations with 100% cleaning and disinfection still resulted in 88% of farms being in contact over one year," investigators wrote. "Importantly, achieving 100% cleaning effectiveness reduced the risk of between-farm contacts only when the ASFV stability was low (≤0.2). Conversely, there was an insignificant reduction in the number of between-farm contacts when the ASFV stability was still high (>0.8)." ASFV stability was measured on a scale from 0 to 1, with 1 being the greatest stability.

The investigators discovered vehicles visited different swine production companies' sites, enhancing the potential for between-company dissemination in the new study as well. In their report, the investigators found that in the absence of cleaning, vehicles connected up to 2157 farms in region one and 437 farms in region two. In region one alone, vehicles transporting feed connected 2151 farms, vehicles transporting pigs to farms connected 2089 farms, vehicles transporting pigs to market connected 1507 farms, undefined vehicles connected 1760 farms, and vehicles transporting personnel connected three farms.

Simulation results of the model provided valuable insight into how contact networks between farms could be reduced through vehicle cleaning, which was assumed to be 100% effective. Specifically, contact networks were reduced as follows:

- crew transport vehicles - 66% reduction
- vehicles carrying pigs to market - 43% reduction
- vehicles carrying pigs to farms - 26% reduction

“The results of this study showed that even when vehicle cleaning and disinfection are 100% effective, vehicles are still connected to numerous farms. This emphasizes the importance of better understanding transmission risks posed by vehicles to the swine industry and regulatory agencies,” they stated.

This study enhances understanding of the role of transportation vehicles in spreading diseases between farms and the risks involved. The new methodology introduced in this study can be used to develop novel disease control strategies, including rerouting vehicles based on their infection and risk status.

SHIC-Funded MSHMP Monitoring Detection of PRRSV variant 1H.18

The SHIC-funded MSHMP noted an increase in occurrence of a novel PRRSV variant in December 2023 and January 2024. In the May 10, 2024, MSHMP report, a total of 61 sequences belonging to the novel PRRSV variant 1H.18 have been reported as of week 19 of 2024 in the MSHMP database. This variant has been identified in nine production systems located mostly in Iowa (n=23) and Minnesota (n=22), along with one sequence detected in Illinois. The 61 1H.18 sequences originated from 46 unique sites, including five breeding, 10 grow-finish, 11 others, and 20 unknown. Assessing MSHMP data for changing trends in PRRSV strain occurrence can serve as an early warning for the presence of new or emerging viral variants. Close monitoring of PRRSV 1H.18 by the MSHMP team is ongoing. See the full report for contributing authors and figures and visit the MSHMP science page as well.

During initial analysis, the sequences belonging to this group were classified as a somewhat rare RFLP pattern (1-12-2) and consequently assigned to sub-lineage L1C or L1H, dependent on the classification method used. When the new variant classification (see below) was applied, a novel clade comprised of sequences positioned between sub-lineages L1H and L1C on the phylogenetic tree was identified. Per the MSHMP report, most of the 61 PRRSV 1H.18 sequences have now been classified as either RFLP 1-8-4 (n=32), 1-12-2 (n=20), or 1-12-1 (n=1). Sporadic detections of the 1H.18 variant date back to 2018 and a slight increase in cases has been noted since late 2023 and early 2024. MSHMP staff point out the surge in 1H.18 sequences in 2020 likely went undetected due to sequences at the time being classified as RFLP 1-8-4 and 1-4-4 L1C, common RFLP types that occur in many different lineages and sub-lineages, and many of the sequences originated from a single site. The production impact of this variant has not yet been formally assessed, although both mild and more severe clinical presentation have been reported by MSHMP participants.

In reporting on the new variant, MSHMP staff commented they do not currently have enough evidence to suggest this variant is of immediate concern to the swine industry, but prospective monitoring is warranted given the sudden increase in cases. The authors recommend careful

consideration when interpreting isolated case reports and sequence counts, as they may lead to erroneous conclusions due to reporting biases. MSHMP staff will continue to proactively monitor this variant, and additional reports will be issued as the situation unfolds.

In their report on the PRRSV variant, MSHMP staff included relevant observations, saying RFLP may erroneously group genetically dissimilar PRRS viruses while segregating closely related ones. Phylogenetic methods organize PRRS viruses into ancestral "families," commonly called lineages and sub-lineages that tend to form broad groups. Recognizing the need for a comprehensive fine-scale variant classification system across all sub-lineages, an American Association of Swine Veterinarians-funded working group, comprised of researchers from the University of Minnesota, Iowa State University, and USDA, is developing and testing a new variant classification method. The new variant nomenclature was used throughout the MSHMP Science Page, since lineage/sub-lineage and RFLP (either separately or combined) were not initially accurate when used as case definition to identify this novel 1H.18 clade.

These observations underscore the challenge faced by both RFLPs and sub-lineages in confidently labeling sequences belonging to this group. With a recent influx of sequences belonging to this variant, the report has compiled current available data to ensure stakeholders and industry are informed. Critical evaluation of routine herd health monitoring data provides a mechanism to detect changes in pathogen occurrence that could indicate a new or emerging disease.

SHIC Engages in Industry's North American African Swine Fever Forum

When African swine fever was diagnosed in China in August 2018, the North American swine industry immediately began actively monitoring its status and subsequent efforts to control the outbreak. Knowing the consequences of an ASF diagnosis in North America would be catastrophic, collaborative efforts among stakeholders in the US, Canada, and Mexico began immediately. The first North American African Swine Fever Forum took place in Ottawa, Canada, in 2019, and recently returned to Ottawa in September 2024 for the fourth Forum. The Swine Health Information Center was among many US participants with Executive Director Dr. Megan Niederwerder speaking during the Spotlight on Communications session.

Government agency representatives, pork industry leaders, international ASF experts, WOAH delegates, international animal health organizations, state and provincial chief veterinary officers, and other stakeholders all took part in the Forum. Their collective focus centered on the protection of the livelihoods of North American pork producers from a devastating foreign animal disease outbreak through the development of tools for prevention, risk mitigation strategies, and collaborative agreements for maintenance of business continuity and trade.

Despite global efforts and knowledge advancements, Forum organizers noted ASF continues to spread globally, negatively impacting economies and pork production in affected regions of the world. They wrote, "Since January 2022, 10 countries have reported ASF for the first time, while 14 countries have reported its spread to new areas. The disease has also re-emerged in regions that had effectively managed it for decades." They further noted the lack of treatment and commercial vaccines for ASF keeps stakeholders vigilant in their efforts to prevent, prepare for, and respond to this threat.

During the fourth ASF Forum, past successes were explored, current experiences shared, and ongoing challenges in ASF control identified. Across the various Forum sessions, participants addressed key topics including business continuity programs, management and surveillance of wild pigs, effective stakeholder communication needs, and the development and use of ASF vaccination as a control tool. A collaborative roadmap for ongoing management of the ASF threat as well as renewed partnerships for continued coordination and collaboration were established.

Key presentations from Germany, Denmark, the EU, the Dominican Republic, and Italy focused on the current status and management of ASF in their respective countries. The importance and development of regionalization and zoning agreements for response to ASF was another key topic for discussion and collaboration across the North American countries. The role of communications for informing stakeholder awareness was a topic discussed by the Forum participants. Dr. Niederwerder provided examples of US stakeholder communication channels for ASF, including the monthly SHIC Global Disease Monitoring Report as a readily accessible source of information on new ASFV outbreaks and introduction risks. She also highlighted the need for rapid and accurate information sharing for producers on ASF and emerging disease events. Forum participants engaged in joint discussion regarding the role and need for robust communications strategies to support backyard pork production in each country and provision of tools for small scale producers.

While the Forum's objective is to prevent entry and mitigate the impacts of ASF in the Americas, the collaborative work of the international participating stakeholders represents significant investment of time, resources, and commitment to safeguarding the pork industries of North America on behalf of producers and all allied organizations.

SHIC Monitors Recombinant ASFV Genotype I/II Strain Emergence Globally

The US swine industry is vulnerable to the introduction of emerging pathogens and routine swine disease monitoring provides early warnings of global challenges that could negatively impact US swine producers. As part of its mission to identify emerging disease threats, SHIC funds Global Swine Disease Monitoring Reports led by Dr. Maria Sol Perez Aguirreburualde at the University of Minnesota. Recent reporting on African swine fever virus strain circulation has highlighted a concerning expansion of the ASFV Recombinant Genotype I/II strains being detected in Asia and now the Russian Far East. Evolving changes in globally circulating ASFV genotypes continue to pose risks for US introduction and inform ongoing prevention and preparedness activities to protect the health of US swine.

Background

Since first being reported in August 2018 on a pig farm near Shenyang, China, 19 additional countries have reported ASF outbreaks in the Asia and Pacific region as of October 2024. The first ASFV genotype occurring in Asia was genotype II, characterized by highly pathogenic strains causing high mortality in domestic pigs. Genotype II is the predominant virus in Europe, Russia, Asia, and the Americas. Ongoing changes in ASFV circulating genotypes are being monitored by SHIC and reported via its Global Swine Disease Monitoring Reports.

Key events altering the ASF epidemiological landscape in Asia

Between 2019 and 2020, there were reports of low pathogenic strains of ASFV genotype II in China and other Asian countries. These low pathogenic genotype II strains were detected during various surveillance activities. Later, in 2021, ASFV genotype I was reported in China which further complicated the epidemiology of the disease in the country and Asia-Pacific region. Prior to this report, ASFV genotype I was only known to be present in Sardinia, Italy, and on the African continent. In 2021, China also reported the discovery of ASF viruses that were a mix between the two genotypes (recombinant viruses).

The recombinant viruses in China were a mix of genetic types, genotypes I and II. These new strains were found in pigs from Jiangsu, Henan, and Inner Mongolia. The viruses were identified as genotype I based on one gene (B646L). However, they showed an unexpected characteristic—they were "HAD-positive" and caused red blood cells to clump together, something not seen in previous genotype I strains in China. This trait is linked to a specific protein, CD2v, encoded by another gene (EP402R). When the researchers sequenced the EP402R gene, they found that it matched genotype II viruses, suggesting a mix between the two genotypes.

In 2023, researchers in Vietnam reported the detection of the recombinant ASFV genotype I and II viruses in domestic pig farms in Northern Vietnam. The recombinant viruses found in Vietnam matched the corresponding sequences of recombinant ASFV I/II strains from China, except for one genetic region, the Central Variable Region. Further molecular analysis of the recombinant strains from Vietnam indicates three possible independent introductions into the country.

ASFV recombinant virus strains reported in Russia
Also in 2023, an ASFV isolate obtained from a domestic pig in the Primorsky Region, a Russian region bordering China, was found to be a recombinant strain. The recombinant genotype I/II virus found in Primosky shares similarities with the recombinant strains from China and has a 99.9% sequence identity, although it does not share identical viral gene sequences. This means the Primosky isolate may be part of a wider transmission network and has undergone minor evolutionary changes as it spread from China. The Primosky recombinant strain presented acute disease in domestic pigs when infected experimentally, which suggests similar characteristics to the Recombinant strains from China.

Timeline of ASFV strain discovery in Asia and the Russian Far East
August 2018 – ASFV emergence in Asia (China) – ASFV genotype II (highly pathogenic strains)
January 2019 – ASFV continues in China and other Asian countries – ASFV genotype II (low pathogenic strains)
December 2020 – ASFV continues in Asia – ASFV genotype II (low pathogenic gene deleted strains)
March 2021 – New outbreak in China – ASFV genotype I (low pathogenic strains)
December 2021 – New outbreak in China – ASFV recombinant genotype I/II
2023 – New outbreaks in Vietnam and Russia – ASFV recombinant genotype I/II

Characteristics of ASFV recombinant strain
Genotype I/II strains from China:

- The genomes are 56.5% genotype II virus and 43.5% genotype I virus, with 10 gene fragments transferred from the genome of ASFV genotype II.

- Animal studies with one of the recombinant viruses indicate high lethality and transmissibility in domestic pigs.
- Deletion of the virulence-related genes MGF_505/360 and EP402R derived from the virulent genotype II virus highly attenuates the virulence of the recombinant strain.
- Immunological studies on these three recombinant viruses showed that the recombinant virus was highly lethal and transmissible in pigs and evaded the immunity induced by vaccination with a live attenuated vaccine.

Genotype I/II strains from Vietnam:

- Genetically similar to the genotype I/II recombinant virus from China, when compared across 13 different genes.
- It is only different at the Central Variable Region
- It can be grouped into three sub-groups based on CVR analysis, which suggests three possible introductions to Vietnam from China.

Conclusions

The ASFV genotype I/II recombinant strains are circulating in swine and have likely spread to neighboring countries of China, not just Vietnam and Russia. Still, to confirm this assumption, molecular surveillance efforts are lacking in many countries in the region.

The recombinant strains are highly lethal and transmissible in pigs. Based on preliminary evidence, current live-attenuated vaccines based on ASFV genotype II, such as those being implemented in countries such as Vietnam and the Philippines, are most likely not protective against these recombinant genotype I/II strains.

Responding to Emerging Disease

SHIC Funds Study Investigating Porcine Astrovirus 4 as Potential Emerging Cause of Respiratory Disease

In December 2023, SHIC funded a study to investigate porcine astrovirus 4 as an emerging pathogen capable of causing respiratory illness in pigs. Dr. Mike Rahe, North Carolina State University, leads the collaborative investigation to define the pathogenesis of PoAstV4 infection in weaned pigs under experimental conditions. Previous studies have shown evidence of PoAstV4 in respiratory tract lesions but the direct contribution of PoAstV4 to clinical disease is poorly understood. The newly funded study seeks to understand if PoAstV4 is a primary cause of respiratory disease, characterize the course of infection over time, and provide a foundation for rapid and accurate identification of respiratory illness in pigs. Investigating the production impacts of potentially emerging pathogens is part of the SHIC mission to define risks to herd health and minimize disease impact.

In a 2022 SHIC-funded study, a retrospective analysis of porcine respiratory disease cases submitted to the Iowa State University VDL from January 1, 2019, to August 1, 2022, was conducted to evaluate the presence of PoAstV4 within microscopic lesions consistent with viral infection of airways. PoAstV4 RNA was detected in affected respiratory epithelium in 73% (85/117) of evaluated cases. This was the first report associating PoAstV4 with respiratory pathology in neonatal and weaned pigs. The next step of research is to define the ability of PoAstV4 to cause clinical respiratory disease and associated lung lesions in naïve pigs.

In the 2023 SHIC-funded study, a collaborative effort between researchers at North Carolina State University, the USDA National Animal Disease Center, Iowa State University, and University of California Santa Cruz, work is underway to evaluate PoAstV4 as a causative agent of respiratory disease in high health, colostrum deprived, caesarean-derived pigs. Utilizing these high health pigs avoids potential exposure to PoAstV4 and the transfer of PoAstV4 maternal antibodies from the sow to piglets. Pigs will be evaluated for the presence of clinical respiratory disease, evidence of gross and microscopic lesions, and presence of virus in multiple tissue types. Characterizing aspects of infection such as location of lesions, duration, and peak virus quantity in tissues over time helps to inform veterinarians how to sample suspect cases for accurate diagnosis. Further, analysis of the immune response to PoAstV4 under a controlled setting will provide information on antibody production.

This information will be important to assist veterinarians in the accurate diagnosis of PoAstV4 in pigs showing clinical signs of respiratory disease without a known etiology. Knowledge gained from the one-year study will be shared with producers and veterinarians as soon as it becomes available.

SHIC-funded APP Study Defines Outbreak Dynamics and Environmental Stability of Bacteria

In response to a severe 2021 outbreak of *Actinobacillus pleuropneumoniae* (APP) serotype 15 in Iowa finishers, SHIC funded research to define the risk and mitigation of this emerging swine disease strain. Drs. Marcelo Almeida and Alyona Michael, Iowa State University, recently completed three objectives as part of the one-year research project, including 1) understanding the APP serological status of sows that supplied the finishers involved in the outbreak, 2) characterizing APP persistence in finishers who had recovered from the disease, and 3) comparing the environmental stability of two APP15 strains with an APP1 strain under laboratory conditions. This study provides information regarding the role of sows for the epidemiology of APP, the recommended sample types for accurate diagnosis, and the bacterial stability across different temperatures and surfaces. Through responding to the APP15 strain emergence, this SHIC-funded study adds key information for improved APP surveillance and implementation of biosecurity practices on the farm.

In late November 2021, several Iowa finisher sites across multiple unrelated systems exhibited high mortality, reaching up to 51% in a matter of days due to an outbreak of virulent APP. Clinical signs associated with the outbreak included rapid onset of high fever, coughing and respiratory distress with mortalities exhibiting frothy, red discharge from both the nose and mouth. This outbreak challenged several assumptions about APP dynamics in the US, such as the prevalence of virulent strains, the risk factors for APP lateral transmission, and environmental persistence. Preliminary sequencing efforts of APP isolates did not identify a clear source herd and further investigation into APP15 was warranted.

Objective 1 of the investigation included cross-sectional sampling to determine the serologic status of sow farms supplying pigs to the APP15 affected finisher sites. Serum samples, nasal swabs, and tonsil scrapings were collected from 30 sows (parity 0 and 1) in each sow herd. Serum samples were tested for APP15 antibodies at the ISU Veterinary Diagnostic Lab, using routine procedures. For the sow farms that submitted samples, 15 of 19 farms were serologically

negative for APP serogroup 3-6-8-15 suggesting the majority of sow farms providing pigs for sites experiencing outbreaks were free of APP15. The sites receiving pigs from those sources may have been laterally infected with APP15 during the post-weaning period. Unfortunately, incomplete serologic screening of farms and lack of culture and sequencing follow-up made it impossible to confirm whether the isolate originated from an endemically infected sow farm, as opposed to originating from an alternative source of lateral transmission.

For Objective 2, a prospective longitudinal study of individually identified finishers was conducted at one Iowa site following a confirmed recent APP15 outbreak. Individually identified pigs were repeatedly sampled weekly to evaluate APP15 persistence in the nasal cavity and tonsils and monitor the development of humoral immunity. These results were compared to oral fluids and environmental swab samples to understand population shedding dynamics and environmental persistence. Environmental swab samples included internal locations including feeders, water nipples, and floors and external locations including rendering area and office door handles.

During the finisher investigations, tonsil scrapings had a higher detection rate than nasal swabs or oral fluid, with positive detection in 95% of sampled pigs across six weekly sampling events ending at eight weeks post-outbreak. PCR of tonsil scrapings were overwhelmingly the most sensitive means of screening for individual carriers long-term. APP detection rate in oral fluids was over 10% by PCR up to eight weeks after the reported outbreak. These results are significant in that they suggest that oral fluids have a more temporally robust utility for post-outbreak population surveillance than previously reported.

Environmental sampling for APP15 genetic material was primarily detected in avenues of human traffic (door handles, barn entry floor) and deadstock collection sites (rendering pile). Except for week eight, APP was not detected by PCR in any feeders or waterers. None of the PCR-positive environmental samples yielded isolates on culture. The environmental viability of APP could not be adequately determined due to the high degree of environmental bacterial contamination and further laboratory investigation of APP viability was performed.

Objective 3 compared the longitudinal viability of APP15, for outbreak and historical strains, to APP1 at different temperatures, surfaces, and organic matrices. Survival of each strain on different surfaces (concrete, stainless steel, and rubber) and in different substrates (water, fecal slurry, and horse serum-NAD) was evaluated at six time points post-inoculation (four and eight hours, one, two, three, and seven days) at four temperature set points (-20°C, 4°C, 25°C, 37°C).

For the laboratory comparison of APP serotypes, this study is the first to observe differences in stability across serotypes and the impact of solid substrates on stability when exposed to cooler or freezing conditions. Concrete surfaces exhibited the longest stability for APP15 and APP1 with all strains surviving up to seven days post inoculation at -20ºC, and up to 48 hours at 4ºC with APP1 and APP15h surviving up to 72 hours. Rubber and stainless-steel surfaces exhibited viability at 4ºC and 25°C, but not at 37°C. The results of this benchtop study support previous APP persistence research showing decreased stability in warmer conditions, with relatively prolonged persistence at 4°C and -20°C.

While the outbreak strain of APP15 did not exhibit enhanced persistence compared to other serotypes, contributing factors to the spread and geographic persistence of this bacterium could include PCR detection at rendering piles, increased survival on concrete and rubber surfaces under laboratory conditions, and cold ambient temperatures during the winter 2021 outbreak. Together, the studies reported here generate new important knowledge related to APP ecology and epidemiology that can have important implications for disease diagnosis, monitoring and surveillance, and biosecurity practices.

SHIC Encourages Use of Standardized Outbreak Investigation Form App

SHIC'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 Work Identifies First Detection of PCV4 in the US

Porcine circovirus associated disease presents a significant challenge to swine health and pork production globally. Multiple types, including PCV2 and PCV3, have worldwide distribution. Since first being described in 2019, PCV4 has been detected in Asia and Europe but not previously in the US. In a study funded by the Swine Health Information Center, PCV4 was detected for the first time in US clinical samples submitted to the Iowa State University VDL from June to September 2023. Led by Dr. Pablo Pineyro at Iowa State University, this study provides initial insight into the frequency of detection, tissue distribution, and genetic characterization of PCV4 in the US. Further studies to understand PCV4 prevalence as well as its role in coinfection and production losses are warranted to assess its importance and perhaps economic impact in the swine industry. The study has been published by the journal Nature Scientific Reports and is available at nature.com.

Objectives of this study included (1) characterizing the detection rate of PCV4 across different sample types from clinical submissions, (2) comparing molecular features of US PCV4 ORF2 sequences to reference strains, (3) characterizing the co-detection rates by direct and indirect methods for PCV2, PCV3, and other endemic viral and bacterial pathogens in PCV4 positive samples, and (4) identifying the tissue distribution and immune cell types which facilitate PCV4 replication by direct detection methods. Overall, PCV4 was detected in 8.6% of samples tested with an average PCR Ct value of 33. Lymphoid tissue had the highest detection rate (18.7% positive) and PCV4 was most commonly identified in nursery to finishing aged pigs displaying respiratory and enteric disease. Co-infection with PCV2, PCV3 and other endemic swine pathogens was frequently observed.

To accurately assess PCV4 tissue distribution, the study utilized 512 porcine lung, feces, spleen, serum, lymphoid tissue, and fetal tissue samples submitted for routine diagnostic investigation to the ISU VDL from June through September 2023. Samples were randomly selected to be representative of those used to evaluate different clinical syndromes. PCV4 was detected in 44 of the 512 samples evaluated (8.6%) with positive results in lung (9%), feces (5%), spleen (9%), serum (10%) and lymphoid tissue (17.2%) but was not detected in fetal samples. PCV4 PCR Ct value ranged from 21.3 to 36.2; the average Ct value for different sample types was not significantly different. Direct detection by in situ hybridization confirmed viral replication in lymph nodes and the lamina propria of the small intestine.

Fetal samples tested in the current study were negative for PCV4, including tissues from aborted fetuses, mummies, and stillbirths. However, previous studies from other countries have reported the detection of PCV4 viral DNA in aborted fetuses from sows with reproductive failure. Further studies are needed to investigate and characterize the presence and significance of PCV4 detection in tissue from aborted fetuses and stillbirths to evaluate its potential role in reproductive failure. The researchers noted that PCV4 tissue tropism may differ from PCV2 and

PCV3, thereby resulting in potential differences in clinical presentation and lesions associated with infection.

Two complete PCV4 ORF2 sequences were obtained from positive lymphoid tissue samples with a Ct value of 21.3 and 25.6. To understand the potential origin of PCV4, the two complete US ORF2 sequences were compared to 73 reference PCV4 ORF2 sequences obtained from GenBank including those sequences of Spanish, South Korean, Tai, Chinese, and Malaysian origin. One strain had 98.98% nucleotide identity with a 2022 Spanish sequence and the second had 98.69% nucleotide identity with a 2020 South Korean sequence. The phylogenetic analysis revealed relatively high nucleotide identity between US sequences and reference sequences from other countries, suggesting potential global dissemination of PCV4 strains.

Researchers reported PCV4 detection was most commonly observed in nursery to finishing aged pigs displaying respiratory and enteric disease. Frequent co-infection with PCV2, PCV3, and other endemic pathogens was observed, with researchers noting this highlights the complex interplay between different PCVs and their potential roles in disease pathogenesis. All samples were analyzed for the presence of PCV2, PCV3, and PCV4 viral DNA by qPCR. The rates for single detection of PCV4 (3-5%) and co-detection of PCV4/2 (2-4%) were similar for lung, feces, spleen, and serum. Additionally, data showed lymphoid tissue displayed the highest detection rate for PCV4 single detection (10.9%) and PCV4/2 co-detection (4.7%). The PCV4/3 co-detection was relatively infrequent and only confirmed in 1% of lung and serum samples.

For respiratory cases with PCV4 detected, co-infections with PCV2, Streptococcus suis, and PRRSV were most frequently identified. In instance of PRRSV and PCV4 co-infection, co-detection of the viruses occurred in the lymph node but not in the lung. For enteric cases, *Escherichia coli* and *Salmonella* species were most commonly identified with seven and three detections, respectively.

Although the pathogenesis of PCV4 remains poorly understood and its role in clinical disease and production losses is still unknown, findings of the study confirm the presence of PCV4 in the US. Further research is warranted to elucidate the pathogenic mechanisms and clinical implications of PCV4 infection, and the interaction of PCV4 with other pathogens in pigs. This study underscores the importance of ongoing surveillance and research efforts to better understand and mitigate the impact of PCV4 as a potential emerging pathogen to swine health and production.

Surveillance and Discovery of Emerging Disease

SHIC-Funded Study Examines Piglet Postmortem Sampling for PRRS Detection

With a goal to provide welfare-friendly and cost-effective methods for active PRRSV surveillance, Drs. Cesar Corzo, Mariana Kikuti and colleagues from the University of Minnesota led a study to evaluate the accuracy of different postmortem specimens collected from piglets in breeding herds for disease detection. Funded by SHIC, the study focused on the sensitivity of PRRSV detection by PCR across six sample types, including nasal, oral, and rectal swabs, tongue-tip fluids, superficial inguinal lymph nodes, and intracardiac blood. Overall, investigators

concluded that oral swabs and lymph nodes showed the best diagnostic performance. Tongue-tip fluids had high sensitivity (92.2%) but low specificity (53.9%) due to likely environmental contamination and may be a less suitable sample type for individual pig diagnosis. Published by mdpi.com, you can find the entire piglet postmortem sampling study online, including citations for content included in this summary.

In the US, PRRS continues to be the primary health challenge faced by swine herds. PRRS outbreaks afflict a significant portion of US breeding and growing herds, causing a major economic impact and production losses across the industry. The estimated weekly PRRS virus prevalence was 20%–40% between 2019 and 2023 in US breeding herds, according to the SHIC-funded Morrison Swine Health Monitoring Project.

Traditionally, PRRS surveillance efforts in breeding herds have heavily relied upon live animal sampling methods, including individual pig-level serum, oropharyngeal and nasal swabs, along with group-level oral fluids and environmental samples. Live animal specimens collected directly from individual pigs tend to have higher analytical sensitivity, the ability to detect a true positive sample, when compared to the group or environmental specimens. However, individual pig sampling poses labor and logistical challenges including concerns for staff safety and animal welfare.

Monitoring the dead piglet population through sampling tongue-tips for PRRS diagnosis has been proposed by European researchers (Baliellas et al., 2021) as an alternative to processing-fluids surveillance for PRRS and was quickly adopted in the US as a complementary specimen when monitoring breeding herds. In the study described herein, the aim was to determine the sensitivity of PRRSV detection across six postmortem sample types collected from dead piglets in US breeding herds.

Three Midwestern US farrow-to-wean farms undergoing PRRS elimination after an outbreak were utilized as the study population. Farms that utilized PRRS-modified live virus vaccination protocols for sows or piglets were excluded. Farm size ranged from 2500 to 5000 sows and all farms were representative of modern pig production and have year-round negative-pressure air-filtration systems.

For each farm, 30 and 60 samples were collected at eight and 20 weeks, respectively, after the PRRS outbreak. Postmortem samples included nasal swabs, oral swabs, rectal swabs, tongue-tip fluids, superficial inguinal lymph nodes, and intracardiac blood. All samples were tested for PRRSV RNA using RT-PCR. Intracardiac serum served as the gold standard for calculating the sensitivity, specificity, and predictive values of other post-mortem specimens.

To establish PRRS prevalence within each farm, blood samples were collected from live piglets via jugular venipuncture in the same rooms as the ones used for post-mortem sampling. Sera from live piglets were tested for PRRS by RT-PCR in pools of five; any sera from positive pools were then tested individually to estimate the within-herd PRRS prevalence. All specimens were submitted to the University of Minnesota Veterinary Diagnostic Laboratory for individual PRRS RT-PCR testing. PRRSV was detected in all specimen types and at all sampling points, except

for two sampling points, where swabs (oral, nasal, rectal) and intracardiac sera did not detect the virus, respectively.

Oral swabs and lymph nodes showed the best overall diagnostic performance with sensitivity ranging from 94.6% to 100% and specificity ranging from 83.9% to 85.1%. Tongue-tip fluids had high sensitivity (92.2%) but low specificity (53.9%), indicating a potential for environmental contamination affecting results. Nasal swabs and rectal swabs had moderate sensitivity and specificity, indicating some diagnostic utility, but had less accuracy compared to oral swabs and lymph nodes. The agreement between each specimen and intracardiac sera, as well as agreement between tongue-tip fluids and oral swabs, were calculated. The agreement between postmortem specimens and intracardiac sera was highest for superficial inguinal lymph nodes (88.89%), followed by oral swabs (87.10%) and nasal swabs (85.48%).

Three specimens were selected to investigate the success rate in obtaining a PRRSV ORF5 sequence based on their routine use in the field (tongue-tip fluids), ease of collection (oral swabs), and lowest probability of environmental contamination (intracardiac serum). The ORF5 sequencing was successful in 29 out of the 31 tongue-tip samples, 23 out of the 28 oral swabs, and 21 out of the 23 serum samples. Even though the sequencing success rate was higher in tongue-tip fluids, all three specimens presented a good sequencing success rate (82.1% to 93.5%), indicating that sequencing was not a limitation for sample type tested.

While there were challenges in meeting sampling targets due to variable pre-weaning mortality, PRRS was detected in all postmortem specimens. Tongue tips are easy and inexpensive specimens to collect but require some manipulation of the piglets with sharps, which can result in longer personnel time requirements when compared to swabs. Swabs (whether oral, nasal, or rectal) are quick, safe, and easy to collect, requiring minimal training. However, the costs associated with investment in individual swabs are high. Oral and nasal swabs showed promising results for disease monitoring. Although tongue tip fluids had high sensitivity, they also had lower specificity, making them less suitable for individual pig diagnostics due to environmental contamination.

Overall, this study provides insight into postmortem sample types as a welfare-friendly alternative for disease monitoring in breeding herds.

SHIC Funded Study Utilizes Endemic Disease Data for Detecting Emerging Diseases

A SHIC-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. The full report is published by PLOS ONE and posted on the SHIC website.

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.

SHIC-Funded Study Investigates Novel Diagnostic Tool for Assessing Farrowing Room Cleanliness

Although visual inspection is a commonly used tool in the industry to assess farrowing room cleanliness after cleaning and disinfection, visual inspection is often insufficient to confirm the absence of pathogens and reduce disease transmission risk. In a study funded by the Swine Health Information Center and led by Dustin Boler at Carthage Innovative Swine Solutions, adenosine triphosphate (ATP) bioluminescence technology was investigated as an objective diagnostic tool for producers to ensure farrowing room cleanliness. Across five farrowing crate locations and the room entry floor testing, the areas of highest concern were the sow feeder and the entryway floor as detected by both ATP bioluminescence and bacterial coliform plate counts (CPC). Overall, this study confirmed that ATP bioluminescence technology can be used as a monitoring tool for ensuring farrowing room cleanliness and identified the highest risk areas in the farrowing room for contamination.

Pig producers have adopted cleaning procedures and biosecurity practices to ensure farrowing rooms are free of infectious organisms before the next group of sows are introduced. However, there is a need for objective pen-side diagnostic tools that can assist in confirming cleanliness. ATP bioluminescence has been used in other industries to provide real-time feedback on surface cleanliness through the detection of ATP from organic sources.

The goals of this project were to 1) determine the areas of the farrowing crate with the greatest surface contamination risks, 2) determine the correlation between microbial counts and relative light units (RLUs) as detected by ATP bioluminescence, and 3) identify the number of farrowing crate locations needed to accurately determine surface cleanliness. Traditional monitoring methods (bacterial culture, qPCR, and virus isolation) were compared to the novel ATP bioluminescence technology.

For this study, samples were collected between April and May 2024 at a 5600-sow commercial farm in western Illinois. The sow farm had recently completed a PRRSV and *Mycoplasma* elimination program but was experiencing frequent rotavirus outbreaks during the sampling period. The designated sow farm weaned approximately 200 litters of pigs each week and each litter averaged 12.5 weaned pigs per sow. Each farrowing room consisted of four rows of 14 crates each for a total of 56 crates per room. Approximately four farrowing rooms were washed every week.

Cleaning procedures followed farm standard operating procedure for farrowing room sanitation. Farrowing rooms were scraped to remove manure from the alleyways and farrowing crates. After most of the manure was scraped into the pit, farrowing rooms were power washed with a commercial pressure washer by farm personnel with fresh hot water set at 3000 pounds per square inch to remove any residual material. The farrowing room was then visually inspected while still wet. The room was disinfected using accelerated hydrogen peroxide at a dilution of 1:64 after it was visually determined to be clean by farm personnel.

Five crates within each room and the entryway floor were swabbed for ATP testing. Swabs were collected from six locations, including the entryway floor to the farrowing room and five areas within each crate: 1) sow feeder, 2) sorting bars, 3) back wall, 4) corners, and 5) piglet floor mat. Swab samples were collected across a total of 21 rooms and 105 crates during the study. Twelve of the 21 rooms were sampled early in the week (Sunday, Monday, or Tuesday) and nine of the 21 rooms were sampled late in the week (Thursday, Friday, or Saturday). Additionally, 13 farrowing rooms of the 21 sampled for ATP bioluminescence were randomly selected and swabbed in the same locations for CPC to determine total colony forming units. A total of 337 environmental swabs were collected during the project. However, only 305 were included in the statistical analyses due to large variability in cleanliness outcomes that resulted in CPC values that exceeded the quantifiable threshold for the procedure.

Three ATP luminometers (Charm Sciences novaLUM II-X, 3M Clean Trace, and Neogen AccuPoint) were used to evaluate real-time testing capabilities, determine variability of RTUs within a crate and across luminometers, and estimate the relationship between ATP bioluminescence and CPC. Bacterial loads were quantified by colony forming units/100cm^2 (CFM) with higher CFM indicating increased levels of bacterial contamination. The percentage of samples above $10^{5.5}$ CFU/100cm^2 was greatest for the entryway floor (93.8%) followed by the sow feeder (93.1%), sorting bars (49.5%), back wall (13.8%), piglet floor mat (11.8%), and corners (10.5%). This ranking gives an indication of highest risk areas in a farrowing room for bacterial contamination and cleaning needs.

Overall, this study demonstrates that ATP luminometers are a novel tool for producers to use, in conjunction with CPC testing, to objectively assess farrowing room cleanliness on-farm. The areas of greatest risk for contamination were the entryway floor and the sow feeder as indicated by both ATP bioluminescence and CPC. These results agree with previous studies showing the sow feeder is difficult to effectively clean after washing and disinfection. Entryways are a sanitation risk but may not represent room cleanliness due to constant worker foot traffic entering and exiting the room. Specifically targeting the sow feeder and piglet sorting bars for additional cleaning and disinfection would be beneficial to reducing risk and ensuring farrowing house cleanliness.

SHIC Tongue Tip Study Optimizes Sampling and Testing Protocols for Successful PRRS Viral Isolation

With the goal of improving the diagnostic value of tongue tips for PRRS surveillance, a study led by Dr. Onyekachukwu Henry Osemeke from Iowa State University aimed to optimize protocols to increase the likelihood of recovering live PRRSV isolates from tongue tip fluids. Successfully isolating PRRS viruses from post-mortem tongue tips enhances their diagnostic value as a

sample type for herd surveillance. Funded by SHIC, the study evaluated four different sample collection protocols across 597 tongue tips from stillborn and dead piglets. Samples with the lowest Ct values on PRRSV PCR testing were selected for virus isolation on two cell lines and primary alveolar macrophages. Overall, the highest rates of successful virus isolation were found in fluids extracted from fresh tongue tissues using PBS (22.6%) and on ZMAC cells (21%).

Porcine reproductive and respiratory syndrome virus surveillance is particularly challenging in low-prevalence scenarios due to the cost of testing representative units and the complexities associated with PRRSV ecology (Muñoz-Zanzi et al., 2006). Recently, the post-mortem tongue tip or tongue tip fluids sample was demonstrated to be a cost-effective and population-sensitive approach for PRRSV surveillance in swine herds. Although the reverse transcription-quantitative polymerase chain reaction (RT-qPCR) detection of PRRSV RNA is the most requested test for PRRSV surveillance in the US (Trevisan et al., 2019), isolating the live virus remains crucial for confirming the presence of infectious PRRSV in a herd. There is currently no documented evidence of live PRRSV being isolated specifically from tongue tip samples.

Thus, the goal of the study described herein was to identify what protocols for collection, processing, and cell culture enhance the recovery of live PRRSV isolates from tongue tip fluids collected from perinatal mortalities. By optimizing collection techniques and testing procedures, this study aimed to improve the diagnostic value of tongue tips as a sample type for PRRSV surveillance. As a field application, this could offer swine practitioners a more herd-representative tool for formulating live vaccines.

To complete this study, samples were collected from 597 perinatal mortalities from a 5,000-head PRRSV-positive breeding herd over a four-day period. Tongue tissues were grouped into 20 batches (approximately 30 mortalities or tongues per batch). Each tongue was divided into four quarters, with each quarter randomly assigned to one of four collection protocols: 1) tongue fluids extraction from fresh tissues using phosphate buffered saline, 2) tongue fluids extraction from fresh tissues using virus transportation medium, 3) tongue fluids extraction in phosphate buffered saline after one freeze-thaw cycle, and 4) tongue tissue homogenate.

The result was 80 total samples (20 batches x 4 protocols) that were sent to a NAHLN-approved veterinary diagnostic laboratory for RT-qPCR testing. The RT-qPCR cycle threshold values were averaged across the four protocols in each of the 20 batches, and the 10 batches with the lowest mean Ct values were selected for virus isolation (VI). Two cell lines (ZMAC and MARC-145) and one batch of primary alveolar macrophages were tested for their ability to successfully isolate PRRSV.

All samples tested positive for PRRSV by RT-qPCR, with the average Ct values for the phosphate buffered saline, virus transportation medium, freeze-thaw, and homogenate groups being 21.9, 21.8, 22.6, and 24.8, respectively. PRRSV was isolated successfully from tongue tissues in all groups with variable success rates. The virus isolation success rate was 22.6% in the phosphate buffered saline group, 12.1% in the virus transportation medium group, and 2.8% in both the freeze-thaw and homogenate groups. The probability of successful viral isolation was 3.1% in MARC-145 cells, 21.0% in ZMAC cells, and 4.8% in primary alveolar macrophages

cells. Mortality batches with only stillborn piglets had a 35.5% probability of successful PRRSV isolation, while batches with stillborn and dead piglets had a 1.0% probability.

Investigators concluded that live PRRSV can be isolated from postmortem tongue tip fluids. Extracting tongue tip fluids from fresh stillborn piglets using phosphate buffered saline or virus transportation medium increases the chances of successful virus isolation. The ZMAC cell line outperformed the MARC-145 cell line and primary alveolar macrophages cells in this study. Ensuring a cold chain from sample collection until arrival at the laboratory maintains the diagnostic quality of the samples. Isolating PRRSV from aggregate samples such as tongue tip fluids provides several surveillance and vaccine development benefits. As virus isolation using aggregate samples allows for the efficient co-detection of multiple PRRSV strains within a herd, there are great advantages for surveillance and developing autogenous vaccines.

Because there is no predicting when or where the next emerging disease will appear, the critical evaluation of convenient sampling protocols for applicability and effectiveness for disease surveillance will help the industry monitor and detect diseases as they emerge. This study provides objective information about diagnostic testing applications and best practices for obtaining tongue tip fluids from perinatal mortalities.

Wean-to-Harvest Biosecurity

Reminder: SHIC Continues to Accept Research Funding Proposals for Wean-to-Harvest Biosecurity Program

SHIC leveraged a collaborative partnership with FFAR and Pork Checkoff to fund the 2-year $2.3 million Wean-to-Harvest Biosecurity Research Program currently underway. The first and second rounds of proposal solicitation, selection, and funding are complete. SHIC, FFAR and Pork Checkoff now remind researchers that proposals continue to be accepted for priorities not adequately addressed in funded projects to date. Proposals are invited for submission and funding consideration to investigate cost-effective, innovative technologies, protocols, or ideas to enhance biosecurity during the wean-to-harvest phase of production.

The ongoing research priorities focus on site and transportation biosecurity and cover five targeted areas – 1) personnel biocontainment and bioexclusion, 2) mortality management, 3) truck wash efficiency, 4) alternatives to fixed truck wash, and 5) packing plant biocontainment. SHIC seeks novel tools across all five areas to help result in comprehensive biosecurity enhancement.

Continued researchable interests include:

- Packing plant or other first point of concentration biocontainment
- Cost-effective transport biosecurity or alternatives to traditional truck wash, including cleaning and disinfection of trailers without water or without heating after initial water flush
- Artificial intelligence or other novel technology to monitor and evaluate biosecurity compliance
- Enhancing biosecurity of mortality management
- Industry barriers to biosecurity adoption and compliance

- Novel air filtration technologies for cost-effective bioexclusion

Proposals must identify and include which of the research priorities is being investigated. They are expected to define current practices and investigate innovative and novel protocols or technologies that may have a cost, efficiency, or implementation advantage. Herd health status monitoring, instead of disease outbreak incidence, can be used to demonstrate success of the protocols or technologies and aid in a required economic analysis of cost-effectiveness. Collaborative projects that include pork industry, allied industry and/or academic public/private partnerships, which demonstrate the most urgency and timeliness of completion and that show efficient use of funds, will be prioritized for funding. If project duration is extended to assess seasonal effects, a justification for the timeline should be clearly stated. Proposals are capped at $200,000. All proposals should be submitted via email to research@swinehealth.org using the proposal template and instructions.

SHIC Wean-to-Harvest Biosecurity: New Projects Funded to Investigate Transportation Biosecurity and Cost of Disease in Grow-Finish Production

SHIC's Wean-to-Harvest Biosecurity Research Program, funded in collaboration with the FFAR and the Pork Checkoff, has recently funded two new projects to advance biosecurity of US swine farms. The newly funded projects include: 1) an investigation of alternative methods for transport sanitation led by Dr. Erin Kettelkamp at the Swine Vet Center and 2) an assessment of the cost of disease in grow-finish production sites led by Dr. Karyn Havas at Pipestone Research. These awards bring the total number of projects to 18 that have been funded by the program for a comprehensive approach to enhancing biosecurity across the wean-to-harvest phases of swine production.

Priorities of the Wean-to-Harvest Biosecurity Research Program focus on site and transportation biosecurity in five targeted areas: 1) personnel biocontainment and bioexclusion, 2) mortality management, 3) truck wash efficiency, 4) alternatives to fixed truck wash, and 5) packing plant biocontainment. The 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. Proactively enhancing wean-to-harvest biosecurity will help control the next emerging disease in the US pork industry. All proposals submitted undergo a competitive review process by a task force of industry stakeholders with funding recommendations approved by the SHIC Board of Directors, FFAR, and Pork Checkoff. Projects are reviewed for their value to pork producers and their ability to provide cost-effective biosecurity solutions on the farm.

Novel tools, technologies and approaches are needed to augment current biosecurity practices in the US swine industry. Each of the two newly funded projects investigate new ways of thinking about wean-to-harvest biosecurity. First, a project led by Dr. Erin Kettelkamp at the Swine Vet Center was awarded entitled "Investigating waterless decontamination and application potential in transportation biosecurity." This project seeks to investigate the efficacy of a new waterless technology for the mobile application of heat and hydrogen peroxide to decontaminate PEDV in trailers and provide an alternative method for achieving necessary transport sanitation.

Second, a project led by Dr. Karyn Havas at Pipestone Research was awarded entitled “What is the cost of disease for grow-finish producers?” This project seeks to understand the cost of common diseases detected in grow-finish hogs through quantification of disease outcome indicators, such as mortality and weight gain. Costs of disease will be compared to costs required for implementation of different biosecurity practices to provide producers an objective understanding of the potential opportunity cost forfeited through poor biosecurity.

The Wean-to-Harvest Biosecurity Program continues to accept research proposal submissions which address the five targeted priority areas until funds have been expended. Total project funds available for the Program since its inception are $2.3 million. 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: Comparing Efficiency and Efficacy of Automated versus Manual Power Washing Final Report

A study funded through the SHIC Wean-to-Harvest Biosecurity Research Program, in partnership with the FFAR and Pork Checkoff, recently completed an evaluation of pressure washing tools and methods to enhance biosecurity and overcome labor shortages. Power washing is a critical step for pathogen reduction and is part of a comprehensive farm biosecurity plan, but it is time, labor and resource intensive. Led by Dr. Francisco Cabezon, vice president of Pipestone Research, the study compared the efficacy and efficiency of an automated power washer to a manned power-washing crew, with evaluation of cleaning time, manpower time, water usage, and cleanliness rate.

Overall study results showed water usage was greater for the robotic power washer compared to manual washing across two seasonal wash events. Further, the overall time required to wash barn rooms was greater with the robotic power washer compared to manual washing. The robotic power washer rooms required additional manual wash time to meet sanitation goals for a clean room. The evaluation showed power washing needs at facilities are time and resource intensive and the robotic power-washer prototype did not provide adequate savings in manpower or water usage. Although manual labor hours were reduced by robotic power washing, further refinements are needed due to washing time and water requirements.

SHIC, along with FFAR, a non-profit organization established in the 2014 Farm Bill, and Pork Checkoff, partnered to develop the Wean-to-Harvest Biosecurity Program to investigate biocontainment or bioexclusion engineering controls (modifying equipment, physical barriers, site design, ventilation, robotics, or other technologies) that will help overcome labor shortages and the need to share personnel, such as with loading, vaccination, or cleaning and disinfection crews, across sites in a production or contracting service network.

The pressure washer study was conducted in a 2,400 head wean-to-finish barn with two rooms of 1,200 head capacity (196 feet x 50 feet) with 44 pens each. A group of nursery pigs were placed in the barn and raised until harvest. The barn was then cleaned, with one room washed using traditional manual power washing methods from a contract service, and the other room cleaned using a railed robotic power washer prototype, followed by a manual power wash to remove any

additional manure (touch-up post robot). The trial consisted of two washing events (August 2023 and February 2024) for comparison and seasonal variation.

In the room washed with the rail robotic power washer prototype, four rails were installed (two on each side of the room divided by the central hallway) to cover the pen floor and side walls at a maximum height of 10 inches from the slat level. The rail robotic power washer prototype consisted of a trailer head carrying a rotary nozzle connected to a gas power washer. The trailer head was battery powered, and the speed of the trailer on the rail and the speed of rotation of the nozzle could be adjusted. Two different rotary nozzles were tested. The robot power washer with a single rotary nozzle was set to move through the rails at an average speed of 11.0 inches per minute, with a nozzle rotation time cycle of 22 seconds (August 2023 data). In the case of the double rotary nozzle, the robotic power washer was set to move at an average speed of 14.8 inches per minute, with a nozzle rotation time cycle of 30 seconds (February 2024 data). In both cases, the speed of the trailer head and rotation of the nozzle were adjusted to achieve two hits per slat.

Multiple methods were used to evaluate cleanliness (pre-wash, post-wash, and post touch-up), including 1) visual assessment, 2) adenosine triphosphate measurements to assess organic material, 3) bacterial culture with dip slides, and 4) a reverse-transcriptase real-time PCR (RT-qPCR) for rotavirus detection. There were 12 pens assessed in each room, which were equally spaced throughout the room. Five sites in each pen were assessed: fencing, floor, wall, waterer, and feeder.

In August 2023 (single rotary nozzle test), total water usage in the robotic power washing room was 8,396 gallons in comparison to 6,211 gallons in the manual power washing room. Total washing time in the robotic power washer room was 22.1 hours (13.0 hours of robotic washing and 9.1 hours of manual touch up washing) in comparison to 10.5 hours of manual power washing in the control room. The manual washing labor time in the robotically washed room was reduced 13% (1.4 hours), but total washing time was longer by 11.6 hours.

In February 2024 (double rotary nozzle data), total water usage in the robotic power washing room was 10,897 gallons in comparison to 7,526 gallons in the manual power washing room. Total washing time in the robotic power washer room was 19.3 hours (10.1 hours of robotic washing and 9.2 hours of manual touch up washing) in comparison to 13.3 hours of manual power washing in the control room. In this case, manual washing labor time in the robotically washed room was reduced by 31% (4.1hours) with the robot, but overall washing time was longer by six hours.

Cleaning score differences before and after washing were significant for each power washer method, at all sites in a pen, and in each testing method. The visual cleanliness trend was from very dirty to clean or very clean. For the robotic power washed room, the post-wash touch-up by the manual power washing team was necessary for the median value to reach the “Very Clean” score.

Greater bacterial count, higher rotavirus detection, and increased ATP levels were found after the washing process for both wash methods. Power washing does not clean the barn, it is solely a

means to remove debris and must be followed by a disinfection process. Power washing should be completed to the necessary level to ensure that disinfection can be performed effectively.

Cleaning expectations of this barn were extremely high and could explain, to some degree, the long touch-up process. The robotic power washer cannot easily access the feeders and as such, the washing crew spent considerable time washing the feeders. The number of feeders in the barn will be a limiting factor to the efficiency of the robotic power washer. The barn used for this research has a low pigs:feeder ratio (27 pigs per feeder, doubled one-hole wet dry feeder). Another limiting factor for the automated power washer was the number of rails and their positioning. In the current study, four rails were installed in the room. This allowed walls to be washed at a maximum height of 10 inches from the slat level; however, the robotic washer did not cover the central hallway. Additional rails could increase the covered area by the rail power washer, but it would represent additional costs for producers and time of operation.

Further investigation of robotic power washing systems is warranted to be able to identify methods for effective and efficient use of this technology on-farm to help address challenges during labor shortages.

SHIC Wean-to-Harvest Biosecurity: Assessing Factors Impacting Pig Caretaker Motivation and Compliance Final Report

A study funded through the SHIC Wean-to-Harvest Biosecurity Research Program, in partnership with FFAR and Pork Checkoff, recently evaluated caretaker motivation related to compliance with biosecurity behaviors. Led by Dr. Michael Chetta of Talent Metrics Consulting, an exploratory study was conducted to establish a baseline for worker motivation and identify the primary factors within the industry that could be impacting biosecurity compliance.

While significant resources are devoted to training personnel on the proper execution of biosecurity control measures, this study aimed to fill the gap surrounding the motivations and barriers that determine whether personnel will consistently perform the measures. This research and measurement related to motivation is the first of its kind in the industry and sets the groundwork for better understanding the social science of swine industry biosecurity.

To conduct this study, an online survey was developed and a total of 139 animal caretakers from five pork production companies participated in the survey and formed the study's sample population. Questions measured quantitative responses to different factors which may impact compliance such as attitude, social norm, perceived behavioral control, behavioral intent, job demands, job resources, level of exhaustion, and disengagement from work. Results suggest the swine industry's challenge with biosecurity compliance is not wholly driven by issues with motivation. Results for attitude and job resources suggest further investigation into the rewards, supervisor support, and performance feedback categories of job resources could be promising avenues for continuing to explore what drives biosecurity non-compliance. Specifically, personnel being rewarded for following biosecurity procedures was highlighted as an opportunity.

SHIC, along with FFAR, a non-profit organization established in the 2014 Farm Bill, and Pork Checkoff, partnered to develop the Wean-to-Harvest Biosecurity Program to investigate the

impact of personnel on pathogen biocontainment and bioexclusion. Research priorities emphasized comparing implementation and compliance incentives and/or rewards and their successes, shortcomings, or adoption barriers across sites or systems to help understand worker motivation to consistently execute biocontainment and/or bioexclusion protocols.

This study highlights a novel application of Industrial and Organizational (I/O) Psychology principles to the U.S. swine industry to assess caretaker motivation to engage in biosecurity-compliant behaviors. Swine caretakers participated in the online survey, provided in both Spanish and English languages, that was developed using items, adapted or in original form, from previous research and established measures.

Initial findings of the caretaker motivation and resources study suggest the swine industry's problem with biosecurity compliance is not a motivationally driven issue, and not wholly influenced in the way initially conceptualized and measured. There is strong support that biosecurity compliance is influenced by job resources (specifically supervisor support), availability of performance feedback and rewards. Additionally, the analyses suggest workers are heavily impacted in doing their work and adhering to biosecurity protocols by physical workload and demanding contact with animals.

There is reason to believe that motivation can be assessed differently and that the impact of training and measuring the implementation/effectiveness of biosecurity procedures could yield valuable insights. Continuing this research across the US swine industry will help to better understand the interactions and motivations behind worker attitudes and perceptions towards biosecurity adherence and to enhance positive outcomes for employees, farms, and consumers.

SHIC Wean-to-Harvest Biosecurity: Effects of Manure Pumping on Disease Spread in Growing Pigs (Final Report)

A study funded by the SHIC Wean-to-Harvest Biosecurity Research Program, in partnership with the FFAR and Pork Checkoff, investigated the risks of manure pumping to introduction and spread of pathogens across wean-to-finish sites. Led by Drs. Ana Paula Poeta Silva and Daniel Moraes, working with the principal investigators Drs. Daniel Linhares and Gustavo de Sousa e Silva of Iowa State University, the study provided evidence that the processes associated with manure pumping and land application pose a risk for the introduction of PRRSV into pig sites.

Also, there was plenty of PEDV RNA detected in pit samples from most herds visited despite the absence of clinical disease or PEDV in oral fluids. Further, the study characterized the level of risk for specific manure pumping practices or site characteristics, such as nursery compared to grow-finish, storage in deep pits or lagoons, timeline of pumping and spread relative to pig placement, and distance of crops for manure application.

SHIC, along with FFAR, a non-profit organization established in the 2014 Farm Bill, and Pork Checkoff, partnered to develop the Wean-to-Harvest Biosecurity Program to investigate research priorities in 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). The goal of the program

is to leverage funds to develop new tools and technologies that can enhance biosecurity in the wean-to-harvest phases of swine production.

Manure removal is a common practice typically performed twice yearly at nursery and grow-finish pig sites. Manure is then spread on fields surrounding those sites for its nutritional and fertilizing value to grain and forage crops. Disease introduction can occur through manure agitation and pathogen spread during the pit pump out process or during the application of contaminated manure on nearby fields. To define the risk of manure pumping on disease introduction to pigs, the objectives of this study included 1) identifying the risk factors for disease onset in wean-to-finish sites following manure pumping and spread in nearby fields, 2) determining the frequency of PRRSV and PEDV detection in pit samples from wean-to-finish sites and the likelihood of increasing PCR-positivity of oral fluids after manure pumping.

For objective one, a retrospective study investigated pig lot- and site-level risk factors related to manure pumping and spread for PRRSV or PEDV onset in wean-to-finish sites. Specifically, the study estimated the odds of a PRRSV or PEDV outbreak occurring within four weeks after manure pumping out from the site (exposure 1) or being near a field receiving manure at 1-, 3-, and 5-miles from the site (exposure 2). Sites included in the study conducted at least one manure pumping event or received manure spread on neighboring crop fields between July 2020 and December 2022. A satellite remote-sensing system was used to locate and characterize manure pumping activities and procedures, such as sites of manure origin and crop fields of manure spread destination.

PRRSV or PEDV outbreaks (cases) were defined based on veterinarian assessment, pathogen detection in tissues, and increased mortality rate after the pumping event or receiving manure. The odds of a PRRSV or PEDV outbreak within four weeks after manure pumping out from the site was calculated across all data collected. For the analyses, controls were selected to match spatially (within 6.2 miles of cases) and temporally (placement dates within a 4-week interval from outbreak dates) cases.

As part of the data set, a total of 2,903 pig lots were placed across 612 wean-to-finish sites. Of those, 1,444 pig lots had at least one manure pumping event with 517 reporting at least one PRRSV onset and 114 reporting at least one PEDV onset. The odds of PRRSV onset within a four-week period following pumping and spreading manure increased 1.7 times as compared to lots that were not pumped. Nurseries had higher odds of reporting PRRSV onset following manure pumping compared to grow-finish. Other characteristics associated with higher PRRSV risk included greater volume of pumped manure, and manure application <16 weeks post-placement. No association between PEDV outbreaks and manure pumping was detected in this dataset.

For objective two, a total of 77 growing pig barns with no evidence of PRRSV or PEDV before the pumping process were investigated. These barns pumped manure within 10 months of the study onset and were monitored over time to investigate the frequency of PRRSV and PEDV detection before and after manure pumping. Manure pumping occurred between April 2023 and December 2023. Oral fluid samples from pigs and environmental samples from the outside the

manure pit were collected. Disease onset was based on at least one positive PCR result for PRRSV or PEDV.

Results of this prospectives study demonstrated an increased likelihood of testing PRRSV-positive in oral fluids after pumping out manure. The PEDV positivity in manure was significantly higher than that of PRRSV in manure; however, there was no increase in oral fluids PEDV positivity after pumping out manure.

Overall, both study objectives provided evidence that manure pumping is associated with risk of PRRSV outbreaks. Understanding the risk factors that are associated with manure removal from wean-to-finish pig sites will enable producers and veterinarians to develop biosecurity steps and timing considerations for the pumping processes to improve bio-exclusion and bio-containment for PRRSV.

SHIC Wean-to-Harvest Biosecurity: Platform to Automatically Classify Truck Sanitation Status (Final Report)

A pilot project funded by the SHIC Wean-to-Harvest Biosecurity Research Program, in partnership with FFAR and Pork Checkoff, aimed to address the challenge of documenting truck washes between visits to slaughterhouses and return to swine barns, a critical aspect of market haul sanitation in the swine industry. Led by Drs. Daniel Linhares and Edison Magalhães of Iowa State University, the study updated the online inventory of truck washes in the Midwest and assessed three different methods for automatically recording truck wash events and market pig deliveries at packing plants. To enable producers to verify trailer cleanliness, automated reports were produced on the status of each trailer to identify non-compliance, such as those trailers not washed between packing plant loads. Read the truck automated sanitation classification (TASC) study industry summary online.

SHIC, along with FFAR, a non-profit organization established in the 2014 Farm Bill, and Pork Checkoff, partnered to develop the Wean-to-Harvest Biosecurity Program to investigate research priorities in 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).

For the recently completed TASC study, the overall objective was to assess three independent platforms to allow swine producers to automatically record events concerning truck-wash and market pig deliveries at packing plants. Specific objectives included 1) update the inventory of truck wash stations available in the Midwest, 2) develop the TASC platform to evaluate the field implementation of three methods to capture and manage truck movement data on slaughter plant and truck wash station visits, 3) develop the TASC dashboard to provide real-time information, and 4) enable a search function to allow producers to identify the sanitation status of trucks. The project was conducted in collaboration with one Midwest swine production system to evaluate the feasibility and effectiveness of different technologies in recording truck-related events for this company in Iowa.

In collaboration with the Iowa Pork Industry Center, the truck wash inventory and mapping, originally developed in 2015, was updated utilizing a 52-question survey applied to truck washes across 12 different states. The goal of the mapping was to provide producers information about the publicly available truck wash location and details related to facility operations, such as services provided, time and type of wash, and other information. The updated map of truck washes with the results from the work mentioned is available at the following link: https://www.ipic.iastate.edu/truckwash.html.

For the development of the TASC platform, three approaches were tested: 1) GPS tracking of trucks and trailers, 2) a software application (CleanTrailer app) for automatic creation of electronic tickets for washing events, and 3) manual data collection at truck wash and packing plant sites. For the truck and trailer GPS approach, beacons were installed in all trucks and trailers to enable data recording every 30 seconds in trucks and every 30 minutes in trailers. Once the beacons were installed and running in trucks and trailers, geofences were established to differentiate between vehicles entering and exiting the packing plant or the truck wash.

For the second approach, the CleanTrailer software application was utilized to create tickets for each trailer wash during the pilot study. The goal was to utilize a technology that is feasible for implementation by the truck wash personnel while automatically storing truck wash information. The CleanTrailer app collected information regarding truck wash events including worker name, trailer plate photo, and pictures captured before and after washing the trailer. For the third approach, manual collection of data on truck movement at the truck-wash and packing plants was performed.

Data was collected in this study between the periods of July 10, 2023, and August 11, 2023, representing 799 deliveries of pigs to the packing plant and 792 trailer washing events. Data was utilized to compare and evaluate the accuracy and reliability of each method.

Further, the collected data was utilized to build the TASC platform using statistical algorithms based on output generated by the three approaches utilized in this study, which captured data concerning GPS movements, the CleanTrailer app, and on-site manual truck and trailer check in. Algorithms were built to summarize the information from all trailers and trucks, across the three approaches into data visualization reports. Information was organized at both the trailer and truck level. Information in the reports included: number of loads per day, number of visits to washing bays, number of dirty (did not visit washing bay) truck movements, number of dirty (did not visit washing bay) trailer movements, number of pig loads between washes, time (minutes) at the truck wash, and number of movements before washing.

Findings of the TASC study revealed that while all three approaches had strengths and limitations, GPS-based tracking showed higher accuracy in documenting truck wash events and deliveries at packing plants compared to other approaches. However, GPS-based methods were susceptible to errors such as false or duplicate events and geofence limits, highlighting the importance of optimizing technology parameters to minimize discrepancies. In comparison, despite the CleanTrailer app having slightly inferior performance for recording truck wash events, it provided an electronic ticket with pictures of before and after the wash, providing additional information beyond the electronic wash ticket. Despite some missed washes, the

agreement between GPS data and the CleanTrailer app was generally high, indicating the potential of automated systems in ensuring compliance with sanitation standards.

Overall, this study demonstrates the capability of utilizing currently available methods used in the swine industry for recording truck wash events and deliveries at the packing plant, thereby establishing a framework for ensuring compliance with sanitation standards and verifying the status-quo of trailers. Examination of the data reveals that trailer-related information was more accurate than truck information. Through automating the processes of integrating data from multiple technologies and reporting wash compliance, the developed TASC platform is a valuable tool for decision-makers within swine production systems, enabling them to identify potential avenues for enhancing market haul sanitation practices.

The results of this study have significant implications for the swine industry, as providing producers with automated reports to monitor truck wash compliance will change behaviors. The scalability of the methods tested suggests broader applicability across production systems, offering a standardized approach to monitoring market haul sanitation practices. Ultimately, these findings empower producers to make informed decisions regarding truck sanitation, thereby safeguarding animal health and improving overall industry practices.

SHIC Wean-to-Harvest Biosecurity: Investigating Fan Coverings for Biocontainment (Final Report)

A study funded by the SHIC Wean-to-Harvest Biosecurity Research Program, in partnership with FFAR and Pork Checkoff, investigated the effectiveness of rapidly deployable, exhaust fan coverings to reduce the risk of airborne particles causing transmission of swine pathogens, such as PRRSV, IAV, and PEDV. Led by Dr. Erin Kettelkamp of the Swine Vet Center, this study sought to determine the most effective material to utilize for covering fans on swine barns to enhance biosecurity and reduce the spread of diseases from farm to farm. Results of the study showed that a nylon tear-resistant fan sock was the most effective material for exhaust fan coverings at reducing large airborne particle emission from the fan surface.

SHIC, along with FFAR, a non-profit organization established in the 2014 Farm Bill, and Pork Checkoff, partnered to develop the Wean-to-Harvest Biosecurity Program to investigate research priorities in 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). The goal of the program is to leverage funds to develop new tools and technologies that can enhance biosecurity in the wean-to-harvest phases of swine production.

To conduct this study, fan covers were tested at a single 2,400 head commercial, tunnel-ventilated, wean-to-finish site fully stocked with mid-finishing pigs. A single air space with one 24-inch pit fan, one 36-inch wall fan, and one 50-inch wall fan was enrolled. Three fan cover materials of varying permeability were evaluated, including PolyKlean™ synthetic air filter media (Blue Poly) that covered the fan cone, a nylon tear-resistant fan sock (Fan Sock) staked to the ground to redirect airflow, and a polyethylene privacy screen material (Black Screen) that covered the fan cone. Fan covers were compared to a fan with no cover (negative control) and

materials were selected based on those that were readily available and could be rapidly deployed in an outbreak.

Airborne particle counts were collected using a handheld optical particle counter (OPC) measuring particles from 0.3 to 5.0 µm. Fan coverings were assessed for their effectiveness to reduce the number of particles when compared to the negative control. Five air particle measurements were collected 1 meter from the interior of the fan shutters and 1, 2, and 3 meters from the exterior of the fan. Three consecutive air particle measurements were performed per distance and location to calculate an average particle count, with three replicates completed for each treatment and fan. Minimum ventilation pit fans and stage two pit fans ran continuously at 100% power during sample collection. Each enrolled fan ran individually at 100% power while treatments were applied. Weather conditions were recorded at all sample locations using a portable weather station.

Under the conditions of this study, the nylon tear-resistant Fan Sock had the greatest impact on reducing air particles at 1 meter outside of the fans compared to the other fan cover treatments, especially for particles measuring 5.0 µm. Conversely, the PolyKlean^{TM} synthetic air filter media was the least effective at reducing airborne particle emissions from fans. However, as the distance from the fan increased, differences in airborne particle quantities were not observed across the treatments, resulting in no overall differences.

These findings suggest that implementing exhaust fan coverings would be most beneficial at reducing larger air particles up to short distances (up to 1 meter) from fans. In previous studies, virus detection and infectivity tend to correlate with larger air particle sizes. For example, PRRSV and IAV have been isolated from particles greater than 2.1 µm. In the current study, fan coverings were most effective at reducing the amount of air particles ranging from 0.7 – 5.0 µm.

Based on the relationship between air particle size and the spread of airborne swine pathogens, additional research is warranted to understand the role of fan coverings on biocontainment. The fan sock provided better airflow than the other materials evaluated and is already commonly used in the swine industry, making it a more practical option for rapid deployment during disease outbreaks to improve regional biocontainment.

Overall, exhaust fan covers can provide a rapidly employable tool for swine producers to enhance wean-to-finish site biosecurity and protect swine health. Further investigation to validate these findings and explore additional biocontainment measures is warranted.

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

SHIC, along with FFAR 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.
- The robotic power washer used in the study 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. Read the entire study online.

- 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: New Projects Funded to Investigate Pathogen Contamination of Trailers at the Harvest Plant and Mortality Disposal Structures on Farm

SHIC's Wean-to-Harvest Biosecurity Research Program, funded in collaboration with FFAR and the Pork Checkoff, has recently funded two new projects to advance biosecurity of US swine farms. The newly funded projects include: 1) quantifying trailer contamination rates at the harvest plant interface led by Dr. Cesar Corzo at the University of Minnesota, and 2) assessing viral contamination of mortality disposal structures at wean-to-market farms led by Dr. Igor Paploski at the University of Minnesota. These awards bring the total number of projects to 20 that have been funded by the program for a comprehensive approach to enhancing biosecurity across the wean-to-harvest phases of swine production.

Priorities of the Wean-to-Harvest Biosecurity Research Program focus on site and transportation biosecurity in five targeted areas: 1) personnel biocontainment and bioexclusion, 2) mortality management, 3) truck wash efficiency, 4) alternatives to fixed truck wash, and 5) packing plant biocontainment. The 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. Proactively enhancing wean-to-harvest biosecurity will help control the next emerging disease in the US pork industry. All proposals submitted undergo a competitive review process by a task force of industry stakeholders with funding recommendations approved by the SHIC Board of Directors, FFAR, and Pork Checkoff. Projects are reviewed for their value to pork producers and their ability to provide cost-effective biosecurity solutions on the farm.

Novel tools, technologies and approaches are needed to augment current biosecurity practices in the US swine industry. Each of the two newly funded projects investigate unique routes for disease transmission through market transport and mortality management. First, a project led by Dr. Cesar Corzo at the University of Minnesota was awarded entitled "Quantification of the trailer contamination risk at the harvest plant: An assessment of current trailer positivity rate and associated factors." Developed in collaboration with the Meat Institute, this project seeks to gather and analyze key data on viral pathogen contamination rates of transport trailers throughout the year at the interface with the harvest facility, including PEDV, SVA, and PRRSV. The goal of the research is to understand potential epidemiological factors related to the trailer and unloading process that contribute to increased or decreased contamination risks.

Second, a project led by Dr. Igor Paploski at the University of Minnesota entitled "Assessing viral environmental contamination: An investigation of dead animal disposal structures in wean-to-market farms" was awarded. This project seeks to describe current biosecurity practices associated with dead animal disposal, assess viral environmental contamination around mortality disposal structures including composting bins and dead boxes, and test an environmental decontamination strategy. The goals of the research are to identify practices associated with viral contamination of mortality structures and develop actionable information for risk mitigation of disease transmission through mortality management.

The Wean-to-Harvest Biosecurity Program continues to accept research proposal submissions which address the five targeted priority areas until funds have been expended. Total project funds available for the Program since its inception are $2.3 million. Real-time results of all projects will be shared as quickly as they become available for producers to implement knowledge gained on the farm.

List of Research Projects Funded Through Wean-to-Harvest Biosecurity Program in 2024

1. Principal Investigator: Erin Kettelkamp, Swine Vet Center
    - Title: Investigating waterless decontamination and application potential in transport biosecurity
    - Start Date: April 1, 2024; Project Duration: 9 months
2. Principal Investigator: Roy Edler, Pipestone Research
    - Title: What is the cost of disease for grow-finish producers?
    - Start Date: June 1, 2024; Project Duration: 24 months
3. Principal Investigator: Igor Paploski, University of Minnesota
    - Title: Assessing Viral Environmental Contamination: An Investigation of Dead Animal Disposal Structures in Wean-to-Market Farms
    - Start Date: August 1, 2024; Project Duration: 12 months
4. Principal Investigator: Cesar Corzo, University of Minnesota
    - Title: Quantification of the trailer contamination risk at the harvest plant: An assessment of current trailer positivity rate and associated factors
    - Start Date: August 1, 2024; Project Duration: 12 months
5. Principal Investigator: Mike Chetta, Talent Metrics Consulting
    - Title: Interview assessment of caretaker motivation and resources to comply with biosecurity procedure in the wean-to-market phase of production
    - Start Date: August 1, 2024; Project Duration: 8 months
6. Principal Investigator: Gustavo Machado, North Carolina State University
    - Title: Cost-benefit analysis of vehicle and trailer rerouting to prevent disease propagation
    - Start Date: October 1, 2024; Project Duration: 12 months
7. Principal Investigator: Noelle Noyes, University of Minnesota
    - Title: Application of Mitigant to Reduce Viral Trailer Contamination at Harvest Facilities
    - Start Date: January 1, 2025; Project Duration: 18 months

Japanese Encephalitis Virus

SHIC-funded Economic Assessment Estimates Production Impact of JEV Outbreak in US Swine

In early 2022, Japanese encephalitis virus (JEV) expanded into new regions of Australia, affecting over 80 swine breeding farms and causing significant production losses. Having never been detected in US swine, JEV poses an emerging transboundary threat to domestic sow herds susceptible to viral infection. As part of industry preparedness activities for JEV, SHIC funded an economic assessment to explore the potential impacts for introduction and establishment of JEV in the US. Dr. Liz Wagstrom, Wagstrom Consulting, led the investigation, alongside a team of economists and production veterinarians, to gather production data during the Australian outbreak and develop a prediction for production losses due to reproductive outcomes during a potential US incursion.

Now complete, the full domestic JEV incursion economic assessment white paper can be accessed online. Authors estimated that 32% of the US sow herd would be at-risk for JEV infection and that resulting sow herd losses would range from 1-2% of production. Assuming no increase in prices due to the diminished output, economic losses to the US pork industry would be between $306 million and $612 million. While the study did not assess the impact on boar studs or changes in demand for pork and pork products, the predicted production impact for US swine herds supports the need for continued JEV prevention and preparedness activities.

The 2022 outbreak of JEV genotype IV spread rapidly across new geographic regions in Australia affecting breeding swine herds and causing reproductive failure, delayed farrowing, stillbirths, mummified fetuses, abortions, and weak shaker piglets. Additional clinical signs were noted for infected boar studs including orchitis, decreased sperm number (in some cases progressing to semen with no sperm) or motility in semen, and abnormal spermatozoa. Between February 25 and March 3, 2022, JEV infection in pigs was confirmed in four Australian states. By mid-2022, more than 80 pig farms located over much of the southern and eastern parts of Australia were infected. Since the last identified JEV infection in Australian swine was in a single gilt in November 2022, no additional JEV infections in Australian domestic swine have been identified during 2023 – 2024. Through interviews with Australian veterinarians and analysis of production data, it was estimated that approximately 60% of Australia's sow herds were impacted with overall production losses ranging from 3% – 6%.

As part of the economic assessment for a potential JEV incursion to the US, the investigative team evaluated differences between the US and Australian pork industries. Compared to the US inventory of 72.2 million swine on over 60,000 farms, the Australian pig industry is smaller with an inventory of 2.4 million swine on 4,300 piggeries. Further, farm ventilation type was compared as it had been previously hypothesized as a risk factor for infection during the Australian outbreak. Australian veterinarians estimated that of the 90% of sows raised in indoor confinement, only 10% are housed in mechanically ventilated facilities. This contrasts with US sow herds predominantly raised in mechanically ventilated facilities including filtered barns, which are believed to have lowered risk for mosquito exposure. For US herds, ventilation type varies by production region and was considered when assessing overall percentage of sows impacted by a potential JEV incursion.

The total estimated number of sows predicted to be impacted in the US was 2,135,940, which is equal to 32% of the total US breeding herd. As affected farms in Australia experienced a 3% – 6% reduction in annual output, applying the same 3% – 6% value across the number of impacted US sows suggests a reduction in overall US production output of 1% – 2%. Cash receipts for the US pork industry totaled $30.6 billion in 2022. This suggests that the economic losses in impacted herds would be between $306 million – 612 million in a 1-year outbreak scenario. For a 2,500 head sow farm that had achieved 30 weaned pigs per sow per year prior to the outbreak and assuming each weaned pig is worth $40, the production losses amount to $90,000 – $180,000 per year.

Understanding the potential economic impacts of JEV on pork production in the US is critical to protecting the health of the US swine herd as well as mitigating the risk of this emerging disease. While certain production losses were not assessed, including impact on trade or boar stud output, the information gained in the report illustrates the potential negative impact for US pork production on sow farms. This economic estimate supports the need for research to understand the dynamics of disease transmission and the development of strategies for prevention and control. Critical research investments continue to be necessary to prevent JEV incursion, ensure rapid detection of JEV if introduced, inform stakeholder response, mitigate production losses on sow farms, identify effective control measures, and develop clear messaging to consumers on the safety of pork.

SHIC/FFAR Collaboration Seeks Japanese Encephalitis Virus Research Proposals

SHIC and FFAR have partnered to fund a $1 million research program to enhance US prevention, preparedness, and response capabilities for Japanese encephalitis virus, a transboundary disease risk for US introduction.

SHIC's strategic mission to identify risks to swine health includes global and domestic disease monitoring to maintain an acute awareness of emerging swine diseases around the world. Japanese encephalitis is an emerging zoonotic disease identified through global monitoring as a priority for North American prevention and preparedness activities. JEV is transmitted through the bite of infected Culex mosquitoes and biosecurity practices focused on mosquito control are key to reducing risk. The US is currently negative for this mosquito-borne virus which has waterbirds as a natural reservoir but is capable of infecting pigs, humans, and horses.

In 2022, an outbreak of JEV genotype IV spread rapidly across new geographic regions of Australia affecting breeding swine herds and causing reproductive failure, delayed farrowing, stillbirths, mummified fetuses, abortions, and weak piglets. This recent incursion of a new JEV genotype into areas previously free from disease warrants the need for a close investigation of this virus and its potential for incursion and establishment in the US. Understanding the potential impacts of JEV on pork production in the US is critical to protecting the health of the US swine herd as well as mitigating the risk of this emerging disease.

In response to this emerging disease, SHIC and FFAR have partnered to invite proposal submissions from qualified researchers for funding consideration to address identified research priorities for JEV, including topic areas of 1) transmission and epidemiology, 2) mosquito

control, 3) diagnostics, 4) communication, 5) surveillance, 6) compatible cases, 7) challenge models, 8) vaccines, 9) cross-protection, 10) competent vectors, 11) role of wildlife, 12) novel hosts, and 13) viral sequencing. Proposal information and a detailed list of research priorities can be found online.

Proposals should clearly state which of the identified SHIC/FFAR JEV research priorities will be addressed through the project. Collaborative projects that include the pork industry, international organizations, allied industry, academic institutions, and/or public/private partnerships are highly encouraged. Projects demonstrating the most urgent, timely completion, providing the greatest value to pork producers, and showing efficient use of funds will be prioritized for funding. Projects are requested to be completed within a 12-to-18-month period with sufficient justification required for extended project duration. The JEV research proposal template can be found online.

Total funding available for the SHIC/FFAR JEV Research Priorities is $1 million. Individual awards are capped at $250,000 but proposals may exceed the cap if sufficient justification is provided. Matching funds are encouraged but not required; the $250,000 cap applies to only those funds requested from SHIC/FFAR. All projects should strive to be unique, have a high impact, show value to pork producers, and have industry-wide benefit.

The deadline for proposal submission is 5:00 pm CDT on April 15, 2024. SHIC and FFAR are co-hosting an informational webinar on February 22, 2024, at 3:00 pm CST to provide additional details about the application criteria.

SHIC/FFAR Webinar Informs JEV Research Program Applicants

SHIC and FFAR partnered to fund a $1 million research program to enhance US prevention, preparedness, and response capabilities for Japanese encephalitis virus (JEV), a transboundary disease risk for US introduction. SHIC and FFAR co-hosted an informational webinar on February 22, 2024, regarding the request for proposals for the program. The webinar recording can be viewed on-demand. Deadline for proposal submission is 5:00 pm CDT on April 15, 2024. Awards for this program are anticipated in late spring 2024.

FFAR staff participating in the webinar included Lauren Hershey, director of strategic partnerships, Dr. Jasmine Bruno, scientific program director and leader of the animal systems research portfolio, and Michelle Olgers, communications officer. They were joined by SHIC Executive Director Dr. Megan Niederwerder and SHIC Associate Director Dr. Lisa Becton. The goal of the joint research program is to develop novel tools and technologies enabling the US to prevent introduction of JEV. Additionally, preparation for a potential JEV incursion will include development of a response strategy and identifying ways to mitigate production losses should JEV be introduced in the US.

With significant solicitation of ideas and stakeholder feedback, SHIC and other partners developed 13 research priorities for the JEV program. Priorities include transmission and epidemiology of the virus, developing mosquito control strategies for US hog farms, development and evaluation of diagnostic tests including genome-based and antibody-based options, developing effective communication strategies for producers and consumers,

surveillance plans and identifying surveillance targets, evaluating compatible cases that would be submitted to veterinary diagnostic labs in the US, developing challenge models to investigate interventions and their impacts on disease, identifying novel vaccine strategies, and understanding the potential for cross protection from other US flaviviruses. Other priorities include identification of competent vectors in the US, understanding the potential role of wildlife in JEV transmission and spread, defining novel hosts that could support viral replication, and evaluating viral sequencing to understand the molecular pathogenesis of JEV.

The mechanics and content requirements for proposal submission were also covered during the webinar. Dr. Becton noted the SHIC proposal template is different from the FFAR template and contains unique requirements for submission under this program. Specifically, proposals should address one or more of the listed research priorities. Project duration should be 12 to 18 months. However, if there is a compelling need for additional project duration, justification for the extended time should be included within the body of the proposal.

The maximum award per submitted proposal is $250,000. SHIC and FFAR encourage matching funds from other entities, but it is not required. Matching funds can be noted in a separate column on the budget template. SHIC and FFAR encourage proposal submissions that include collaborations across industries, including international organizations, allied pork industry partners, academic institutions, and other private and public partnerships. All proposals must provide research outcomes that benefit US pork producers and the US swine industry.

The proposal template requires the proposal body to be five total pages, typed in single-spaced, 12 point Times New Roman font. Proposal introductions should include project rationale, the specific priority being addressed, and a brief listing of project objectives. As the second part of the proposal, the research design should clearly and comprehensively state the details of the experimental methodology to accomplish each objective. Details should include reference assays or tests being utilized, sample types including frequency of collection, and statistical tests that will be employed for data analysis. This section is critical for reviewers to understand the research plan and evaluate scientific merit. Objectives should provide a clear format for data generation and be able to answer the key hypotheses within the proposal.

A description of the quality assurance and quality control plans should be incorporated into the proposal, including the steps investigators will take to ensure the project is completed in a standardized, consistent, repeatable, and accurate format. This may include a description of how testing is standardized, how staff or personnel will be trained, and other related steps. Investigators should detail the operating timeline lined out by key activities and milestones. For example, some investigators utilize a Gantt chart to signify key milestones by month. All proposals should include contact information for key persons managing research contracts on the cover page. This information is critical to connect SHIC/FFAR with the appropriate contacts for contract processes once awards have been granted.

On the budget template, specific sections are provided to detail individual costs that may occur for the project, including travel and publication. Overhead or indirect costs are typically not covered by SHIC research funds. SHIC funding can include graduate student support, student hourly labor, and other post-doctoral support. Regarding principal investigators, if appointments

are less than 12 months, funding requests must commiserate with the time being spent on the project. SHIC typically does not cover equipment unless it's approved in advance. In these cases, justification should be included within the budget section for equipment expenses.

Letters of cooperation from stakeholders, co-investigators, and/or institutions who have agreed to work on the project can be added within the proposal but are not counted as part of the five-page limit. The cover page and budget page are in addition to the five-page proposal body. Investigators are also welcome to include a two-to-three-page biosketch and/or references at the end of the proposal. All proposals should be submitted as a single word document.

SHIC highlighted some considerations for proposal review, including the value of research to the US pork industry, addressing one or more of the 13 research priorities, and project relevance and impact to US pork production. Experimental design review can include an evaluation for clearly outlined aims and objectives, inclusion of appropriate, trackable, timely, and feasible methodology, and the presence of a qualified research team. Reviewers will evaluate if the objectives are achievable and if the budget requests are justified. Multiple proposals from the same principal investigator/co-principal investigator, and consortium applications are welcomed. US-based collaborator(s) are encouraged but not required. If projects have international lead investigators, the proposal should clearly demonstrate that the research provides value back to US pork producers and the US swine industry. For additional questions or to review the template and RFP, please refer to https://www.swinehealth.org/call-for-research/ for the SHIC/FFAR JEV RFP.

SHIC/FFAR JEV Request for Research Proposals Nets 26 Responses

SHIC and FFAR leveraged funds to develop a $1 million research program to enhance US prevention, preparedness, and response capabilities for Japanese encephalitis virus (JEV), a transboundary emerging disease risk for US swine. Announced in February 2024, the partnership between SHIC and FFAR invited proposals to be submitted by qualified researchers to address 13 JEV research priorities. Proposals were due April 15, 2024, and a total of 26 research proposals from 23 different institutions, including international organizations, were received and will undergo competitive review for funding recommendation.

JEV is an emerging disease transmitted by infected mosquitoes and identified as a priority for North American prevention and preparedness through global swine disease monitoring. In 2022, an outbreak of JEV genotype IV spread rapidly across new geographic regions of Australia affecting breeding swine herds and causing reproductive failure, delayed farrowing, stillbirths, mummified fetuses, abortions, and weak piglets. The US is currently negative for this mosquito-borne virus which has waterbirds as a natural reservoir host but is capable of infecting pigs, humans, and horses.

Recently completed, a SHIC-funded economic assessment on the impact of a JEV introduction to the US reports that 32% of the US sow herd would be at-risk for JEV infection and that resulting sow herd losses would range from 1-2% of production. Assuming no increase in prices due to the diminished output, the assessment says economic losses to the US pork industry would be between $306 million and $612 million. Coupled with the recent outbreak in Australia, this

economic assessment highlights the need for close investigation of this emerging disease and its potential for incursion and establishment in the US.

Responding to this emerging disease risk, SHIC and FFAR joined efforts to form the JEV Research Program with a goal of generating new knowledge for US pork producers on JEV prevention, preparedness, and mitigation. The 26 JEV proposals received in response to this Program will undergo a competitive review process by a task force comprised of pork producers, veterinarians, allied industry, academic researchers, and government scientists. Proposals will be reviewed for their value to US pork producers, application to identified research priorities, scientific soundness, timely completion of objectives, efficient use of funds, level of impact on swine health, and industry-wide benefit.

Proposals were requested to address one or more of 13 research priorities for JEV: 1) transmission and epidemiology, 2) mosquito control, 3) diagnostics, 4) communication, 5) surveillance, 6) compatible cases, 7) challenge models, 8) vaccines, 9) cross-protection, 10) competent vectors, 11) role of wildlife, 12) novel hosts, and 13) viral sequencing. Proposal information and the detailed list of research priorities can be found online.

Upon review, project awards are expected to be announced in the summer of 2024. Projects demonstrating the most urgent and timeliness of completion, providing the greatest value to pork producers, and showing efficient use of funds are prioritized for funding. Results will be shared with producers and veterinarians as soon as they become available.

Research investments are necessary to prevent JEV incursion, ensure rapid detection of JEV if introduced, inform stakeholder response, mitigate production losses on the sow farm, identify effective control measures, and develop clear messaging to consumers on the safety of pork. Outcomes from the funded proposals will provide critical information that producers, veterinarians, and industry stakeholders can use to better prevent incursion and develop preparedness plans if JEV is identified in the US.

SHIC Project Develops Japanese Encephalitis Virus Diagnostic Test for Swine

Japanese encephalitis virus, a transboundary emerging disease risk for US introduction, carries with it potential economic implications greater than $500 million per a recent economic assessment white paper (Cook et al., 2024). Transmitted by the bite of infected mosquitos, JEV can cause severe disease in pigs, horses, and humans. While historically endemic to Asian and western Pacific regions, the 2022 JEV outbreak in Australia raised concerns of a renewed threat to the US pig industry and public health.

For US preparedness, it is critical to establish a reliable way to detect JEV in swine samples prior to an introduction or outbreak. Principal investigator Dr. Rahul Nelli and co-investigator Dr. Phil Gauger, Iowa State University, recently completed a SHIC-funded project to establish RT-rtPCR assays for JEV and its five genotypes, comparing the newly established test with a previously published assay in the process. Development of a JEV test for US veterinary diagnostic labs that can accurately and efficiently detect multiple JEV genotypes will help the US pig industry monitor and respond rapidly to a potential JEV incursion.

A potential outbreak of JEV in the US pig population can have detrimental economic and public health impacts. It is crucial to be vigilant and establish a screening method to detect the virus early when clinical signs suggest that JEV could be a differential diagnosis. Recently completed, the full report of the project entitled, “Establish and validate RT-rtPCR for detecting JEV in porcine samples,” can be found online.

Findings from this project suggest the newly developed novel RT-rtPCR assay is more specific than previously published assays and can detect all five JEV genotypes (G-1, -2, -3, -4, -5) accurately and efficiently. The new assay also has a low detection limit, meaning it can detect very small amounts of the virus. Further, the project confirmed that the novel JEV PCR assay does not cross-react with other viruses endemic to the US swine herd, such as PRRSV, PPV1, PPV2, PEDV, TGEV, PDCoV, PoAstV3 or PoAstV4. Validation of genotype-specific RT-rtPCR assays and evaluation of assay performance on known status clinical samples in collaboration with Australian swine industry stakeholders is ongoing.

Before the assay developed in this project can be used for routine diagnostics, it must be further validated for diagnostic specificity and sensitivity utilizing the American Association of Veterinary Laboratory Diagnosticians and National Animal Health Laboratory guidelines. To accomplish this, a collaborative effort will be undertaken with known status JEV samples from the Australian outbreak. This collaborative research aims to ensure that the assay is accurate and reliable in detecting JEV in various conditions and across different clinical samples. By validating the assay using these methods, greater confidence is achieved in its ability to help identify and prevent the spread of JEV in pigs. Early and accurate diagnosis of JEV is crucial for rapid response efforts to reduce the potential disease impact on humans and the production impacts for pork producers.

SHIC-Funded Assessment Identifies US South as Highest Risk Region for JEV Introduction and Transmission

Global swine disease monitoring identified Japanese encephalitis virus, a transboundary disease transmitted by *Culex* mosquitos, as an emerging threat to the US swine industry. The 2022 JEV outbreak in Australia heightened the need to define the risk this virus poses to US pork production, informing prevention, preparedness, and response efforts. In 2022, the Swine Health Information Center funded a study led by Dr. Natalia Cernicchiaro, Kansas State University, in collaboration with researchers at the USDA ARS Foreign Arthropod-borne Animal Diseases Research Unit, to update her group’s 2018 qualitative assessment estimating the risk of JEV emergence and subsequent transmission in the continental US. Incorporating the latest scientific information and elements into the new study, the updated semi-quantitative assessment evaluated the risk of JEV introduction into seven US regions, its subsequent spread, and economic impact. Study results found the overall risk, reflecting the rate of introduction and economic impact of a JEV incursion, was non-negligible for the south, west, midwest, and northeast regions.

Although currently free from JEV, the US is considered a susceptible region for incursion due to multiple factors. Specifically, the availability of competent insect vectors, susceptible maintenance (avian) hosts, large populations of susceptible and amplifying hosts (domestic and feral pigs), extensive travel and trade to and from JEV-affected countries, as well as similar climatic and environmental conditions as endemic countries fuel susceptibility. To reassess the

current risk of JEV emergence into the US, the study sought to update the 2018 assessment and add information regarding transmission post-emergence by incorporating the latest scientific information, updating assumptions, adding data sources, including the recent outbreak data from Australia, and considering regional elements contributing to the risk. Find the industry summary of the JEV risk assessment online.

To perform the updated semi-quantitative JEV risk assessment, the 48 contiguous US states were grouped into five regions based on climate, domestic swine production, and presence of feral swine. Due to their geographic isolation, Hawaii and Alaska were identified as their own respective regions. Using the risk framework, introduction of JEV into the seven US regions was evaluated from the current international regions of JEV distribution (i.e., southeast Asia, Australia, western Pacific rim). Many pathways of entry were considered, including infected vector eggs/larvae via imported goods, infected adult vectors via aircraft, ships, or shipping containers, and infected ardeid birds migrating from the current region of distribution.

Information utilized to update model parameters included data from an updated systematic review of the literature on vector and host competence for JEV. The updated review, assessing literature published from 2016-2022, reported a slightly higher number of articles that focused on host competence and susceptibility to JEV compared to vector competence. This shift in focus could be attributed to, in part, the realization of certain host species' (e.g., pigs, migratory and domestic birds) high susceptibility to JEV. Additional sources of information for the risk assessment models included global databases, scientific literature, and expert opinion obtained from the JEV advisory group and project collaborators. The JEV advisory group consisted of swine producers, veterinarians, entomologists, researchers and stakeholders from the US and Australia with knowledge on commercial swine production, JEV, and the 2022 Australian outbreak.

Summary output parameters calculated by this risk assessment included the rate of introduction, estimated epidemic size, and the overall risk estimate. The highest risk scores for the rate of introduction were deemed moderate and associated with the entry of adult mosquitoes in ships into the US south (AL, AK, DE, Fl, GA, KY, LA, MD, MS, NC, OK, SC, TN, TX, VA) and west (CA, ID, OR, WA) regions, and via mosquito eggs/larvae in imported tires into the northeast (ME, MA, NH, NY, VT) and west regions. The overall risk, which reflects the rate of introduction and economic impact of a JEV incursion into the region at risk, was very high for the south, moderate for the west, and very low for the northeast and the midwest regions.

In summary, based on the results from this risk assessment, the US south region had the highest risk of introduction and impact and should be prioritized for preparedness, in addition, the west and northeast regions should promote surveillance to facilitate early detection. This qualitative risk assessment is crucial to prepare for the threat of an emerging disease and protect the swine industry from suffering production and economic losses. Defining the US regions at greatest risk for JEV is an important step towards US prevention and preparedness as well as allocation of efforts for surveillance.

USDA APHIS Revised 2024 Japanese Encephalitis Disease Response Strategy

SHIC highlighted the request for feedback and subsequent publication of the revised USDA APHIS JEV response strategy through its monthly newsletter for stakeholder awareness.

From the USDA APHIS Stakeholder Release: APHIS Veterinary Services published the revised 2024 Japanese Encephalitis (JE) Disease Response Strategy, which can be found on the APHIS Foreign Animal Disease Preparedness and Response website. JE is not currently found in the United States. This document is intended to provide strategic guidance for USDA, APHIS, and responders at all levels in the event of a JE outbreak, should it enter the United States. If JE is introduced into the United States, Veterinary Services will provide additional policy guidance on specific response operation activities, tailored to the conditions of the outbreak. The 2024 Strategy updates and expands the scope of the 2013 version. Veterinary Services incorporated current science and research, shifted away from eradication as a response strategy, and updated considerations for control and vaccination. The updated version also includes more elements of the response than were previously addressed, such as recognizing a one health approach, increasing collaboration with public health authorities, and enhancing communication plans. VS included feedback from industry and Federal One Health partners in this update.

SHIC/FFAR Fund Six Japanese Encephalitis Virus Research Projects

The Swine Health Information Center and the Foundation for Food & Agriculture Research have recently funded six new projects to enhance US prevention, preparedness, mitigation and response capabilities for Japanese encephalitis virus (JEV). As a transboundary disease risk for US introduction, JEV is transmitted through the bite of infected mosquitos and can cause reproductive failure, abortions, and stillbirths or weak piglets in swine breeding herds. Recent expansion of JEV into new geographic regions of Australia warrants close investigation to prevent a potential JEV incursion into the US. In the fall of 2024, a total of $1.3M was awarded through the SHIC/FFAR JEV Research Program across six projects now underway.

Announced in February 2024, the SHIC/FFAR JEV Research Program sought to invest in critical research to prevent JEV incursion, ensure rapid detection of JEV if introduced, inform stakeholder response, mitigate production losses on sow farms, identify effective control measures, and develop clear messaging to consumers on the safety of pork. With a goal to address the emerging threat that JEV poses to US swine health, SHIC and FFAR invited proposal submissions from qualified researchers for funding consideration based on value to US pork producers.

A total of 26 proposals from 23 different institutions were received by the submission deadline in April 2024. Six proposals were selected for funding after a highly competitive review process conducted by swine industry stakeholders and subject matter experts. Newly funded projects address the SHIC/FFAR JEV Research Program priorities, including transmission and epidemiology, competent vectors, the role of wildlife, diagnostics, challenge models, and vaccine development.

SHIC/FFAR JEV Research Program projects funded and initiated in response to the RFP include:

Transmission and epidemiology

Epidemiology of JEV in Australian intensive piggeries
Principal Investigator: Brendan Cowled, Ausvet Pty Ltd
Objectives: 1) Understand the transmission and epidemiology of JEV within farms through a literature review and data analysis of affected farm parameters for model development; 2) Understand and validate the farm-level risk factors for JEV in the Australian outbreak through a qualitative study of expert veterinarians.

Competent vectors

Vector competence and JEV pathogenesis and immunity in domestic pigs
Principal Investigator: Angela Bosco-Lauth, Colorado State University
Objectives: 1) Evaluate vector competence of JEV in the primary West Nile virus mosquito vectors in the US; 2) Determine susceptibility and pathogenesis of JEV in domestic swine; 3) Assess protective efficacy of WNV vaccination and JEV vaccination against JEV infection in domestic swine; 4) Evaluate cross-neutralization of porcine antibodies against JEV, WNV, and St. Louis encephalitis virus.

Role of wildlife

Understanding the threat of wild pigs and mosquitoes for JEV transmission to domestic swine farms
Principal Investigator: Daniel Peach, University of Georgia
Objectives: 1) Establish whether wild pigs increase the habitat available to JEV vectors by identifying the mosquito species that breed in wild pig wallows; 2) Determine the extent of access and which mosquito species commonly try to enter sow and wean-to-finish farms; 3) Assess exposure of domestic swine herds to mosquito-borne pathogens associated with wild pigs.

Diagnostics

Building diagnostic capability for Japanese encephalitis virus in the United States
Principal Investigator: Katharine Bossart, Integrated Research Associates, LLC
Objectives: 1) Assess assay performance using recombinant and inactivated viral antigens from multiple JEV genotypes to build serologic diagnostic capabilities; 2) Create a prototype JEV IgM ELISA kit with all reagents and instructions and create a prototype JEV IgM dot enzyme immunoassay; 3) Develop secondary JEV IgM ELISAs and dot enzyme immunoassays using JEV nonstructural proteins.

Challenge models

Development of a pregnant sow model to study the pathogenesis of the emergent Japanese encephalitis virus genotype IV
Principal Investigator: Juergen Richt, Kansas State University
Objectives: 1) Develop robust and harmonized *in vivo* and *in vitro* methods for comparative analysis of infected pregnant sows across two study centers; 2) Conduct JEV infection trials at three gestational timepoints at each site; 3) Determine the pathobiological features of *in utero* infection and compare across the two study centers.

Vaccine development

Translation of the highly safe, pure and potent IMOJEV® live, attenuated chimeric vaccine against JE in humans for prevention of JEV infection and disease in swine
Principal Investigator: Thomas Monath; Substipharm Biologics SA
Objectives: 1) Demonstrate safety and immunogenicity of IMOJEV in swine; 2) Demonstrate efficacy of IMOJEV in protecting pigs from challenge with JEV; 3) Determine minimum effective dose for immunization with IMOJEV; 4) Provide quality assurance and quality control; 5) Develop a product development plan to meet product licensing requirements.

Awarded projects are nine to 24 months in duration; research results will be shared as soon as they become available. In partnership with FFAR, this effort helps SHIC fulfill its mission to generate new intelligence for preventing, preparing for, and responding to emerging swine disease threats. Understanding the potential impacts of JEV on pork production is critical to protecting the health of the US swine herd as well as mitigating the risk of this emerging disease.

List of Research Projects Funded Through the JEV Program in 2024

1. Principal Investigator: Angela Bosco-Lauth, Colorado State University
    - Title: Vector competence and JEV pathogenesis & immunity in domestic pigs
    - Start Date: August 1, 2024; Project Duration: 18 months
2. Principal Investigator: Katharine N. Bossart, Integrated Research Associates, LLC
    - Title: Building diagnostic capacity for Japanese Encephalitis Virus in the United States
    - Start Date: August 1, 2024; Project Duration: 18 months
3. Principal Investigator: Juergen A. Richt, Kansas State University
    - Title: Development of a pregnant sow model to study the pathogenesis of the emergent Japanese encephalitis virus genotype IV
    - Start Date: August 1, 2024; Project Duration: 24 months
4. Principal Investigator: Brendan Cowled, Ausvet Pty Ltd
    - Title: Epidemiology of JEV in Australia intensive piggeries
    - Start Date: August 1, 2024; Project Duration: 9 months
5. Principal Investigator: Thomas P. Monath, Substipharm Biologics SA
    - Title: Translation of the highly safe, pure and potent IMOJEV® live, attenuated chimeric vaccine against Japanese encephalitis (JE) in humans for prevention of JE infection and disease in swine
    - Start Date: August 1, 2024; Project Duration: 14 months
6. Principal Investigator: Daniel Peach, University of Georgia
    - Title: Understanding the threat of wild pigs and mosquitoes for JEV transmission in domestic swine farms.
    - Start Date: December 1, 2024; Project Duration: 18 months

H5N1 Influenza Risk to Swine

SHIC/AASV H5N1 IAV Webinar Addresses Global Influenza Surveillance and Risk to Swine

SHIC, in collaboration with AASV, hosted a webinar on influenza A viruses on Friday, April 19, 2024. The goal of the webinar was to understand the threat HPAI H5N1 poses to domestic

livestock species and to inform producers of actions that can be taken to prevent infection on-farm.

This article includes an overview of influenza A viruses, global and domestic distribution of the virus, IAV swine surveillance programs, and research outcomes for HPAI H5N1 experimental infection in swine. A second article summarizes information including an overview of influenza A viruses, global and domestic distribution of the virus, IAV swine surveillance programs, and research outcomes for HPAI H5N1 experimental infection in swine. The webinar garnered high interest with 1341 registrants and 921 joining the webinar live from 30 countries. The webinar recording is available online.

Dr. Amy Baker, research veterinary medical officer at the USDA National Animal Disease Center, started the presentations with an overview of influenza A virus in swine. Influenza A has a negative strand RNA genome, is enveloped, and contains two major surface glycoproteins – hemagglutinin (H) and neuraminidase (N). Dr. Baker said influenza A is prone to rapid evolution by two main processes – genetic mutation and reassortment – and that the virus escapes population immunity by antigenic drift and/or shift. With reassortment, influenza A evolution can lead to antigenic shift which was seen in the 2009 H1N1 pandemic in humans. Dr. Baker said influenza is constantly changing and shared that wild waterfowl are a native host for the virus. Influenza from waterfowl has the potential to infect swine and those same viruses can also interact with humans and poultry. During her presentation, Dr. Baker highlighted how several species, including pigs, birds, wild mammals, and humans, have the potential to serve as mixing vessels and share the influenza A virus among mammalian species.

Dr. Baker reviewed the ongoing USDA IAV surveillance in swine stating that this system has been active since 2009. Viruses identified at veterinary diagnostic laboratories are initially screened for the presence of IAV through PCR. The current testing methodology can detect the different H and N glycoproteins including H5N1. Cases that meet specific criteria can then be added into the surveillance for further whole genome sequences. Three sample streams are incorporated into the current surveillance system, including 1) case-compatible swine accessions to the NAHLN laboratories, 2) swine population samples epidemiologically linked to a human case of IAV, and 3) swine exhibiting influenza-like illness at commingling events such as fairs or exhibition events. Goals of the surveillance system are to monitor the genetic evolution of endemic IAV in swine and make influenza isolates from swine available for research. Further, goals include establishing a data management system for genetic analysis to facilitate the development of relevant diagnostic reagents, updating diagnostic assays, and identifying proper isolates for vaccine seed stock. The ongoing surveillance system helps to address the human/swine influenza A interface.

Dr. Baker noted that human influenza A greatly influences the pathogen's diversity in swine due to interspecies transmission from humans to swine. Surveillance of influenza viruses assists with the One Health approach to understand swine influenza A hemagglutinin and neuramidase diversity in the US and globally. Human variant cases from swine hemagglutinin clades are detected globally and monitored by the World Health Organization Collaborating Centres of the Global Influenza Surveillance and Response System. The USDA Swine Surveillance system provides valuable information regarding the evolution of the virus within the US to benefit swine

and human populations. Dr. Baker highlights the public health-animal health collaboration within the influenza community as a success story. While the current HPAI H5N1 panzootic is a concern for swine health and human pandemic preparedness, robust surveillance and disease investigation are the foundation for improving intervention strategies for animal and public health, Dr. Baker concluded.

Dr. Bailey Arruda, research veterinary medical officer with the USDA Agricultural Research Service at the National Animal Disease Center in Ames, began her presentation by discussing the differences between HPAI H5N1 and low pathogenic avian influenza. The HPAI designation refers to a specific clinical presentation in poultry based on the ability of the virus to replicate outside of the gastrointestinal tract. She said there have been multiple introductions of HPAI from 2021 to present with viruses of European decent being maintained in the US. A change in global HPAI epidemiology due to unprecedented detections of the virus in many different mammalian species has increased research interest and concern regarding the potential for mammalian adaptation of the virus. Dr. Arruda shared HPAI detections in wild birds are on the rise and incidence in commercial poultry flocks are continuing as well. Swine adapted influenza A infection in the US is common in commercial production and routinely monitored, per data from the SHIC-funded swine disease reporting system and the USDA surveillance.

To understand the risk of HPAI, it is important to note that multiple adaptations of the influenza A virus are required to overcome species restriction, stated Dr. Arruda. In one study led by Dr. Arruda and colleagues to characterize the divergent pathology and transmission among avian and mammalian origin isolates of HPAI H5N1 in swine, they discovered that overt clinical signs were not observed in pigs after experimental challenge. All isolates caused lung lesions consistent with influenza A virus infection, but differences included the variability of lesion severity across strains, the antigen distribution and cells affected, and only mammalian isolates had limited nasal shedding and partial transmission to direct contact pigs. In another recently completed study with full analysis pending, research observed that HPAI H5N1 strains vary in their clinical presentation post exposure in pigs. Based on results from this study, HPAI may need to be considered for the differential list when pigs present with neurologic clinical signs.

From research outcomes, Dr. Arruda stated that pigs are at risk from hemagglutinin H5 circulating strains and reassortment with endemic swine strains is a concern. She also stated that risk is higher for incursion into swine located in backyard multi-species or transitional outdoor pig farms that include the presence of poultry and/or wild waterfowl species. Finally, risk of incursion into conventional confinement swine operations in the US is likely low, but awareness and precautions are critical. Influenza A viruses are constantly evolving and pose a risk to domestic livestock species. To address and mitigate the impact of emerging influenza strains for producers, SHIC and AASV collaborated to provide this influenza A virus webinar with the latest information on influenza in domestic livestock species. Prevention efforts should focus on actions to reduce biosecurity risks including the use of outbreak investigation tools to identify biosecurity hazards at the farm. Understanding the status of influenza in US pig populations through targeted surveillance provides information on virus evolution, distribution and support of diagnostic tests and vaccines. Influenza viruses present a challenge for swine health and production and tools exist to reduce the impact this disease can have on pork producers.

SHIC/AASV H5N1 IAV Webinar Addresses Dairy Experience and Biosecurity on Swine Farms

SHIC, in collaboration with AASV, hosted a webinar on influenza A viruses on Friday, April 19, 2024. The goal of the webinar was to understand the threat HPAI H5N1 poses to domestic livestock species and to inform producers of actions that can be taken to prevent infection on-farm. This article includes an overview of the clinical presentation and epidemiology of the multi-state dairy herd outbreak and a review of biosecurity considerations for swine farms to mitigate risks of HPAI H5N1. A second article summarizes information including an overview of influenza A viruses, global and domestic distribution of the virus, IAV swine surveillance programs, and research outcomes for HPAI H5N1 experimental infection in swine. The webinar garnered high interest with 1341 registrants and 921 joining the webinar live from 30 countries. The webinar recording is available online.

Dr. Jamie Jonker, chief science officer with the National Milk Producers Federation, shared information on the diagnosis of HPAI H5N1 in domestic livestock. The first confirmation of H5N1 in a dairy herd was in Texas on March 25, 2024. As of the date of the webinar, 29 herds in eight states had confirmed HPAI H5N1 detections including Texas, New Mexico, Kansas, Idaho, South Dakota, Michigan, Ohio, and North Carolina. As of May 1, 36 herds in nine states confirmed HPAI H5N1 detection.

Affected dairy cows are typically multiparous in production at over 150 days in milk. About 10% of this population are affected in impacted herds with no mortality. Affected cows exhibit decreased activity with a drop in rumination and decline in feed intake. Milk yield drops with a change in milk consistency to a thicker, often yellowish to brown color resembling colostrum. Flakes can periodically be observed in milk which are most often associated with mastitis. Severely affected cows have all quarters impacted while others have just one or two quarters affected. There is a widespread increase in milk conductivity, also a typical indicator of mastitis. Affected herds take just four to six days to reach peak incidence, then clinical signs taper off at 10 to 12 days. However, it takes around 45 days for full herd recovery. Affected cows are managed symptomatically as there are no current treatments or vaccines approved for use in dairy cattle.

Dr. Jonker pointed to migratory birds as the likely source of HPAI H5N1 infection in dairy cows as well as subsequent animal movements. He also shared information about commercial poultry herds in the vicinity of impacted dairies being diagnosed with HPAI since March 25, including one egg layer in the Texas panhandle and three egg layers in Michigan. Research on virus transmission is needed to understand areas of risk and to identify potential management and mitigation steps. Additional research needs include understanding the long-term health and production implications for infected mature lactating dairy cattle and characterizing the impact in young-stock and dry cows.

Due to the HPAI outbreaks in dairy herds, a new emphasis is being placed on biosecurity on dairy farms to reduce the risk of introduction and infection. Dr. Jonker described the challenges of dairy farms' typically open design and areas of concern for disease introduction. USDA, American Association of Bovine Practitioners, National Milk Producers Federation, FARM, and Secure Milk Supply are all providing guidance and resources to dairy farms in these biosecurity

efforts. Human workers can also be at risk of infection, with upper respiratory protection (eyes, nose and mouth mucosa) being important after a dairy caretaker presented with symptoms of conjunctivitis after exposure. The CDC is providing additional guidance for animal caretaker protection to prevent potential exposure.

Dr. Derald Holtkamp of Iowa State University shared perspectives on what the HPAI H5N1situation means for biosecurity on swine farms. While these outbreaks do not signal novel biosecurity hazards for swine farms, it can change the prioritization of hazards to be addressed relative to wildlife. Dr. Holtkamp talked about the biosecurity hazards posed by wild birds and other animals inside and around swine barns, compost facilities, storage sheds, and other facilities including the perimeter buffer areas.

Water, food, and shelter including trees/windbreaks can act as attractants for wild birds. To implement control measures, attractants should be removed or protected from wild bird access. This includes cleaning up spilled feed daily, eliminating bird nesting and roosting sites, controlling rodents, removing wild animal habitats, using bird netting to prevent access inside swine barns, repairing curtains where needed, and draining ponds. Biosecurity control measures to eliminate nests and roosting sites near air inlets and entry points into swine farms is especially important. Harassment of birds to deter contact is also possible through lasers and loud noises. The potential use of lethal control measures for birds should always be carefully considered with assistance from the USDA Wildlife Services before being implemented.

Contaminated feed sources are another area of concern. Ingredient sources, including DDGs, feed storage facilities and feed mill biosecurity all need to be assessed for potential biosecurity hazards. In some cases, bovine-derived feed ingredients are used in swine rations including whey, milk replacers, dairy by-products, and raw milk potentially fed to show pigs. To address these factors, Dr. Holtkamp recommends an audit of ingredient sources, storage, and off-site processing. Bird-proofing and rodent control in these feed manufacturing and storage facilities are necessary.

Surface water used as a source of drinking water for pigs is another biosecurity hazard. Surface water control measures included avoidance or water treatment with chlorine, acidifiers, iodine or peroxide. Proximity to nearby poultry and dairy farms and the related operational connections of third-party service providers (equipment repairs, supply deliveries, etc.) raise additional concerns for biosecurity hazards.

Dr. Holtkamp shared information regarding the SHIC-funded Standardized Outbreak Investigation Program. This consistent approach to identify, assess, and prioritize biosecurity hazards can be used to conduct outbreak investigations or to proactively conduct a biosecurity hazard analysis. To request access to this free tool, send an email to soip@iastate.edu.

Influenza A viruses are constantly evolving and pose a risk to domestic livestock species. To address and mitigate the impact of emerging influenza strains for producers, SHIC and AASV collaborated to provide this influenza A virus webinar with the latest information on influenza in domestic livestock species. Prevention efforts should focus on actions to reduce biosecurity risks including the use of outbreak investigation tools to identify and prioritize biosecurity hazards at

the farm. Understanding the status of influenza in US pig populations through targeted surveillance provides information on virus evolution, distribution and support of diagnostic tests and vaccines. Influenza viruses present a challenge for swine health and production and tools exist to reduce the impact this disease can have on pork producers.

SHIC Highlights Ongoing Influenza A Surveillance in US Swine Herds

Part of SHIC's mission to protect and enhance the health of the US swine herd includes identifying emerging disease threats through surveillance and monitoring. The recent detection and confirmation by USDA of HPAI H5N1 in domestic livestock raises concerns regarding the emerging threat and potential risks to swine herds. In collaboration with AASV, SHIC recently hosted a webinar on HPAI in livestock which highlighted the ongoing surveillance of influenza A viruses in swine. IAV monitoring is important for early detection of newly emerging strains, to track changes in known viruses over time, and for informing response to an emerging threat. Current influenza monitoring in US swine populations include the SHIC Domestic Disease Monitoring Reports and the USDA Influenza A Swine Surveillance Program.

Supported by funding from SHIC, the Swine Disease Reporting System monitors and provides monthly Domestic Disease Monitoring Reports on the detection of IAV from swine samples submitted to participating veterinary diagnostic laboratories. Samples submitted to the six participating VDLs represent >96% of swine samples being tested in the US. The report highlights the detection of IAV by PCR, including the number of IAV submissions tested over time, the percent of positive submissions by age, a comparison of expected versus actual percent of positive submissions for seasonal trends, and the IAV subtype detected by PCR. Further, the IAV subtype distribution and location is now available through the new IAV state-level monitoring dashboard. Additionally, confirmed disease diagnosis for influenza A from porcine tissue cases received at ISU VDL is also available in the report. These combined reports provide tools to aid veterinarians and producers in timely identification of IAV in their herds and to determine if the influenza A positive cases are above expected in their region. Information from surveillance is necessary to guide prevention and control efforts including evaluation of the use of vaccines within the herd. The SDRS report is included in the monthly SHIC newsletters and can be found online.

In conjunction with IAV monitoring by VDLs, USDA monitors IAV from multiple surveillance streams and provides additional information regarding these viruses. The USDA Influenza A Swine Surveillance Program was initiated after the 2009 H1N1influenza pandemic. A visual showing the diagnostic criteria for inclusion on the program is available here. Goals of the surveillance program include monitoring the genetic evolution of endemic IAV in swine to better understand endemic and emerging influenza virus ecology, making influenza isolates from swine available for research, and establishing a data management system to facilitate genetic analysis of these isolates and related information. Additional goals include selecting the proper isolates for the development of relevant diagnostic reagents, updated diagnostic assays, and vaccine seed stock products. Samples submitted for influenza detection through this Program can originate from sick pig cases submitted to a VDL, samples from pigs at the pig/human interface, such as fairs and exhibitions, and from IAV strains collected from pigs with a link to confirmed isolation of IAV in a human case.

Influenza viruses that have been identified through specific IAV case criteria at the VDLs can be included in the USDA IAV Swine Surveillance Program. Producer data is anonymized with information such as age/production stage of animals sampled, sample type, subtype, and region of origin within the US. Samples that are PCR positive can be further evaluated by virus isolation, subtype sequencing, and whole genome sequencing. Information generated by the Surveillance Program is publicly reported and a tool for the visualization of aggregate IAV data developed by the USDA ARS National Animal Disease Center is available.

The American Association of Swine Veterinarian's position statement on influenza A viruses includes the statement, "It is the position of the AASV that we…recommend pork producers, swine veterinarians and diagnostic laboratories actively participate in IAV surveillance programs that provide information regarding IAV evolution and epidemiology."

The recent detection of influenza A virus H5N1 in livestock highlights the potential for influenza viruses to infect different species and the necessity for routine monitoring of influenza-like illness and maintaining good biosecurity practices in swine herds. Daily evaluation of pig health is important to rapidly identify early signs of an influenza outbreak such as increased coughing, difficulty breathing, nasal or ocular discharge, fever, lethargy and reduced feed intake. When pigs are sick, producers should work with their herd veterinarian to submit samples for testing to a veterinary diagnostic laboratory. Ongoing surveillance, at the VDL and in cooperation with USDA, is important to assist in identifying influenza detection trends for the national swine herd, to ensure veterinary diagnostics and vaccines are effective, and to determine the best strategies for prevention, management, and control.

Swine Industry Organizations Respond to H5N1 Outbreak in Dairy Cattle; Efforts inform preparedness and response planning for pork producers and veterinarians

A multistate outbreak of HPAI Type A (H5N1) in dairy cows began on March 25, 2024, in Texas. The cross-species outbreak immediately drew the attention of pork industry organizations whose representatives began collaborating for a cohesive, coordinated – not duplicative – effort to be informed, engaged, and responsive on behalf of the pig farmers and practitioners they represent and serve.

"Since H5N1 was identified in dairy cattle, there's been constant collaboration and communication between partners in the pork industry. The Pork Board has been meeting at least weekly with stakeholders from the Swine Health Information Center, the American Association of Swine Veterinarians, The Meat Institute, the National Pork Producers Council, the USDA, and others to closely monitor H5N1 updates and response within the dairy industry. These meetings give us the opportunity to discuss the potential implications and possible response," remarked Dr. Marisa Rotolo, veterinary epidemiologist, director of swine health, National Pork Board.

As of July 7, 2024, H5N1 had been confirmed in dairy cattle in 12 states. This includes 28 herds in Idaho, 25 in Michigan, 27 in Colorado, 21 in Texas, 12 in Iowa, eight in New Mexico, seven in Minnesota, five in South Dakota, four in Kansas, and one each in North Carolina, Ohio, and Wyoming, per USDA's Animal and Plant Health Inspection Service. H5N1 has not been found in pigs.

In an opinion piece by US Secretary of Agriculture Tom Vilsack titled, Good Biosecurity Is the Key to Mitigating the Spread of H5N1, released on June 26, 2024, he wrote, “The more we learn about H5N1, the more we understand that good biosecurity is a critically important path to containing the virus. Containing, and eliminating, the virus in our dairy cattle is essential – to protect the health of our herds and flocks, our farmers, our farmworkers, our families, and the rural economy they make possible.” Pork industry representatives support efforts being made by the dairy and poultry sectors, while looking for lessons in their experience to apply in the event it is needed for pigs.

Collaboration Is Critical

Collaboration is critical for preparedness and response, not only with other pork organizations, but within the barnyard and beyond. “We have those relationships in place and communicate almost daily with our colleagues in other pork organizations, and frequently with those working in animal health, human health, and the regulatory space,” said Abbey Canon, DVM, MPH, DACVPM, director of public health and communications with the American Association of Swine Veterinarians.

Part of AASV’s mission is to increase the knowledge of swine veterinarians, protect and promote the health and well-being of pigs, and advocate for science-based approaches to veterinary, industry, and public health issues. Dr. Canon says the organization strives to disseminate the most up-to-date information that swine veterinarians need and can use or distribute to their clients.

Leveraging Lessons Learned

Preparing for and responding to livelihood-damaging endemic and emerging swine disease, including influenza, is nothing new for the pork industry. “The pork industry is not a stranger to managing new and novel influenza strains. We learned a lot from H1N1 in 2009, which resulted in a lot of good planning between industry stakeholders and federal and state government agencies which can serve as the foundation for a measured and appropriate response to the introduction of different strains in the future,” remarked Dr. Patrick Webb, assistant chief veterinarian, National Pork Board.

Existing preparedness programs developed for the swine industry serve multiple purposes. “While the swine industry has had a particular focus on African swine fever and other foreign diseases, much of this work and preparation benefits current conversations about H5N1. Examples include enhanced biosecurity protocols as part of the Secure Pork Supply plan, development of the Certified Swine Sample Collector program to improve our surveillance capacity, and improvements to live swine traceability with the swine traceability standards supported by producers at National Pork Forum. The industry recognizes that there are multiple threats to swine health and in response, has invested time, money and resources into improving our readiness,” explained Anna Forseth, DVM, MS, director of animal health, National Pork Producers Council.

“The swine industry has been monitoring the evolving H5N1 situation closely. We know that new or novel strains of a virus can raise questions and activity beyond how it impacts the animals themselves, including regulatory action and impacts to trade. As we watch the dairy

industry's experience, we are engaging in conversations with state and federal regulators, public health officials, diagnostic laboratories, and trading partners to educate decision makers about the swine industry," Dr. Forseth said.

Informing the Pork Industry's Preparedness and Response

The Swine Health Information Center was founded in 2015, after the porcine epidemic diarrhea virus outbreak of 2013 when resources and response were determined to be inadequate. Resulting work of the Center has informed the industry's response, preparation, and preparedness efforts surrounding emerging disease issues, including H5N1.

"The recent detection of HPAI in domestic livestock raised questions regarding the emerging threat and potential risks for swine herds. The Swine Health Information Center, along with the American Association of Swine Veterinarians, hosted a webinar April 19, 2024, on influenza A viruses, with the goal of informing producers about influenza A virus pathogenesis, distribution, surveillance and research including the H5N1 outbreak. The webinar highlighted practical steps producers could take to reduce the risk of avian influenza on their farms, with a focus on biosecurity considerations to decrease wild bird access, and outlined the outbreak investigation tools available through SHIC for use during suspected health challenges," explained Megan Niederwerder, DVM, PhD, executive director of SHIC.

SHIC provides additional tools for practitioners and producers to employ in preparedness efforts as well. "Swine producers and their veterinarians are very familiar with surveillance and management of influenza A viruses in their herds and the detection of H5N1 in dairy cattle highlights the continued importance for IAV surveillance. The Swine Disease Reporting System, funded by SHIC, provides information and tools that can be applied for use in decision making on farms. Monthly domestic disease monitoring reports detail the detection of influenza A virus across six veterinary diagnostic laboratories and represent >96% of U.S. swine sample submissions, enabling producers to rapidly detect new viruses, track changes over time and by region, and inform decisions for management strategies," stated Lisa Becton, DVM, MS, DACVPM, associate director of SHIC.

One Health Perspective Incorporated in Collaboration

Influenza has indeed been present in the U.S. swine industry for decades with multiple strains impacting herds. "AASV recommends pork producers, swine veterinarians and diagnostic laboratories actively participate in IAV surveillance programs that provide information regarding influenza A virus evolution and epidemiology. Participation in these surveillance programs can help identify and quickly respond to emerging threats with early detection," stated Dr. Canon. "Further, AASV supports the recommendation that people working with swine take all available precautions, including vaccination (with their human health professional's approval), biosecurity, and personal protection measures to work towards prevention of bidirectional influenza transmission. It is important to consider cross-species transmission of influenza viruses as part of a One Health approach."

Following the discovery of H5N1 in dairy herds, four human cases of the influenza strain have been detected in people, per the U.S. Centers for Disease Control and Prevention "This is a great reminder for the industry of how important our seasonal flu shots are. Since pigs can contract

influenza strains from humans, keeping workers healthy also keeps pigs healthy. Everyone who works with pigs should be getting their annual flu shot," commented Dr. Heather Fowler, public health veterinarian, director of producer and public health, National Pork Board.

Preparing for Outbreak Together

"The current influenza outbreak is a great example of how important a One Health approach is when dealing with illnesses that affect both humans and animals in a shared environment. Since the identification of the H5N1 virus in dairy cattle, the Pork Board has been working collaboratively with partners across the barnyard to help us prepare if we were to have an introduction of H5N1 into the swine herd," said Dr. Fowler.

"The swine industry already has extensive knowledge and experience when it comes to flu management and monitoring. We have multiple programs that can be quickly deployed should H5N1 be detected in swine," Dr. Rotolo observed. Existing programs combined with intentional preparedness efforts equip the pork industry to deploy an effective response to H5N1 in the U.S. swine herd if needed.

SHIC Expands Ongoing Monitoring and Communication Efforts for Influenza with Project to Identify Research Priorities for H5N1 Risk to Swine

In response to the ongoing outbreak of HPAI H5N1 in the dairy industry, SHIC has highlighted IAV monitoring in swine through the domestic disease monitoring reports, coordinated a HPAI H5N1 in livestock webinar along with AASV, and published newsletter articles to inform stakeholders of current IAV knowledge. To build on these efforts, SHIC has recently funded a literature review to identify research priorities and knowledge gaps for HPAI H5N1 risk to swine. Led by Dr. Montse Torremorell, University of Minnesota, the project will outline currently available information on clinical presentation, detection, mitigation strategies on swine flu, and research priorities for HPAI H5N1 in swine.

The mission of the Swine Health Information Center is to protect and enhance the health of the US swine herd by minimizing the impact of emerging disease threats. Disease threats are evaluated for risk when there is a change in the species affected, the clinical presentation, the severity of disease, or the geographic range impacted. SHIC identified HPAI H5N1 as a potential emerging disease threat to US swine due to the recent outbreak in dairy cattle, which represents a change in species affected and clinical presentation through mastitis. No cases of H5N1 have been detected in US swine and industry efforts are focused on preventing infection.

Due to be completed by late summer 2024, the HPAI H5N1 literature review will outline current knowledge on the virus and identify the greatest research needs to mitigate risk to swine. More specifically, the review will cover the current knowledge for H1 and H3 influenza strains currently circulating in swine as well as the H5N1 influenza strains circulating in wild birds and dairy cattle. Current understanding of clinical presentation, diagnostic samples, surveillance and management strategies will be reviewed. Research priorities for prevention, preparedness, mitigation and response for H5N1 risk to swine will be identified.

In other ongoing influenza activities, SHIC supports routine monitoring of IAV in swine through the Swine Disease Reporting System which aggregates data from participating veterinary

diagnostic laboratories in the US and reports the major findings to the swine industry through monthly reports. A newly implemented monitoring capability provides the industry with information regarding IAV detection in each state, including an expected rate of prevalence based on historical detection. Further, there is an added feature for mapping IAV diagnostic data across states for visualization of changes from state-specific baselines. Monthly reports can be accessed here: https://www.swinehealth.org/domestic-disease-surveillance-reports/.

SHIC, in collaboration with AASV, hosted a webinar on HPAI H5N1 in livestock and risk to swine on Friday, April 19, 2024 that garnered high interest. A total of 1341 individuals registered with 921 joining the webinar live across 30 countries. Goals of the webinar were to have subject matter experts provide the latest information on influenza A virus, including an overview of the pathogen, global and domestic distribution, research outcomes for HPAI experimental infection in swine, experiences and perspectives of the dairy industry from the current outbreak, and an outbreak investigational tool for identifying and mitigating biosecurity risks. Additionally, information for producers on actions that can be taken to reduce the risk of avian influenza introduction on-farm was provided. The webinar can be viewed on demand here: https://www.swinehealth.org/podcasts/.

Through the SHIC newsletter and SHIC website, several articles have been provided to inform stakeholders about IAV risk and monitoring in swine including a two-part article series overview of the HPAI H5N1 in livestock and risk to swine webinar and an article detailing current IAV monitoring in swine through USDA surveillance and SDRS. Additional SHIC activities include development of a SHIC Talk podcast on H5N1 IAV, participation in a producer roundtable for disease monitoring and control at World Pork Expo, and multiple interviews with agriculture media outlets to inform producers on steps to reduce the risk of IAV introduction into their farms.

Information about influenza and research priorities for prevention and preparedness of HPAI H5N1 in swine can be found at www.swinehealth.org.

SHIC Lit Review Outlines Current Information and Knowledge Gaps for H5N1 Risk to Swine Including Highest Priority Needs for Prevention and Preparedness

The recent emergence of H5N1 Influenza A clade 2.3.4.4b in dairy animals, coupled with persistent outbreaks in commercial poultry, poses a significant threat to the US swine industry. To summarize the current understanding of H5N1 risk to pigs as well as identify knowledge gaps, SHIC funded a literature review conducted by Dr. Montse Torremorell and colleagues at the University of Minnesota College of Veterinary Medicine. The goal of the literature review completed October 17, 2024, was to help identify highest priority research needs for H5N1 risk to the swine industry, assist in the process of influenza prevention and response planning for pork producers, and provide a summary of the clinical presentation of H5N1 in livestock compared to other known influenza strains.

Given the transmission of H5N1 infection to novel species including livestock, the potential risk of H5 infections in humans, and the epidemiological connections between swine, dairy, and poultry, it is imperative to fully understand the risks to pigs. Developing science-based strategies

to prevent H5N1 introduction into swine populations and to contain outbreaks, should they occur, is equally critical.

Read the literature review in full with references online. The following headings highlight topics covered in the review:

- Experimental infections of H5N1 in dairy cattle and pigs
- Field investigations of H5N1 2.3.4.4b in dairy cattle, pigs and peri-domestic animals
- Transmission through indirect routes
- Aerosol transmission and risk of exposure to workers
- Reassortment risks
- Cross-protective immunity against H5N1 2.3.4.4b viruses
- Diagnostics and surveillance
- Mutations and H5N1 mammal adaptation
- H5N1 Environmental stability
- Management practices to control H5N1 virus

H5N1 has caused significant losses in the US poultry industry and has more recently affected the US domestic dairy industry, with infections leading to reduced milk production, changes in milk quality, and occasional respiratory clinical signs. While experimental studies have shown pigs can be infected with H5N1, the specific impact of the 2.3.4.4b clade on pigs remains unknown. The potential for severe consequences to the US pork industry as well as human health is significant.

Experimental infections in pigs have shown variable results, with some studies indicating mild infections and others showing more severe disease. Several factors, such as viral genotype, animal species from which the strain was isolated, and immune status, can influence the severity of H5N1 infections in pigs. Questions surrounding the differences between H5N1 and endemic swine influenza viruses H1 and H3 remain, such as if current protocols for diagnostic surveillance and management of endemic swine influenza can be utilized for H5N1 control and elimination if introduced into commercial swine herds. Direct contact, indirect transmission through fomites, and aerosol transmission are potential routes of H5N1 spread. Enhanced surveillance, improved biosecurity measures, and vaccination strategies are crucial for considering how to best prevent and rapidly control a potential H5N1 infection in pigs.

Results of the literature review confirm studies are needed to assess the clinical signs, viral shedding, and transmission dynamics of H5N1 2.3.4.4b in pigs. Monitoring pig populations, particularly those with outdoor access or exposure to poultry and dairy cattle, is essential to identify potential H5N1 infections. Literature review authors report research on the survival of H5N1 in various environments, including farm settings and outdoor habitats, is important. Additionally, studies should evaluate whether pre-existing immunity to other influenza viruses or H5N1 vaccines can provide protection against the 2.3.4.4b clade in pigs. For the research needed, validation of diagnostic tests for H5N1 in pigs is necessary to ensure accurate and timely detection.

Addressing these knowledge gaps and implementing effective control measures is crucial to protect the swine industry and public health.

USDA-APHIS Confirms H5N1 in Pig from Small Oregon Backyard Farm; SHIC Monitoring Situation with Industry Partners and Emphasizes Safety of Pork

The Swine Heath Information Center has been coordinating with other swine industry organizations to follow the first detection of H5N1 in a pig in the US. USDA-APHIS confirmed the H5N1 diagnosis from a Crook County, Oregon, backyard farm where a mix of poultry, swine, and other livestock were housed together. SHIC shared the USDA-APHIS press release through an email blast to its stakeholder listserv and through its monthly newsletter.

SHIC, FFAR, and Pork Checkoff Announce H5N1 Risk to Swine Research Program RFP

SHIC has partnered with FFAR and the Pork Checkoff to fund a $4 million research program to enhance prevention, preparedness, mitigation, and response capabilities for H5N1 influenza in the US swine herd. H5N1 influenza, an emerging disease identified as a priority for the US pork industry, poses a risk due to ongoing outbreaks in poultry and a growing number of diverse mammalian species susceptible to infection. The unprecedented 2024 H5N1 outbreak impacting dairy herds across the US fuels the urgency for greater understanding and information, along with the recent discovery of the virus in a single backyard pig in Oregon.

On October 30, 2024, USDA reported the first detection of H5N1 in a pig on a small Oregon backyard farm where pigs were co-housed with poultry and other livestock. Although the farm is a non-commercial operation and the pig was not intended for the commercial food supply, this furthers the concern for potential incursion into US commercial swine herds. Research priorities for H5N1 are designed to further strengthen US swine industry prevention and preparedness as well as inform response efforts should H5N1 be introduced into the commercial swine herd.

SHIC, FFAR, and the National Pork Board invite proposal submissions from qualified researchers for funding consideration to address H5N1 risk to swine research priorities described in the detailed Request for Research Proposals found here along with the instructions for completion and submission, including topic areas of 1) vaccines, 2) clinical presentation, 3) mammary transmission, 4) surveillance, 5) introduction risks, 6) caretakers, 7) biosecurity, 8) pork safety, 9) production impact, and 10) pig movements.

Individual awards are capped at $250,000, however, proposals may exceed cap if sufficient justification is provided. Matching funds are encouraged but not required; the funding cap applies to only those funds requested from SHIC/FFAR/NPB. All projects should strive to have a high impact, show value to pork producers, and have pork industry-wide benefit.

Collaborative projects including the pork industry, allied industry, dairy or poultry industries, academic institutions, and/or public/private partnerships are highly encouraged. Projects demonstrating the most urgent priorities and timeliness of completion, providing the greatest value to pork producers, and showing efficient use of funds will be prioritized for funding. Projects are requested to be completed within a 12-to-18-month period with sufficient justification required for extended project duration. The deadline for proposal submission is 5:00 PM CT on December 31, 2024.

SHIC/AASV Webinar Update on H5N1 Risk to US Swine Set for November 20

As part of SHIC's response to the USDA-APHIS-confirmed diagnosis of H5N1 in a backyard pig housed with a mix of poultry and other livestock on a small Oregon farm on October 30, 2024, a webinar titled H5N1 Influenza Risk to US Swine will be held on Wednesday, November 20, 2024, from 11:00 am to 12:30 pm CST.

The recent detection and confirmation of H5N1 in a backyard pig on a multi-species farm by USDA has raised questions regarding the emerging threat and potential risks for commercial swine herds. During the webinar, presenters will provide the latest information on the detection of H5N1 in Oregon, an overview of the risks to swine and knowledge gaps for prevention and preparedness, a review of the impact of H5N1 on the dairy industry, and an overview of experimental studies of H5N1 in pigs.

Confirmed presenters are:
Ryan Scholz, DVM, MPH, State Veterinarian, Oregon Department of Agriculture

- Overview of the first detection of H5N1 in a pig on a backyard multispecies farm in Oregon

Montse Torremorell, DVM, PhD, Department Chair and Professor, University of Minnesota

- H5N1 risks to swine and knowledge gaps for prevention and preparedness in pigs

Fred Gingrich, DVM, Executive Director, American Association of Bovine Practitioners

- H5N1 impact to the dairy industry and update on diagnostic surveillance

Bailey Arruda, DVM, PhD, Research Veterinary Medical Officer, USDA ARS

- Update on H5N1 experimental infection studies in pigs

Locke Karriker, DVM, MS, Veterinary Diagnostic and Production Medicine, Iowa State University

- Update on aspirin use in pigs

This webinar, hosted by SHIC and the American Association of Swine Veterinarians, is conducted by the Swine Medicine Education Center at Iowa State University.

SHIC/AASV Webinar Addresses H5N1 Influenza Risk to US Swine

The Swine Health Information Center, in collaboration with the American Association of Swine Veterinarians, hosted a webinar on H5N1 influenza risk to US swine on November 20, 2024. The goal of the webinar was to provide current information on H5N1 in livestock including updates on the H5N1 outbreak in dairy cattle, the first detection of H5N1 in a pig on a small backyard farm in Oregon, research on H5N1 in swine, and a literature review covering gaps in knowledge for H5N1. Additionally, an update on the use of aspirin in livestock was presented. The webinar can be accessed online.

Fred Gingrich, II, DVM, executive director of the American Association of Bovine Practitioners, shared information on the H5N1 outbreak in dairy cattle first identified in a Texas dairy herd exhibiting unusual clinical signs of illness. On March 25, 2024, USDA officially announced the first isolation of influenza A H5N1 in milk from an affected cow. The initial introduction of H5N1 into dairy cattle was likely from wild birds, potentially as early as December 2023. But since that time, the source of virus transmission among dairy herds is thought to be from infected cattle.

Dr. Gingrich stated that clinical signs of virus infection and impact on lactating dairy cows are different from infection in poultry and wild birds. In dairy cattle, there is low morbidity of 20% – 30% with a low mortality of 2% – 5% reported. He noted that there is no need for depopulation as cattle recover from the infection. H5N1 affects mostly lactating dairy cows, and clinical signs include decreased appetite and rumination, tacky manure, decreased milk production, and milk turning abnormally thick and yellow. Herd-level production losses can average 20% and the long-term impact on herds is yet unknown.

Recent research into the dairy outbreak has shown that bulk milk tank samples can have PCR positive test results 10 to 14 days before peak clinical signs are observed. This offers an opportunity for increased surveillance for early detection and can facilitate implementation of biosecurity measures for preventing transmission. Biosecurity remains a challenge due to the segmented dairy industry structure and specialized production sectors. Transportation of adult and young stock cattle occurs daily, sometimes over long distances. Continued development of biosecurity to decrease disease transmission is critically important. Moving forward, Dr. Gingrich said safe movement will be more manageable than stopping movement in the event of an outbreak. Other needed methods for disease control include the development of safe and effective vaccines.

Dr. Gingrich also noted that the dairy industry has worked closely with FDA and USDA to ensure food safety for consumption of products. FDA has performed testing on bulk tank samples of raw milk to confirm that pasteurized milk is safe to consume while unpasteurized milk carries a significant risk for pathogens. In addition, USDA has confirmed the safety of eating properly handled and cooked beef. Dr. Gingrich noted that the USDA plan for national bulk tank surveillance is critically important, and that this surveillance effort continues to inform efforts for effective disease prevention and control in the US dairy industry.

Ryan Scholz, DVM, MPH, State Veterinarian of Oregon, provided an overview of the first detection of H5N1 in a pig co-housed with poultry on a small backyard farm. The call to the Oregon Department of Agriculture on October 22, 2024, was initiated due to sick and dying birds observed on the farm. Birds on the farm included ducks, geese, peafowl, and chickens. There were three kunekune pigs housed with sheep and goats and two teacup pigs housed with chickens. A USDA technician was sent to the farm to sample affected birds. The kunekune pigs were sampled because they had direct contact with dead waterfowl on the farm but none of the pigs showed any clinical signs of illness. Samples were submitted to the Oregon Veterinary Diagnostic Lab for testing. After the initial detection of H5N1 in birds and one pig, all poultry were depopulated, and the decision was made to euthanize all of the pigs for a comprehensive diagnostic case evaluation. Samples from one kunekune pig were PCR positive including nasal and tracheal swabs, brain tissue, heart, and lymph nodes, and one teacup mini pig had PCR positive samples of tracheal tissue and tracheal swab. Virus sequencing from poultry sampled on the farm confirmed detection of the D1.2 genotype of H5N1.

Dr. Scholz noted that transitional and backyard pigs are significantly different from commercial swine production for pork. The handling of backyard animals and sampling techniques present unique challenges and alternative methods to address these challenges should be considered. Lifestyle and backyard farms tend to have limited to no biosecurity due to outdoor exposure and

direct contact with multiple species. He noted that the knowledge and implementation of biosecurity for small holdings and lifestyle farms can be minimal and resources to address the gap in knowledge are needed. He also said partnership with public health officials is important, especially when dealing with potential zoonotic diseases, as part of emergency response planning.

Bailey Arruda, DVM, PhD, Research Veterinary Medical Officer, USDA-ARS, National Animal Disease Center, described the new paradigm of the now panzootic H5N1 virus and updated results on H5N1 research in swine. She noted that the number of mammalian species infected with the H5N1 virus since 2021 has significantly increased. The virus naturally changes over time, exhibiting reassortment that results in co-circulating genotypes and potentially different phenotypes. Dr. Arruda noted that in the past, H5N1 viruses contained a Eurasian N1 but some more recent viruses contain a North American N1.

Dr. Arruda reviewed the protocol for H5N1 virus challenge studies at the NADC BSL-3 facilities with weaned pigs negative for influenza A virus, PRRSV and *Mycoplasma hyopneumoniae*. Multiple strains of H5N1 have been used in challenge studies with pigs, but until recently, the viruses were not sourced from the current H5N1 dairy isolates. The goals of the challenge studies are to characterize clinical signs and pathogenesis of each isolate and to generate known positive samples for diagnostic test development and evaluation.

In summarizing the H5N1 dairy isolate studies, Dr. Arruda noted that three H5N1 strains were utilized from contemporary dairy herd outbreaks, including two cattle origin isolates (cattle/TX/008 and cattle/TX/002) and one from a human case associated with an infected dairy herd (TX/37). In general, pigs exhibited minimal to mild respiratory signs with some showing short-term fever. No pigs exhibited neurologic signs of disease. At necropsy, mild tissue lesions were noted. Virus was found in brain samples for TX/37 and cattle/TX/002 and virus was identified in heart and spleen for all three virus strains. All pigs were positive by nasal swabs across the three viruses studied. Results from additional sample types are pending.

Dr. Arruda concluded by saying pigs are at risk to circulating strains of H5N1, noting reassortment with endemic swine IAV strains is of concern. Clinical signs in the experimentally infected pigs were mild, and there is the potential to overlook infection. For sampling of ill pigs, nasal swabs were shown to be able to detect H5N1. To reduce the risk of introduction into a swine herd, producers should consider biosecurity steps including avoiding the use of untreated surface water, ensuring bird-proofing, restricting scavenger mammals in or around barns, not feeding pigs unpasteurized milk products, and evaluating biosecurity risks posed by area dairy or poultry farms, including shared resources or personnel.

Montse Torremorell, DVM, PhD, Professor, University of Minnesota, shared the results of a recently completed SHIC-funded literature review on H5N1 risks to swine. She stated that the H5N1 2.3.4.4b genotype has demonstrated the ability to spread globally across many different species with clinical presentations ranging from high mortality to subclinical infection. H5N1 genotype 2.3.4.4b can infect pigs and there are concerns that infection with H5N1 will not exhibit similar clinical signs to endemic strains currently seen in commercial pigs.

Dr. Torremorell reviewed that H5N1 viruses exhibit variable clinical presentations, lesions, and transmission risks in pigs, depending on the genotype and animal species origin of the isolate. Knowledge gaps exist in pathogenesis and transmission, accurate methods and appropriate samples for detection, routes of infection, identification of the potential source of introduction, and understanding the virus's complex epidemiological picture.

Dr. Torremorell noted outbreak investigations are necessary for gaining needed information for prevention and control of the virus. Investigations can help identify epidemiological links between poultry, swine, and cattle while also elucidating potential pathways of infection and assessing risk of transmission. Understanding the role of nonclinical pigs, identifying the duration of virus infection and shedding on a population level, and quantifying the risk of interactions between other species and shared resources will be important to implement effective intervention strategies.

Defining the applicability of commonly collected swine samples, such as udder wipes, processing fluids, oral fluids and water samples, for accurate and rapid detection of H5N1 is needed. Accurate surveillance can address knowledge gaps around the potential for H5N1 2.3.4.4b reassortment with other endemic swine influenza strains and the impact of those changes for risks to animal and public health. Further knowledge gaps include the impact of partial immunity from endemic viruses, the role of vaccination for protection against H5N1, risk from mammalian adaptation viruses, current and common biosecurity practice effectiveness, aerosol transmission, and effective management practices for virus control.

The final presentation was provided by Locke Karriker, DVM, MS, DACVPM, reviewing the regulatory situation regarding aspirin use in swine. An AASV summary of his presentation can be found online.

Center Outreach and Industry Engagement

List of Organizations and meetings with SHIC Engagement

Following is a partial list of organizations and meetings where SHIC's research and programs were presented or discussed.

Pork producers

- Partial list of producers/companies: AMVC Swine Health Services; Carthage Veterinary Service; Christensen Farms; Clemons Food Group; The Maschoffs; New Fashion Pork; JBS; Pipestone; Pork Veterinary Solutions, Prestage Farms; Schwartz Farms; Seaboard Foods; Smithfield Foods, Hog Production Division; Tyson's Pork Group; Swine Vet Center; Livestock Veterinary Services; Topigs Norsvin; 21st Century Pork Club
- Iowa State University Pork Industry Center
- State Pork Producer Associations, individually and through meetings such as the NPB/NPPC hosted State Executives and State Leaders Meeting
- NPB's Board of Directors
- NPB's Swine Disease Research Task Force
- Pork Industry Forum
- World Pork Expo
- Pork Leadership Institute

- Allen D. Leman Swine Conference
- US SHIP House of Delegates

Allied industry

- American Feed Industry Association
- Boehringer Ingelheim Vetmedica
- DSM-Firmenich
- Medgene
- Merck Animal Health
- National Association of Farm Broadcasters
- National Institute for Animal Ag
- NOVUS
- The Meat Institute
- Seek Labs
- Tetracore, Inc.
- Thermo Fischer Scientific
- Zoetis

Veterinarians

- 2024 AASV annual meeting
- AASV/CTED PEDV Elimination Task Force
- McKean ISU Swine Disease Conference
- Swine Medicine Education Center, Iowa State University
- North Carolina Veterinary Medical Association Swine Meeting
- NAPRRS/NC229 International Conference for Swine Viral Diseases

US Centers for Disease Control and Prevention

- Centers for Disease Control and Prevention Veterinary Influenza Division
- Centers for Disease Control and Prevention Arboviral Diseases Branch Division of Vector-Borne Diseases

US Animal Health Association, including allied industry, USDA and State Animal Health Officials

- 2024 USAHA/AAVLD Annual meeting
- Committee on Animal Health Surveillance and Info Systems
- Committee on Foreign and Emerging Diseases
- Committee on Animal Emergency Management
- Committee on Swine
- Global Animal Health and Trade Committee

Research Funding Partners

- Foundation for Food & Agriculture Research, funded through the US Farm Bill
- USDA National Institute of Food and Agriculture Tactical Sciences for Agricultural Biosecurity
- USDA National Institute of Food and Agriculture Animal Health and Disease
- USDA National Animal Disease Preparedness and Response Program

Veterinary Diagnostic Laboratories, Colleges of Veterinary Medicine, and Academics

- Cornell University College of Veterinary Medicine
- Kansas State University Department of Diagnostic Medicine/Pathobiology

- Kansas State University Department of Statistics
- Kansas State University Biosecurity Research Institute
- Iowa State University Veterinary Diagnostic Laboratory
- Iowa State University Veterinary Diagnostic and Production Animal Medicine
- North Carolina State University, College of Veterinary Medicine and College of Agriculture and Life Sciences
- Ohio Animal Disease and Diagnostic Laboratory, Ohio State University
- Ohio State University College of Veterinary Medicine
- South Dakota State University Veterinary Diagnostic Laboratory
- Texas A&M University Institute for Infectious Animal Diseases
- University of Arizona College of Veterinary Medicine
- University of Georgia Center for the Ecology of Infectious Diseases
- University of Georgia Global Infectious Disease Intelligence Consortium
- University of Illinois at Urbana-Champaign Department of Pathobiology
- University of Minnesota Center for Animal Health and Food Safety
- University of Minnesota Veterinary Diagnostic Laboratory
- University of Minnesota Veterinary Population Medicine

State Animal Health Officials

- Numerous State Veterinarians/State Animal Health Officials

US Department of Agriculture

- USDA Ag Research Services Director
- USDA Ag research Services, National Animal Disease Center
- USDA Ag Research Services Foreign Arthropod Borne Animal Disease Research Unit
- USDA Ag Research Services Zoonotic and Emerging Disease Unit
- USDA Ag Research Services Plum Island Animal Disease Center and National Bio and Agro-defense Facility
- USDA Ag Research Services Virus Prion Research Unit
- USDA Animal and Plant Health Inspection Service (APHIS), Administrator
- USDA APHIS ASF Technical Working Group
- USDA APHIS ASF Slaughter Plant Working Group
- USDA APHIS, Deputy Administrator, Veterinary Services
- USDA APHIS One Health Coordination
- USDA APHIS Trade Sector
- USDA APHIS Veterinary Services Leadership Team and Veterinary Services staff
- USDA Center for Epidemiology and Animal Health
- USDA National Animal Health Laboratory Network
- USDA National Import Export Services
- USDA National Wildlife Services
- USDA National Veterinary Services Laboratory, Foreign Animal Disease Diagnostic Laboratory

US Department of Homeland Security

- Customs and Border Protection
- Science & Technology Directorate

International

- Canadian Food Inspection Agency
- Canadian Pork Council
- Canadian West Swine Health Intelligence Network, Canada
- Manitoba Pork, Canada (PEDV Elimination)
- OPORMEX, Mexican Pork Organization
- SunPork Fresh Foods, Australia
- US Delegation, WOAH, World Organization for Animal Health, France
- National Service of Agrifood Health, Safety and Quality (SENASICA), Mexico
- North American ASFV Forum

Presentations at Industry Meetings

SHIC's executive and associate directors participate in external events which help share the Center's information and messaging. Whether participating themselves or coordinating subject matter experts on SHIC-related topics and SHIC-funded research projects, these events amplify SHIC's presence. An example is the National Hog Farmer's Global Virtual Hog Industry Conference. Numerous conference presentations have the same impact and reach.

Invited presentations conducted by SHIC Staff:

1. "Swine Health Information Center 2024 Plan of Work and Collaboration Opportunities." National Pork Board, Board of Directors Meeting, Des Moines, IA; January 9, 2024.
2. "Swine Health Information Center Programs and Research." Pork Leadership Institute, Des Moines, IA; January 17, 2024.
3. "Swine Health Information Center 2024 Plan of Work." National Pork Board Swine Disease Research Task Force, virtual meeting; January 24, 2024.
4. "Swine Health Information Center 2024 Plan of Work and Requests for Proposals." 55th American Association of Swine Veterinarians Annual Meeting, Committee on Transboundary and Emerging Diseases Meeting, Nashville, TN; February 24, 2024.
5. "Japanese encephalitis virus update." 55th American Association of Swine Veterinarians Annual Meeting, Special Session, Nashville, TN; February 26, 2024.
6. "Swine Health Information Center: Plan of Work and New Leadership." 21st Century Pork Club, 2024 Spring Pork Club Meeting, Savannah, GA; April 9 – 11, 2024.
7. "Swine Health Information Center Role in Emerging Disease Monitoring and Surveillance." Iowa State University Swine Medicine Education Center student rotation, virtual meeting; April 17, 2024.
8. "Swine Health Information Center Biosecurity Research and Protocols for Disease Prevention." Pre-ACVPM Class participants, virtual meeting; April 29, 2024.
9. "Swine Veterinary Medicine Opportunities and the Role of SHIC for Industry Preparedness." Novus WISE event, Elizabeth, IL; May 22-23, 2024.
10. "Emerging Domestic Disease Threats." Farm Progress, Global Hog Industry Virtual Conference; May 22, 2024.
11. "Endemic Diseases, Biosecurity and Other Hot Topics in Swine Health" Veterinary Panel, Pork Academy Session, World Pork Expo, Des Moines, IA; June 6, 2024.
12. "Swine Health Information Center Mission and Plan of Work." NPB/NPPC hosted State Executives and State Leaders Meeting, Reno, NV; June 26, 2024.
13. "Swine Health Information Center: Wean-to-Harvest Biosecurity Research Program Review of Research Results." McKean Swine Conference, Ames, IA; July 24, 2024.

14. “Review of SHIC Mission and Research Focus: Opportunities for Research Funding Collaborations.” NCSU Food Animal Initiative Conference, Raleigh, NC; August 16, 2024.
15. “Swine Health Information Center Coordinated Stakeholder Communications on Emerging Swine Disease Threats.” North American African Swine Fever Forum, Ottawa, Canada; September 17-19, 2024.
16. “Wean-to-Harvest Research Program Update.” National Hog Farmer Global Hog Industry Virtual Conference Update; October 30, 2024.
17. “Wean-to-Harvest and SHIC Research Updates.” North Carolina Veterinary Medical Association Swine Meeting; November 1, 2024.

SHIC Shares Information with Swine Veterinarians at AASV Annual Meeting

SHIC continues to share information on its strategic priorities and mission to protect the health of the US swine herd with veterinarians and pork producers. During the recent American Association of Swine Veterinarians Annual Meeting, February 24-27 in Nashville, Tennessee, over 1000 attendees had the opportunity to learn about SHIC’s work through session presentations, committee participation, and a tech table display.

As part of the pre-conference committee meetings, SHIC Executive Director Dr. Megan Niederwerder and SHIC Associate Director Dr. Lisa Becton presented SHIC’s 2024 Plan of Work and Requests for Proposals on research priorities to the Committee on Transboundary and Emerging Diseases. Both Drs. Niederwerder and Becton attended the pre-conference session on biosecurity and participated in the SDRS advisory group meeting where new information about this SHIC-funded disease monitoring report was shared.

During AASV’s special session, “Beagles and Bagels,” Dr. Niederwerder presented the latest information on Japanese encephalitis virus, including the current JEV status in Australia, the availability of JEV testing at National Veterinary Service Laboratories, progress on the updated USDA response strategy, the SHIC/FFAR JEV Research Program, and updates on the risk and potential impact that JEV poses to the US pork industry. She also updated attendees about SHIC research activities on emerging diseases and collaborative partnerships with the other pork industry organizations at the AASV annual business meeting.

The results of SHIC-funded research and programs were featured in several seminars, on research posters, and during presentations, including in the general session. A tech table display featured SHIC projects and tools for communicating the research results to help keep the US swine herd safe and stay ahead of economically devastating health issues. Interactions with AASV participants were instrumental in furthering SHIC’s outreach and expanding the network for SHIC as a resource to help herd veterinarians, pork producers, and researchers work on emerging swine diseases.

SHIC Outreach at World Pork Expo 2024

The annual World Pork Expo, held June 5 – June 6, 2024, in Des Moines, Iowa, presented a unique opportunity for swine industry stakeholders to gather and learn about current events, new technologies and discuss production challenges. The Swine Health Information Center team attended the event to participate in swine health meetings, serve as a panelist on endemic

diseases, interact with attendees to understand current health challenges, gain insight on producer priorities for swine health research, and share updates on SHIC activities. Executive Director Dr. Megan Niederwerder and Associate Director Dr. Lisa Becton met with pork producers, swine veterinarians, production company staff, media, and other industry organizations over two full days of World Pork Expo.

Dr. Becton served as a panelist in the Pork Academy Session entitled, "Endemic Diseases, Biosecurity and Other Hot Topics in Swine Health," during World Pork Expo. A Farm Journal's PORK magazine article, "Producers Have Resources on Swine Health," highlighted the session. Dr. Becton is quoted as saying, "Monitoring allows you to see trends. It's important for producers to continue to monitor diseases, knowing there's a cost for diagnostics, but swine health metrics are needed to manage diseases effectively on the farm." Multiple resources to assist producers with swine health management are available on the SHIC website, including the monthly domestic and global disease monitoring reports, the latest information on research project outcomes, and disease fact sheets.

Drs. Niederwerder and Becton took part in almost a dozen interviews with swine-industry media outlets, including Feedstuffs/National Hog Farmer podcast, Brownfield Network, Linder Farm Network, WHO Radio (Des Moines), Farm Journal's PORK magazine, and many others. Media interviews are an opportunity for SHIC staff to discuss key programs and activities that help SHIC fulfill its mission to protect and enhance the health of the US swine herd by minimizing the impact of emerging disease threats. Topics highlighted to media partners included biosecurity for wean-to-finish production and transport, influenza challenges in livestock, and updates on the current global ASFV status.

SHIC's focus on targeted research investments is supported by a robust outreach effort to share its work and the benefits for US pork producers. Research programs for 2024 include programs focusing on its Wean-to-Harvest Biosecurity Program, Japanese encephalitis virus research efforts, and projects addressing its 2024 Plan of Work.

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 SHIC 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.

SHIC/FFAR Partnership to Minimize Emerging Swine Disease Threats Highlighted During Webinar

Swine Health Information Center Executive Director Dr. Megan Niederwerder, Associate Director Dr. Lisa Becton, and Board Chair Mark Schwartz were guests of the Foundation for Food & Agriculture Research (FFAR) for a recent webinar. “Minimizing the Impact of Emerging Disease Threats in Swine through Research Funding Partnerships” illustrated SHIC and FFAR’s successful collaborations to date and was part of FFAR’s 10th anniversary celebration webinar series. Find the entire webinar online.

FFAR has funded hundreds of research grants and worked with over 500 partners to steward research across the food and agricultural value chain to advance innovation. SHIC has successfully collaborated with FFAR, as well as the National Pork Board, on Japanese encephalitis virus and Wean-to-Harvest Biosecurity Program projects with more on the horizon. On November 6, 2024, SHIC, FFAR and the Pork Checkoff announced their latest partnership to fund the H5N1 Risk to Swine Research Program.

The webinar was hosted by FFAR’s Dr. Jasmine Bruno, scientific program director, who manages their animal systems portfolio within FFAR’s Thriving Productions Systems team. She shared how FFAR’s portfolio maintains a focus on developing animal agriculture partnerships with entities like SHIC to address emerging disease threats in livestock. “FFAR was established in the 2014 Farm Bill to connect funders, researchers, and farmers together to pioneer the next frontier of agriculture research, including developing science-based solutions to improve animal health and welfare, advance environmental sustainability, bolster producer profitability and sustain our food supply,” she explained. FFAR continues to build these collaborative partnerships to support research to address these and other challenges facing food and agriculture today. In this process, FFAR looks to complement USDA’s research agenda, identifying where there are critical knowledge and funding gaps.

This effort involves FFAR integrating producers along with other agricultural stakeholders to increase public agriculture research investment. “For every federal dollar that we spend, we have to match that with at least one non-federal dollar, amplifying the public’s investment in agriculture,” Dr. Bruno stated. “We really focus on actionable science.”

Dr. Bruno said SHIC has been an invaluable partner in working with FFAR and informing them when there are critical swine health needs. Collaboration between SHIC, FFAR, and NPB allows for leveraging producer dollars with federal funds to increase overall research funding. Together, the organizations expand the scientific network of researchers working on swine diseases while ensuring research is producer-driven and addresses industry needs. Ultimately, the partnership facilitates the transition of research findings into actionable changes for producers.

Dr. Niederwerder thanked FFAR for their partnership, stating SHIC’s board of directors and working groups, along with US pork producers, are grateful for their collaboration. SHIC’s mission is to protect and enhance the health of the US swine herd by minimizing the impact of emerging disease threats. Dr. Niederwerder shared how SHIC does this through various mechanisms such as a coordinated communication strategy, preparedness activities, looking at both global and domestic disease monitoring, and analysis of swine health data. This information

is then used to target research investments that will provide the greatest value back to pork producers.

One partnership between SHIC and FFAR resulted in a research program focused on Japanese encephalitis virus. “We received an outstanding response from this RFP with 26 research proposals across 23 different institutions,” Dr. Niederwerder commented. “Overall, there was $1.3 million awarded through this program across six projects, and those six projects will address research needs and priorities to prevent and prepare for Japanese encephalitis virus, of which the US is currently negative.”

Another SHIC/FFAR collaboration revolves around wean-to-harvest biosecurity. A gap was identified as a chink in the armor of pork production biosecurity and preparedness that protects swine health. “In the grow-finish population, a lot of what happens there, and then going to the plant on the harvest side, can have a backflow into our sow farms and really cause significant health challenges,” Dr. Niederwerder shared.

Wean-to-Harvest Biosecurity Program research priorities were divided into two categories – onsite or on-farm biosecurity and transport biosecurity. Since 2022, 22 related projects have been funded. Dr. Becton reviewed the projects, results-to-date, and application of results to positively impact biosecurity on and off the farm. Cost-effectiveness of interventions as well as worker motivation, air filtration, mortality management, packing plant biosecurity, and truck wash efficiency were all detailed.

Mark Schwartz, a pork producer and SHIC board chair, highlighted the importance of ensuring research translates into real-world applications for producers. Schwartz emphasized the role of SHIC’s board to maintain focus on producer needs and maximize the value of research investments.

Schwartz observed the pork industry has evolved with a focus on productivity, efficiency, and sustainability. And regardless of production size or type, Schwartz says producers focus on being competitive while producing wholesome, safe, and affordable pork for domestic and global consumers.

To be efficient, minimizing disease outbreaks and preventing introduction of new pathogens into herds is essential. “Because pig production is concentrated and with the evolution of multi-site production, a great number of pigs moved daily and weekly interstate across state lines and across the Midwest and from the high plains to the Midwest, there’s vulnerability,” Schwartz commented.

Recalling the outbreak of porcine epidemic diarrhea virus in 2013 and resulting creation of SHIC in 2015 with Pork Checkoff funding, producers began investing in emerging swine disease research to achieve the Center’s mission. Schwartz observed SHIC’s ability to take data from these research projects, which are typically conducted with viruses being addressed currently, and to apply learnings to how to deal with the next novel pathogen that’s detected in a swine herd. Consequently, an informed, rapid response is possible. “The value of these partnerships, the

value of leveraging our dollars with that of the producers is so important to our industry," Schwartz concluded.

SHIC to Host a Special Session in 2024 North American PRRS/NC229 International Conference of Swine Diseases

SHIC is co-hosting a special session entitled, "Novel Tools and Technologies to Address Emerging Diseases of Swine," at the 2024 NAPRRS/NC229: International Conference of Swine Viral Diseases from December 8 – 9, 2024, in Chicago. This conference, an annual educational event, brings together swine industry researchers, professionals, and field practitioners to learn about the latest information and research results for emerging viruses, swine health, and biosecurity. SHIC has invited six principal investigators to provide program updates and research results for their SHIC-funded projects.

Coordinated communication and broad dissemination of swine health information to industry stakeholders is part of SHIC's mission to minimize the impact of emerging disease threats. Working with the NAPRRS/NC229 organizing team offers the opportunity to expand SHIC's reach by sharing outcomes from work conducted as a result of the Center's research priorities. The Session will be moderated by SHIC Executive Director Dr. Megan Niederwerder and SHIC Associate Director Dr. Lisa Becton.

Topics and presenters for the SHIC special session at the NAPRRS/NC229 ICSVD include:

- Development of a Standardized Outbreak Investigation Program Web-Based Application – Dr. Derald Holtkamp, Iowa State University
- Optimizing Tongue-Tip Sampling Protocols for Enhanced PRRS Virus Isolation – Dr. Onyekachukwu (Henry) Osemeke, Iowa State University
- Evaluation of Deployable Fan Coverings for Biocontainment of Airborne Swine Pathogens – Dr. Erin Kettelkamp, Swine Vet Center
- Evaluation of Electrostatic Precipitation for Biocontainment of Viral and Bacterial Pathogens Emitted from Finishing Facilities – Dr. Brett Ramirez, Iowa State University
- Self-Vaccinating Pigs to Save Labor, Improve Efficacy and Enhance Biosecurity - Lucas Spetic Da Selva, Texas Tech University
- Development of an Online Dashboard for Near-Real Time Global Swine Disease Surveillance – Dr. Rachael Schulte, University of Minnesota

NAPRRS/NC229 ICSVD was first held in 2003 and provides a forum to bring together members of the global swine disease community. Though inspired by PRRS-related concerns, the conference has expanded to include other emerging and transboundary viral disease topics in swine. Further information on the conference, including registration and hotel accommodations, can be found online.

Communication Channels and Information Sharing

Website Activity and Impact through www.swinehealth.org

Activity on www.swinehealth.org. NOTE: In GA4 (Google Analytics platform), / = homepage and (not set) is a widespread glitch failing to identify specific webpages.

Top pages on SHIC website with number of views: January 1 – December 31, 2024

- Not set – 53,710
- Homepage – 21,301
- Podcasts – 6,769
- Call for Research – 6,494
- Global Disease Monitoring Report – 5,871
- Domestic Disease Monitoring Report – 5,456
- About – 2,660
- Research Results – 1,991
- Seneca A Summary – 1,728

Website impact (January 1 – December 31, 2024. For comparison, 2023 totals are included in parentheses after each applicable line.)

- 343,680 events (new measure – previously reported individual sessions 48,202)
- 25,314 separate users (13,327)
- 153,156 total page views (77,458)
- Average session duration of 2:03 (2:07)
- Top countries
    - 15,196 users were from the USA (7,343)
    - 1,260 users were from China (1,246)
    - 1,030 users were from Canada (679)
    - 748 users were from India (299)
    - 627 users were from The Philippines (403)
    - 475 users were from Australia (171)
    - 427 users were from the United Kingdom (241)
    - 314 users were from The Netherlands (194)
    - 291 users were from Vietnam (169)
    - 270 users were from Germany (200)

Press Releases and Impact

Press Releases: Six SHIC-specific press releases have been issued as of December 31, 2024:

- SHIC Releases 2023 Progress Report and 2024 Plan of Work - 1/26/2024
- SHIC/FFAR Collaboration Seeks Japanese Encephalitis Virus Research Proposals - 2/12/2024
- SHIC Requests Research Proposals to Address Emerging Swine Disease Challenges - 2/25/2024
- Krantz and Miller Join SHIC Board of Directors - 8/8/2024
- SHIC, FFAR, and Pork Checkoff Announce H5N1 Risk to Swine Research Program RFP – 11/6/2024
- SHIC/FFAR Fund Six Japanese Encephalitis Virus Research Projects – 12/10/2024

Press release impact: Emails were sent to 260 ag news outlets for each press release. Farm broadcasters continued as a very important media outreach for SHIC.

Individual emails are sent to the top five pork media editors as well as ten farm broadcasters with each press release. Press releases were picked up by these national editors and farm broadcasters covering the US pork industry, many times resulting in one-on-one interviews with the executive and associate director. In 2024, more than 110 interviews with Drs. Niederwerder and Becton have taken place. Publications, radio networks, and stations receiving personalized emails include:

- National Hog Farmer/Farm Progress Publications - 2 editors
- PORK/Farm Journal
- Agri-Pulse - 3 editors
- Feedstuffs
- Successful Farming and associated daily e-newsletter
- Brownfield Network
- Rural Radio Network
- WHO Radio – Des Moines, Iowa
- WMT Radio – Cedar Rapids, Iowa
- KWMT Radio – Fort Dodge, Iowa
- KICD Radio – Spencer, Iowa
- WNAX Radio – Yankton, SD
- Market Talk Ag – National
- Red River Farm Network
- Agriculture of America – National
- Ag Daily News Podcast
- This Week in AgriBusiness

SHIC communications efforts are amplified by stakeholders who share our articles in their publications including online newsletters, social media posts, and presentations. These stakeholders include National Hog Farmer, PORK, USAHA, NPPC, NPB, and others.

Articles Prepared for Partners

As of December 31, 2024, content was provided for 72 articles for the AASV weekly e-letter and other partners, including:

- SHIC 2023 Progress Report Summarizes Activities and Accomplishments
- SHIC 2024 Plan of Work Continues Focus on Protection of US Swine Herd Health
- SHIC/AASV Webinar to Address Porcine Circovirus Challenges and Emerging Trends
- SHIC Funds Study Investigating Porcine Astrovirus 4 as Potential Emerging Cause of Respiratory Disease
- SHIC Requests Research Proposals to Address Emerging Swine Disease Challenges
- SHIC-funded APP Study Defines Outbreak Dynamics and Environmental Stability of Bacteria
- SHIC/FFAR Collaboration Seeks Japanese Encephalitis Virus Research Proposals
- SHIC/AASV Porcine Circovirus-Focused Webinar Provides Timely Updates
- Coming February 22: SHIC/FFAR JEV Research Program Informational Webinar
- SHIC/FFAR Webinar Informs JEV Research Program Applicants
- SHIC 2024 Plan of Work Competitive Call Nets 43 Proposals from 21 Institutions
- SHIC Shares Information with Swine Veterinarians at AASV Annual Meeting

- SHIC-funded Economic Assessment Estimates Production Impact of JEV Outbreak in US Swine
- SHIC/AASV Webinar Will Address HPAI in Livestock and Risk to Swine
- SHIC Global Disease Monitoring Report Renewed by Board
- SHIC-funded Vehicle Movement Study Provides Insight into Risks for Swine Disease Spread
- SHIC-Funded Assessment Identifies US South as Highest Risk Region for JEV Introduction and Transmission
- SHIC Project Develops Japanese Encephalitis Virus Diagnostic Test for Swine
- MSHMP Continues to Build Capacity with SHIC Funding per Annual Report
- SHIC Project Develops Japanese Encephalitis Virus Diagnostic Test for Swine
- Retired SHIC Executive Director Sundberg Receives Pork Industry Honor
- SHIC/AASV Webinar Will Address HPAI in Livestock and Risk to Swine
- SHIC Global Disease Monitoring Report Renewed by Board
- SHIC-funded Vehicle Movement Study Provides Insight into Risks for Swine Disease Spread
- SHIC Wean-to-Harvest Biosecurity: Platform to Automatically Classify Truck Sanitation Status (Final Report)
- SHIC-Funded MSHMP Monitoring Detection of PRRSV variant 1H.18
- Pork Industry Representatives Serve as US Delegation Members at WOAH General Session
- SHIC/FFAR JEV Request for Research Proposals Nets 26 Reponses
- SHIC-Funded MSHMP Project Fills PDCoV Epidemiologic Information Gap
- SHIC/AASV H5N1 IAV Webinar Addresses Dairy Experience and Biosecurity on Swine Farms
- SHIC/AASV H5N1 IAV Webinar Addresses Global Influenza Surveillance and Risk to Swine
- SHIC Highlights Ongoing Influenza A Surveillance in US Swine Herds
- SHIC Wean-to-Harvest Biosecurity: Assessing Factors Impacting Pig Caretaker Motivation and Compliance Final Report
- SHIC Wean-to-Harvest Biosecurity: Comparing Efficiency and Efficacy of Automated Versus Manual Power Washing Final Report
- SHIC Wean-to-Harvest Biosecurity: Platform to Automatically Classify Truck Sanitation Status (Final Report)
- SHIC Expands Ongoing Monitoring and Communication Efforts for Influenza with Project to Identify Research Priorities for H5N1 Risk to Swine
- SHIC Wean-to-Harvest Biosecurity: Effects of Manure Pumping on Disease Spread in Growing Pigs (Final Report)
- SHIC Wean-to-Harvest Biosecurity: New Projects Funded to Investigate Transportation Biosecurity and Cost of Disease in Grow-Finish Production
- Swine Industry Organizations Respond to H5N1 Outbreak in Dairy Cattle
- SHIC-Funded Work Identifies First Detection of PCV4 in the US
- SHIC-Funded Study Investigates Novel Diagnostic Tool for Assessing Farrowing Room Cleanliness

- SHIC Wean-to-Harvest Biosecurity: Investigating Fan Coverings for Biocontainment (Final Report)
- Krantz and Miller Join SHIC Board of Directors
- SHIC/AASV Webinar 8/26/2024: Mitigation Strategies for Mosquitos as an Emerging Threat to Swine Health
- SHIC Outreach at World Pork Expo 2024
- USDA: Revised 2024 Japanese Encephalitis Disease Response Strategy
- Minimizing the Impact of Emerging Disease Threats in Swine through Research Funding Partnerships
- SHIC Funded Study Utilizes Endemic Disease Data for Detecting Emerging Diseases
- SHIC Delivers Swine Health Information at Leman Conference
- Take Homes from SHIC Wean-to-Harvest Program Enhance Biosecurity
- SHIC Wean-to-Harvest Biosecurity: Evaluation of Truck Cab Decontamination Technologies (Final Report)
- SHIC Funds Nine Plan of Work Projects to Advance Emerging Disease Mission
- SHIC/AASV Webinar Recap: Mitigation Strategies for Mosquitos as an Emerging Threat to Swine Health
- SHIC Encourages Use of Standardized Outbreak Investigation App
- SHIC Invites Input for 2025 Plan of Work
- SHIC Engages in Industry's North American African Swine Fever Forum
- SHIC-Funded Study Examines Piglet Postmortem Sampling for PRRS Detection
- SHIC Wean-to-Harvest Biosecurity: New Projects Funded to Investigate Pathogen Contamination of Trailers at the Harvest Plant and Mortality Disposal Structures on Farm
- SHIC Tongue Tip Study Optimizes Sampling and Testing Protocols for Successful PRRS Viral Isolation
- Swine Disease Reporting System Seeks Your Input on Survey
- Updated SHIC Fact Sheets for Pseudorabies, Japanese Encephalitis, Ebola, and Reston Viruses Available
- Position Announcement: Swine Health Information Center Grant and Contract Administrator
- SHIC Lit Review Outlines Current Information and Knowledge Gaps for H5N1 Risk to Swine
- SHIC/AASV Webinar on H5N1 Risk to US Swine Set for November 20
- SHIC, FFAR, and Pork Checkoff Announce H5N1 Risk to Swine Research Program RFP
- SHIC to Host a Special Session in 2024 North American PRRS/NC229 International Conference of Swine Diseases
- SHIC Monitors Recombinant ASFV Genotype I/II Strain Emergence Globally
- USDA-APHIS Confirms H5N1 in Pig from Small Oregon Backyard Farm
- SHIC/FFAR Fund Six Japanese Encephalitis Virus Research Projects
- SHIC/AASV Webinar Addresses H5N1 Influenza Risk to US Swine
- SHIC Renews Domestic Swine Disease Monitoring Reports and Approves *E. coli* Addition

SHIC Monthly E-Newsletters and Timely Eblasts

Edition	Date Sent	# Sent	Open	Open %	Clicks	Click %
January 2024 newsletter	1/4/2024	3251	1182	41.7%	567	5.2%
PCV webinar eblast	1/19/2024	3249	1320	47.1%	852	9.9%
February 2024 newsletter	2/6/2024	3248	955	34.0%	545	4.8%
March 2024 newsletter	3/6/2024	3244	987	35.4%	660	5.3%
April 2024 newsletter	4/3/2024	3273	1127	40.0%	730	7.3%
HPAI (H5N1) webinar eblast	4/12/2024	3270	1053	37.5%	468	7.6%
May 2024 newsletter	5/8/2024	3267	1390	49.8%	1082	22.5%
June 2024 newsletter	6/4/2024	3266	1180	42.5%	4131	17.8%
July 2024 newsletter	7/3/2024	3269	983	35.5%	718	6.7%
August 2024 newsletter	8/7/2024	3312	895	31.9%	752	6.8%
Mosquito mitigation webinar eblast	8/19/2024	3311	1461	51.6%	5329	25.1%
September 2024 newsletter	9/5/2024	3300	1538	55.3%	5739	22.8%
October 2024 newsletter	10/2/2024	3299	1015	37.3%	1220	7.4%
Oregon H5N1 eblast	10/30/2024	3297	1292	48.0%	271	2.6%
November 2024 newsletter	11/6/2024	3340	1105	39.4%	576	6.0%
H5N1 Risk to Swine Webinar eblast	11/15/2024	3334	1443	51.7%	3180	18.6%
December 2024 newsletter	12/6/2024	3330	965	34.5%	436	5.2%

Podcasts and Webinars

SHIC coordinates webinars in collaboration with AASV on emerging disease issues and “industry chatter” topics to provide information through a virtual platform that stakeholders can view in real-time or view recorded versions anytime on the SHIC and AASV websites.

SHIC has coordinated four Webinars in 2024 with AASV:

- 2/6/24: Porcine Circovirus Challenges and Emerging Trends
- 4/19/24: HPAI in Livestock and Risk to Swine
- 8/26/24: Mitigation Strategies for Mosquitos as an Emerging Threat to Swine Health
- 11/20/24: H5N1 Influenza Risk to US Swine

SHIC Talk is a podcast hosted by Barb Determan and features guests on “industry chatter” topics. Four episodes have been produced in 2024. SHIC Talk is available on the SHIC website as well as many popular podcast platforms. All time downloads of all SHIC Talk episodes total 3305 as of January 14, 2025.

SHIC Talk 2024 Podcasts:

- 2/2/24: SHIC’s emerging swine disease focus and plans for 2024 with Dr. Niederwerder

- 4/3/24: JEV Economic Assessment with Drs. Liz Wagstrom and Lisa Becton
- 7/3/24: Influenza Discussion with Drs. Niederwerder, Canon, Rotolo, Forseth
- 9/30/24: Wean-to-Harvest Biosecurity Projects with Drs. Becton, Kettelkamp and Moraes

Episode	Title/Topic	Guest(s)	Date	Downloads
SHIC Talk Ep 1	SHIC	Joe Connor	8/5/2020	188
SHIC Talk Ep 2	Coccidiosis	Pittman, Schwartz	9/18/2020	155
SHIC Talk Ep 3	Rapid Response Program	Holtkamp, Donovan	10/14/2020	188
SHIC Talk Ep 4	ASF Research in Vietnam	Sundberg, Wagstrom, Pyburn	12/2/2020	254
SHIC Talk Ep 5	PRRS 1-4-4 1c	Yeske, Linhares	2/15/2021	235
SHIC Talk Ep 6	SHIC Progress	Connor, Olsen	4/20/2021	142
SHIC Talk Ep 7	SHIC Fact Sheets	Leedom-Larson, Sundberg	5/26/2021	127
SHIC Talk Ep 8	Morbillivirus	Arruda, Li	7/14/2021	207
SHIC Talk Ep 9	Biosecurity	Clayton Johnson	1/31/2022	278
SHIC Talk Ep 10	Australian JEV Outbreak	Cernicchiaro, Cohnsteadt, Sundberg	4/29/2022	173
SHIC Talk Ep 11	FAD Prevention Feed Research	Sundberg, Niederwerder	5/23/2022	132
SHIC Talk Ep 12	ASF Update	Niederwerder, Snelson, Wagstrom, Webb	7/27/2022	194
SHIC Talk Ep 13	Wean-to-Harvest Biosecurity Program	Niederwerder, Sundberg	9/15/2022	147
SHIC Talk Ep 14	SHIC 2023 Plan of Work	Sundberg, Niederwerder	1/19/2023	100
SHIC Talk Ep 15	New SOIP Instrument	Derald Holtkamp	4/4/2023	147
SHIC Talk Ep 16	ASF Research Results from Vietnam	Paul Sundberg	11/20/2023	99
SHIC Talk Ep 17	Emerging Disease	Megan Niederwerder	2/2/2024	148
SHIC Talk Ep 18	JEV Economic Assessment	Liz Wagstrom	4/1/2024	163
SHIC Talk Ep 19	IAV Discussion	Niederwerder, Rotolo, Canon, Forseth	7/2/2024	166
SHIC Talk Ep 20	W2HBP - Fan Coverings/Manure Pumping	Becton, Kettelkamp, Moraes	10/4/2024	62

Partner Webinars and Podcasts including SHIC Information:

- 1/25/24: Ag News Daily Podcast: SHIC and Iowa State University Standardized Outbreak Web-based Investigation Program
- 2/22/24: SHIC/FFAR JEV RFP Informational Webinar

- 5/29/24: What Is SHIC? Pipestone's SwineTime Podcast featuring SHIC Executive Director, Dr. Megan Niederwerder
- 10/22/24: SHIC/FFAR Webinar: Minimizing the Impact of Emerging Disease Threats in Swine Through Research Funding Partnerships with Mark Schwartz and Drs. Niederwerder and Becton
- 10/29/24: Swine Disease Reporting System – Podcast #81 with Dr. Lisa Becton

Media Interviews Completed

In 2024, over 110 media interviews with Dr. Niederwerder and Dr. Becton took place throughout the year. Participation in the National Association of Farm Broadcasters annual meeting and Trade Talk, World Pork Expo, AASV Annual Meeting, Leman Conference, as well as other industry events always have good event interview opportunities. Interviews have been conducted with more than 20 different media outlets and interviewers.

Examples of interviewers conducting interviews with SHIC staff:

- Bruce Cochrane, Reporter and Editor, Farmscape.Ca
- Mark Dorenkamp, Reporter, Brownfield Ag News
- Jesse Allen, Reporter, Host of Market Talk
- Bob Quinn, Reporter, WHO Radio
- David Geiger, Reporter, WHO Radio
- Tyler Donaldson, Reporter and Editor, Red River Farm Network
- Ann Hess, Reporter, Feedstuffs/Feedstuff 365
- Chip Flory, Reporter, Host AgriTalk, Farm Journal
- Chad Moyer, Reporter, Nebraska Rural Radio
- Delaney Howell, Reporter, Ag News Daily
- George Bower, Reporter, Spencer (Iowa) Radio Group
- Corey Harguth, Reporter, Linder Farm Network
- Jennifer Shike, Reporter, Farm Journal's PORK
- Tammi Arender, Reporter, RFD-TV Segment
- Duane Murley, Reporter, KWMT Farm Director, Alpha Media
- Mike Davis, Reporter, Southern Farm Network
- Bob Larson, Reporter, Ag Information Network for Washington Farm Bureau
- Haylie Ship, Reporter, California Ag Today
- Rod Bain, Farm Broadcaster, USDA
- Don Wick, Reporter, Red River Farm Network
- Derek Nester, Reporter, SunflowerStateRadio

Outlets Publishing SHIC Information

In 2024, there have been 420 reports that help expand the coverage of SHIC published articles with their respective readers, resulting in an average of 35 external (outside of SHIC and AASV publications) reports per month representing at least 39 different partner and media outlets.

Examples of outlets that have helped amplify SHIC articles and reports:

- National Hog Farmer
- PORK/PORK Business

- Feedstuffs/Feedstuffs 365
- Community for Emerging and Zoonotic Diseases Weekly Intelligence Reports
- USAHA Daily News Alerts
- Farms.com, US
- Farms.com, Canada
- Brownfield Ag News
- The Pig Site
- National Pork Board
- Swineweb
- American Ag Network
- Morning Ag Clips
- Red River Farm Network
- Ag Wired News
- FFAR news
- KMAland
- Farmscape.ca
- WHO Radio
- RFD-TV
- Feed Strategy
- Nebraska Rural Radio
- Spencer Radio Group
- Linder Farm Network
- FarmWeekNow.com.
- Agriculture of America
- Farm Progress
- Washington State Farm Bureau Report
- Southern Farm Network
- California Ag Today
- Morning Ag Clips
- Philanthrophy News Digest
- Pig333.com
- Swine Health Ontario
- UC ANR Contracts & Grants Updates
- KTIC Agriculture Information blog
- Feed & Aqua Middle East and Africa
- Farm Talk News
- SunflowerStateRadio

SDRS Communication Multiplication

In addition to being distributed in the monthly SHIC newsletter and posted on the SHIC website, the Swine Disease Reporting System team at Iowa State University amplifies the reports' distribution. A total of 646 subscribers from 192 organizations receive the reports via email. The PDF report reaches seven countries and since the implementation of the podcast platforms (Spotify, Apple Podcast, Amazon Music, and Google podcast), the audio report has been listened

to by 36 different countries (https://rss.com/podcasts/sdrs/). The SDRS report is also distributed through video format on LinkedIn (https://www.linkedin.com/in/fieldepi-field-epidemiology-46814a194), YouTube (Swine Disease Reporting System SDRS - YouTube), and Instagram (https://www.instagram.com/isufieldepi/), accumulating over 20,000 views in these social media platforms.